September 2011

NORTHLAND POWER

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McLean's Mountain Wind Farm

Design and Operations Report - Final

Submitted by:

DILLON CONSULTING

McLean's Mountain Wind Farm - Renewable Energy Approval (REA) Application Submission

Design & Operations Report

FINAL SUBMISSION
September 2011

Northland Power Inc.

09-1983

Submitted by

Dillon Consulting Limited

Executive Summary

Northland Power Inc. (NPI) and Mnidoo Mnising Power (MMP) form the McLean's Mountain Wind Limited Partnership (MMWLP). MMWLP proposes to develop the McLean's Mountain Wind Farm (MMWF), located south of the community of Little Current, in the Municipality of Northeastern Manitoulin and the Islands (NEMI); geographic Township of Howland, and the geographic Township of Bidwell in the District of Manitoulin, Ontario and falls within the traditional lands of the Anishnabee of Mnidoo Mnising. The selection of the project's location was based primarily on the wind resource, access to the Provincial transmission system, environmental constraints and local landowner support.

The proposed wind farm (the "project") will consist of 24, 2.5 MW wind turbines with a nameplate capacity of 60 MW. The electricity generated from the wind turbines will be collected through a network of collection grid lines to the on-site transformer. The transformer will step-up the voltage to 115 kV. A 10.3 kilometre transmission line will be installed to connect the project to the Provincial Grid on Goat Island. A section of the transmission line will involve a submarine cable to cross the North Channel to access Goat Island. Each wind turbine will be accessed by a short access road.

The proposed project will require approval under Ontario Regulation 359/09 – Renewable Energy Approval (REA) under the *Green Energy Act*. Based on the REA Regulations, this project is a "Class 4" wind facility. The *Design and Operations Report* is one component of the REA Application for the Project, and has been written in accordance with Ontario Regulation 359/09, the Ontario Ministry of Natural Resources' (MNR) Approval and Permitting Requirements Document for Renewable Energy Projects (September 2009) and MOE's draft Technical Bulletin Two: Guidance for preparing the Design and Operations Report (March 2010).

The *Design and Operations Report* presents the Site Plan, Facility Components, Cultural and Natural Features and Water Bodies, Noise receptors, the Facility Design Plan, and the Facility Operations Plan. Appended to the Design and Operations Report is the Environmental Management and Protection Plan (EMPP) that outlines construction and operating procedures that the owner's of the facility and their contractors are obligated to comply with during all stages of the project.

It is the general conclusion of the *Design and Operations Report* that this project can be operated without any significant adverse residual effects to the natural or social environment. Significant adverse effects to the natural and social environment have been avoided through careful site selection, facility layout planning and strict adherence to all regulatory requirements. All turbines, access roads and ancillary facilities have been sited with landowner consultation to minimize the impact to current agricultural operations. No significant adverse environmental effects are anticipated.

There are net benefits of this project resulting from an increased municipal tax base for NEMI, increased number of employment opportunities (especially during the construction stage) and the generation of clean, renewable electricity from wind power. The operation of the wind farm will also provide annual economic benefits through royalties to landowners and a continuing need for supplies and services in the local and regional rural economies.

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1. INTRODUCTION

Northland Power Inc. (NPI) and Mnidoo Mnising Power (MMP) together form the McLean's Mountain Wind Limited Partnership (MMWLP) MMWLP proposes to develop the McLean's Mountain Wind Farm (MMWF). The proposed wind farm (the "project") will consist of 24, 2.5 megawatt (MW) wind turbines that will generate 60 MW of electricity. The proposed project will require approval under Ontario Regulation 359/09 – Renewable Energy Approval (REA) under the *Green Energy Act*. Based on the REA Regulations this project is a "Class 4" wind facility. This *Construction Plan Report* is written in accordance with Ontario Regulation 359/09.

For the purposes of all the environmental studies, twenty-nine (29) potential turbine sites have been identified and examined. Approval is only being sought for the construction of 24 turbines. The five additional turbine sites will only be implemented, should any of the preferred 24 sites become unsuitable for development.

The McLean's Mountain Wind Farm Environmental Study Report (ESR) document was released in July 2009 for a 30–day public review, as part of the former Environmental Assessment process. The ESR document is consistent with the former Environmental Screening provisions of Ontario Regulation 116/01 for a Category B project and with the requirements of the *Canadian Environmental Assessment Act*. The ESR document was developed to assist in the determination of potential environmental effects, including both the social and natural environment, which could result from the proposed project. The ESR document contains additional information that is not required under the REA legislation and can provide further reference as required.

The REA approval process replaces approvals formerly required under the Environmental Assessment Act, Planning Act, and Environmental Protection Act. The project is being developed under the *Green Energy Act* (GEA) Feed-In-Tariff (FIT) program.

This *Design and Operations Report* has been prepared to fulfill the requirements of Item 4 in Table 1 of the Ontario Regulation 359/09, Renewable Energy Approvals as per the table below (**Table 1-1**).

Table 1-1: Adherence to O.Reg 359/09 Design and Operations Report Requirements

Requirements	*Section Reference*
1. Set out a site plan of the project location at which the renewable energy project will be engaged in, including:	
i. one or more maps or diagrams of,	
A. all buildings structures, roads, utility corridors, road allowances and easements required in respect of the renewable energy generation facility and situated within 300 m of the facility	Section 4 Appendix A
B. Any ground water and surface water supplies used at the facility	Section 4.2.5.2 Table 6.1
C. any things from which contaminants are discharged into the air	N/A
D. any works for the collection, transmission, treatment and disposal of sewage.	Section 4.2.5.1
E. any areas where waste, biomass, source separated organics and farm material are stored, handled, processed or disposed of,	N/A
F. the Project Location in relation to any of the following within 125 m: properties described in Column 1 of the Table to section 19, heritage resources, archaeological resources, the portion of the Oak Ridges Moraine Conservation Plan Area that is subject to the Oak Ridges Moraine Conservation Plan, the area of the Niagara Escarpment Plan, the Protected Countryside, the Lake Simcoe watershed, and	N/A
G. any noise receptors or odour receptors that may be adversely affected by the use or operation of the facility.	Section 3 .1 Appendix A
ii. a description of each item diagrammed under subparagraph I, and	Section 3.1 Section 4.2
iii. one or more diagrams of land contours, surface water, drainage and any of the following, if they have been identified in complying with this Regulation: properties described in Column 1 of the Table to section 19, heritage resources, archaeological resources, water bodies, significant or provincially significant natural features and any other natural features identified in the Protected Countryside or in the portion of the Oak Ridges Moraine Conservation Plan Area that is subject to the Oak Ridges Moraine Plan.	Section 3 Appendix A
2. Set out conceptual plans, specifications and descriptions related to the design of the renewable energy generation facility, including a description of:	

Table 1-1: Adherence to O.Reg 359/09 Design and Operations Report Requirements	
Requirements	***Section Reference***
i. any works for the collection, transmission, treatment and disposal of sewage, including details of any sediment control features and storm water management facilities.	Section 4.2.4 Section 4.2.7 Section 5.3
ii. any things from which contaminants are discharged into the air, and	N/A
iii. any systems, facilities and equipment for receiving, handling, storing and processing any waste, biomass, and source separated organics, farm material and biogas.	N/A
3. Set out conceptual plans, specifications and descriptions related to the operation of the renewable energy generation facility, including,	
i. in respect of any water takings,	
A. A description of the time period and duration of water takings expected to be associated with the operation of the facility	Section 4.2.5.2
B. a description of the expected water takings, including rates, amounts and an assessment of the availability of water to meet the expected demand, and	Section 4.2.5.2
C. an assessment of and documentation showing the potential for the facility to interfere with existing uses of the water expected to be taken.	Section 4.2.5.2
ii. a description of any expected concentration of air contaminants discharged from the facility.	N/A
iv. in respect any biomass, source separated organics and farm material at the facility	
A. the maximum daily quantity that will be accepted,	N/A
B. the estimated annual average quantity that will be accepted,	N/A
C. the estimated average time that it will remain at the facility,	N/A
D. the estimated average rate at which it will be used, and	N/A
v. in respect of any waste generated as a result of processes at the Project Location, the management and disposal of such waste, including:	
A. the expected types of waste to be generated,	Section 5.4
B. the estimated maximum daily quantity of waste to be generated , by type,	Section 5.4
C. Processes for the storage of waste, and	Section 5.4
D. Processes for final disposal of waste.	Section 5.4

Table 1-1: Adherence to O.Reg 359/09 Design and Operations Report Requirements	
Requirements	***Section Reference***
4. Include an environmental effects monitoring plan in respect to any adverse environmental effects that may result from engaging in the renewable energy Project, setting out:	
i. performance objectives in respect of the adverse environmental effects.	Section 6 Table 6.1
ii. mitigation measures to assist in achieving the performance objectives mentioned in subparagraph I,	Section 6 Table 6.1 EMPP
iii. a program for monitoring adverse environmental effects for the duration of the time that the Project is engaged in, including a contingency plan to be implemented if any mitigation measures fail.	Section 6 Table 6.1 EMPP Avian and Bat Post-Construction Monitoring Plan (PCMP)
5. Include a response plan setting out a description of the actions to be taken while engaging in the renewable energy Project to inform the public, aboriginal communities and municipalities, local roads boards and Local Services Boards with respect to the Project, including,	
i. measures to provide information regarding the activities occurring at the Project Location including emergencies,	Section 7 EMPP
ii. means by which persons responsible for engaging in the Project may be contacted, and	Section 7.2
iii. means by which correspondence directed to the persons responsible for engaging in the Project will be recorded and addressed.	Section 7.3
6. If the Project Location is in the Lake Simcoe watershed, a description of whether the Project requires alteration of the shore of Lake Simcoe, the shore of a fresh water estuary or a stream connected to Lake Simcoe or other lakes or any permanent or intermittent stream and,	
i. how the Project may impact any shoreline, including the ecological functions of the shoreline, and	N/A
ii. how the Project will be engaged into,	
A. maintain the natural contour of the shoreline through the implementation of natural shoreline treatments, such as planting of natural vegetation and bioengineering, and	N/A
B. use of vegetative riparian area, unless the Project Location is used for agricultural purposes, and will continue to be used for such purposes.	N/A

The MOE's Draft Technical Bulletin Two: Guidance for preparing the Design and Operations Report provides further guidance for the Design and Operations Report, as per the table below (**Table 1-2**).

Table 1-2: Design and Operations Report Requirements: MOE Draft Technical Bulletin Two	
Requirements	***Section Reference***
Report Introduction	Section 1
Site Plan	Section 3
Facility Design Plan	Section 4
Facility Operations Plan	Section 5
Environmental Effects Monitoring Plan	Section 6
Emergency Response and Communications Plan	Section 7

Additional information about the Project can currently be found in the *Construction Plan Report*, *Decommissioning Plan Report* and the *Project Description Report*. Technical studies associated with the REA requirements have been completed. In addition to this report the REA submission package includes:

- Project Description Report;
- Construction Plan Report;
- Noise Study Report;
- Natural Heritage Assessment Reports (Records Review, Site Investigation, Evaluation of Significance, and Environmental Impact Statement (EIS));
- Water Bodies Assessment Summary Report;
- Archaeological Assessment Reports (Stage 1 and 2) ;
- Cultural Heritage Self-Assessment Report;
- Decommissioning Report;
- Consultation Report;
- Property Line Setback Report;
- Wind Turbine Specification Report;
- Environmental Management and Protection Plan (EMPP);
- Post-Construction Monitoring Plan (PCMP); and
- Supporting Documents.

2. THE PROPONENT

Northland Power Inc. (NPI) is a developer, owner and operator of power generation facilities and the proponent of the "McLean's Mountain Wind Farm Project". In February 2011, Mnidoo Mnising Power (MMP), a company formed by the United Chiefs and Councils of Mnidoo Mnising (UCCMM), entered into a 50/50 partnership with Northland Power Inc. to form the MMWLP and to develop, own and operate the McLean's Mountain 60 MW Wind Farm project.

NPI's development activities include building, owning and operating wind energy facilities. In the course of developing its wind energy projects, NPI satisfies various

environmental approval requirements and obtains regulatory approvals that vary depending on the jurisdiction, project capacity and site location.
The MMP company was formed to lead renewable energy projects on Manitoulin Island in order to protect First Nations' rights, heritage and ensure the future for First Nations' youth.

MMWLP is the primary contact for this project. The MMWLP contact information is as follows:

Full Name of Company:	*McLean's Mountain Wind Limited Partnership*
Address:	*30 St. Clair Avenue West, 17th Floor* *Toronto, Ontario M4V 3A1* *Canada*
Telephone:	*Local Office: (705)-368-0303* *Mobile: (705)-271-5358*
Prime Contact:	*Rick Martin, Project Manager*
Email:	*rickmartin@northlandpower.ca*

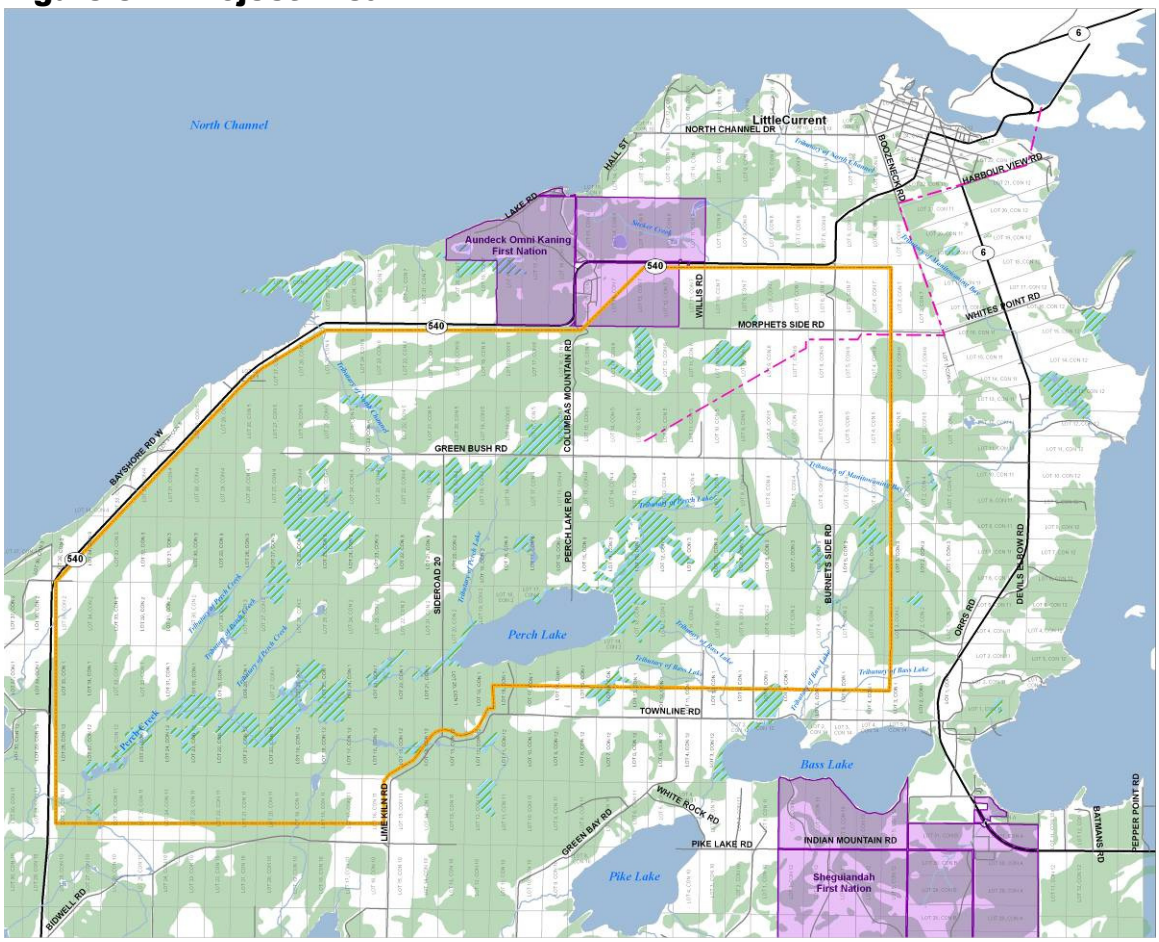
Dillon Consulting Limited is the prime consultant for the preparation of this *Design and Operations Report*. The Dillon contact is:

Full Name of Company:	*Dillon Consulting Limited*
Address:	*235 Yorkland Boulevard, Suite 800, Toronto, ON M2J 4Y8*
Telephone:	*Office: (416)-229-4646 ext 2335*
Prime Contact:	*Don McKinnon, Associate and REA Project Manager*
Email:	*dpmckinnon@dillon.ca*

3. PROJECT LOCATION

The Project Study Area is located entirely in the Municipality of Northeastern Manitoulin and the Islands; geographic Township of Howland and the geographic Township of Bidwell, in the District of Manitoulin and falls within the traditional lands of the Anishnabee of Mnidoo Mnising. The project location is about 5 kilometres from the Town of Little Current. Within this broader Project Study Area is the Project Site Area, where the wind turbines and associated wind farm infrastructure will largely be located (excluding a portion of the transmission line and the connection yard at the Hydro One grid, which is located on the adjacent Goat Island). **Figure 3-1** presents the location of the Project Area.

Figure 3-1: Project Area



The selection of the project's location was based primarily on the wind resource assessment results, access to the local electrical transmission system, environmental constraints and local landowner support.

4. SITE PLAN OF THE PROJECT LOCATION

The site plans are presented in **Appendix A**. The site plan details the location of facility components, natural features, noise receptors, required setbacks and lands within 300 metres of all project components and construction activities. The UTM coordinates for the locations of the noise receptors within 2000 metres of project components and their distances from the project location boundary can be found in the *Environmental Noise Impact Assessment Report* **(Appendix B)**. The project does not fall within or adjacent to any protected properties and no cultural heritage resources or significant archaeological resources fall within the project location (see the *Archaeological Assessment Reports* and *Cultural Heritage Self-Assessment Report*).

The following are not shown in the site plans because they will not be collected, transmitted, treated, stored, handled, processed or disposed of in the construction, operation or decommissioning of the facility:

- surface water supplies;
- sewage;
- biomass; and
- source-separated organics.

Figure A-1 in **Appendix A** provides the location of major facility components making up the outer boundary of the project location. The purpose of this figure is to provide the larger context for the facility components and natural features that will be shown in more detail in **Appendix A** - **Figures A-2** and **A-3**.

The proposed McLean's Mountain Wind Farm layout with all project components is provided in **Appendix A** - **Figure A-2**. The wind turbine setbacks were determined based on the REA setback requirements that ensure:

- minimal impact on sensitive natural environments;
- public safety in the event of ice shedding or turbine failure; and
- acceptable sound levels for surrounding receptors.

The locations of all noise receptors within 2000 metres are also shown in **Appendix A - Figure A-2**. The closest noise-sensitive receptor to a wind turbine is Receptor ID 281, which is 700 metres from a wind turbine #23.

Appendix A -Figure A-3 builds on the previous two figures and includes land contours and delineates all required set-backs. Setbacks apply only to those natural features deemed 'significant' by the *Evaluation of Significance Report* (included in the *Natural Heritage Assessment*) and watercourses that are intermittent or permanent. Setbacks include:

- 30 metre Watercourse setbacks;
- 120 metre River/Stream setback;
- Perch Lake setback;
- 120 metre ANSI setback;
- 61.5 metre non-participating landowner lot setback (A Property Line Setback Report is included in the REA submission);
- 61.5 metre road setback; and
- 550 metre noise receptor setback.

All wind turbines have been sited at least the length of the wind turbine blade plus 10 meters from any non project participating property boundaries.

MMWLP have sited its wind turbines to reflect the MOE's position (as outlined in their March 19 and 22, 2010 letters to NPI) that "hunt camps" (existing or proposed) do not need to be considered as sensitive noise receptors. Please find these letters attached as **Appendix E**.

The transformer lies outside of all required setbacks. Additional information is provided in the *Environmental Impact Statement Report*, and more specifically the *Natural Heritage Assessment Report* and *Water Assessment Report*. **Table 4-1** below lists all wind turbines and setbacks from non-participating receptors, lot lines and other significant features.

Table 4-1: Turbine Setbacks to Receptors and Significant Features

Turbine ID #	Nearest Non-Participating Receptor (m)	Nearest Non-Participating Lot Line (m)	Nearest Public Road (m)	Heritage or Archaeological Resources closer than 120m (m)	ANSI Closer than 120m (m)	Wetland Closer than 120m (m)	Watercourse Closer than 120m (m)
5	998	686	205	n/a	n/a	n/a	n/a
6	1200	575	443	n/a	n/a	n/a	n/a
9	1100	75	356	n/a	n/a	n/a	n/a
10	1420	430	356	n/a	n/a	n/a	n/a
11	1391	218	594	n/a	n/a	n/a	n/a
12	917	250	285	n/a	n/a	n/a	n/a
13	817	200	776	n/a	n/a	n/a	n/a
14	1146	225	581	n/a	n/a	n/a	n/a
15	928	100	80	n/a	n/a	n/a	n/a
16	1607	150	1367	n/a	n/a	n/a	n/a
17	2584	135	625	n/a	n/a	n/a	n/a
18	721	331	500	n/a	n/a	n/a	n/a
19	1110	303	370	n/a	n/a	n/a	n/a
20	737	295	370	n/a	n/a	n/a	n/a
21	1534	68.2	360	n/a	n/a	n/a	n/a
23	698	520	574	n/a	n/a	90	n/a

Table 4-1: Turbine Setbacks to Receptors and Significant Features

Turbine ID #	Nearest Non-Participating Receptor (m)	Nearest Non-Participating Lot Line (m)	Nearest Public Road (m)	Heritage or Archaeological Resources closer than 120m (m)	ANSI Closer than 120m (m)	Wetland Closer than 120m (m)	Watercourse Closer than 120m (m)
25	919	550	1167	n/a	n/a	n/a	n/a
28	1800	220	880	n/a	n/a	n/a	n/a
29	1663	400	1212	n/a	n/a	n/a	n/a
30	1440	445	645	n/a	n/a	60	n/a
31	1795	430	1650	n/a	n/a	n/a	n/a
34	1095	197	608	n/a	n/a	n/a	n/a
35	1290	500	1295	n/a	n/a	n/a	n/a
36	1911	230	1913	n/a	n/a	n/a	n/a
38	1800	225	1800	n/a	n/a	n/a	n/a
39	2707	415	1470	n/a	n/a	n/a	n/a
40	2035	175	1953	n/a	n/a	92	n/a
42	970	550	1010	n/a	n/a	n/a	n/a
43	2258	65	1885	n/a	n/a	n/a	n/a

4.1 Noise Receptors

Building upon the project specific guidelines, noise impact prediction modelling was undertaken. The noise impact from the Project's wind turbine array and transformers and including neighbouring wind turbines operating at maximum rated power on the nearest points of reception was predicted using an acoustic model, ISO 9613, as required by the MOE.

The analysis shows that the noise impact from the Project does not exceed the most restrictive noise limits that apply for areas with acoustic designation of Class 3 (Rural) as defined by the MOE. Consequently, there is no need for the application of any additional mitigation measures and no further studies are contemplated for environmental noise in relation to the Project.

Details regarding the proposed wind turbines acoustic emissions and sound power level are provided in the *Environmental Noise Impact Assessment Report* developed by Aerocoustics Engineering. This report is included in **Appendix B** of this document.

5. FACILITY DESIGN PLAN FOR THE PROJECT

5.1 Name Plate Capacity and Classification

The McLean's Mountain Wind Farm is designed to generate a maximum of 60 MW of electricity. According to Part II, Section 4 of O. Reg. 359/09, the project is a Class 4 Wind Facility. The characteristics of a Class 4 Wind Facility, as described in the regulation, are as follows:

- at a location where no part of a wind turbine is located in direct contact with surface water other than in a wetland;
- the nameplate capacity of the facility is greater than 50 kW; and
- the greatest sound power level is greater than 102 dBA.

5.2 Wind Farm Components

The major components of the project during the Operations and Maintenance phase of the project are as follows:

- Twenty-four (24) wind turbines;
- 690V /34.5 kV step up transformers (located in the nacelle of each turbine);
- 34 kV collection system to link the wind turbines to the substation;
- Transformer/substation (34.5 kV to 115 kV);
- A 10.3 km, 115 kV single circuit transmission line;
- A connection station at the point of connection with the provincial grid;
- Transition yard;
- Wind turbine access roads; and
- Four (4) meteorological towers (which are already installed and operating).

Wind Turbine Generators

The project includes twenty-four (24) GE 2.5 MW wind turbine generators with a total installed nameplate capacity of 60 MW. The turbine towers are 98.3 metres in height and the blade diameter including hub, are 103 metres across. The nacelle, located at the top of each turbine tower, houses the generator, inverter, gearbox, bearings, couplings, rotor and auxiliary equipment. The nacelle is constructed of fiberglass, lined with sound insulating foam, and has lighting and ventilation to allow work to be conducted inside. The turbine blades are mounted on a hub and shaft that are connected to the nacelle. Each turbine tower consists of several stacked segments which are mounted on a concrete foundation. Specifications of the turbines can be found in the *Wind Turbine Specifications Report*.

A summary of the basic specifications of the GE 2.5 MW wind turbines can be found below in **Table 5-1**. Please refer to the *Wind Turbine Specifications Report* for more detailed information on the wind turbines proposed for the Project.

Table 5-1: Basic GE 2.5 MW Wind Turbine Specifications

Manufacturer	General Electric (GE)
Model	2.5xl
Name Plate Capacity (MW)	2500 kW
Hub Height	98.3 metres
Rotor Diameter	103 metres
Blade Sweep Area	8328 m^2
Mode of Operations	Horizontal Axis, Upwind, Pitch Controlled
Approximate Foundation Diameter	18 metres

Appendix D lists the UTM Coordinates for the project components, including all wind turbine sites, the operations and maintenance building and the transformer station.

Wind Turbine Lighting

The proposed wind turbines will be lit according to Transport Canada (TC) standards. Select wind turbines located on the perimeter of the proposed wind farm will be lit with appropriate lighting. The highest wind turbines in the wind farm will also be lit. Flashing lights are required. All lit wind turbines will flash simultaneously. The amount of lighting required for the proposed wind farm is not expected to unduly impact residents and cottagers in the area.

Ancillary Equipment

Step-up Transformers & Collection System

A small "step-up" transformer will be located in the base of the tower of each turbine to transform the electricity from 690 V to 34.5 kV for transmission through the collection system. The collection system will consist of four different feeder lines (see **Figure A-3** for mapping). The feeder lines will generally follow the turbine access roads, although in some cases, to reduce the distance of the lines, the lines may divert from the roads.

All feeder lines will be located underground with the exception of 2 water crossings where there will be overhead lines. It is expected that the above ground sections of the overhead lines would be supported by single poles although in some cases, double poles could be required (due to soil conditions, angles in the line, etc.). There are 4 additional water crossing or wetland crossing locations that will be directional drilled. Descriptions of these crossings are provided in the *Construction Plan Report* and *Waterbodies Assessment and Water Body Report.*

Met Tower

Currently there are four (4) met towers installed within the Project Study Area. At least one of these towers will remain (possibly all 4) to collect meteorological data during the operations of the facility. The met towers currently on-site collecting data are tubular in construction and are 60 metres tall. The foundations are steel reinforced concrete filled

tubular pile. Guy wires are mounted on steel anchors and embedded into the concrete pads. There are three anchor points and the guy wire radius is 35 metres.

Turbine Access Roads

Access roads are required in order to deliver the wind turbine components as well as allow operation and maintenance of the wind turbines. The central and eastern areas of the project will be accessed via Highway 6 and Green Bush Road, while the western area of the project will be accessed via Highway 540. There is the potential for Greenbush Road to be widened in at least 2 locations to 5.5 metres to 8 metres in width. The intersection of Green Bush Road and McLean's Mountain Road will require widening of the turning radius. A 38.1 metre turning radius is required for the delivery of the wind turbine components. Widening of the turning radius would involve the placement of granular material to create a widened roadbed. The road grade and vertical curves may have to be adjusted to comply with the *General Electric Specification Report - Site Roads and Crane Pad*. See *Appendix D* of the *Construction Plan Report* for the Specification Report. The widened intersections would be removed after component delivery but the entrances and any culverts would remain.

Access roads will be required to access each turbine site from existing public roads during both the construction and operation phases of the project (see **Figures A-2 and A-3** for the routing of the access roads). The access roads will be excavated and constructed, to be 5.5 metres wide with no ditches and be composed of a gravel base. Where turning is required the width of the road may be wider. One watercourse crossing, a tributary to Bass Lake, will be required and the crossing would be facilitated through the use of a culvert allow stream flow to continue.

For further information on the turbine access roads please refer to the *Construction Plan Report*.

Transformer and Transmission Line

Transformer/Sub-Station

A single walled transformer will be required to increase the voltage of the electricity from 34.5 kV to 115 kV. The higher voltage is required to allow connection with the provincial grid. The sub-station will consist of an open-air design facility with one transformer unit and would be surrounded by a security fence and would have security lighting. The sub-station would require an area of 50 metres x 80 metres of land (see **Figure 5-2** for the location of the sub-station).

A concrete containment system would be installed to capture any leaks from the transformer. The containment system would be sized so that it would contain all of the oil in the transformer should there be a complete failure of the unit (which would be a rare and unexpected event). The containment system is to be approximately 5 metres x 6 metres in size. Water in the containment system would be visually inspected for any evidence of oil (as oil would float to the top). If oil is present, a tank truck would be

brought to site to pump the water/oil mix into it. The water/oil mix will then be disposed of off-site at a licensed facility. If no oil is detected in the water, the water would be pumped out to an adjacent swale and then allowed to infiltrate into the ground. Given the small size of the containment system, the volume of water collected would be very small.

High Voltage Transmission Line

From the step-up transformer, a 115 kV single-circuit transmission line will be constructed to connect the project to the existing Hydro One transmission system circuit S2B that is located on Goat Island (see **Figures A-1 and A-2** for the proposed route). This connection will be facilitated through the transition yard, where the overhead transmission line will go underground and cross the channel to Goat Island. The 115 kV transmission line will be supported through either single or double poles. The transmission line is largely contained within municipal road rights-of-way but some private property will be crossed and MMWLP has acquired easements through the affected parcels of private land. It is anticipated that the maximum width of the right-of-way (RoW) would be 8-10 metres depending on the distance of poles and conductor swing. There will be the need to cross the North Channel to Goat Island with a submarine cable (500 metres of submarine cable). The cable will lie on the bed of the channel but be trenched in at both shorelines. Once on Goat Island, the cable will run underground for 300 metres to connect to the provincial transmission line at Hwy 6.

Other than the North Channel crossing the transmission line will have to cross 2 watercourses by overhead lines. These watercourses would be spanned by the overhead lines and there would be no effect to these watercourses. Descriptions of these crossings are provided in the *Construction Plan Report* and *Waterbodies Assessment Report*.

Connection Station

A connection station would be required at the point of connection with the provincial grid on Goat Island. Breaker/disconnect switches would be installed to allow the flow of electricity from the project to be turned off/on.

Operations and Maintenance Building

An operations building will be constructed and used for the duration of the wind farm project. This building will be located on Lot 13 Concession 5, Township of Howland and the footprint would be 450 m^2. This building would provide warehouse and workshop spaces, administrative offices and telecommunications areas. From this building the wind farm would be operated, monitored and controlled 24 hours per day. This building would have a separate containment area for the storage of spent oil and lubricants until they are transported off-site.

5.3 Sewage

To service the Operations and Maintenance Building a septic system, with a 4000 L tank, would be constructed. It would be the project owner's responsibility to ensure proper maintenance of the septic system, with regular pumping of the tank (every 4-5 years) and to ensure that no chemicals or hazardous materials that could destroy the bacteria required for sewage breakdown and cause environmental harm be released into the septic system.

5.4 Groundwater

A well will be required to provide a potable source of water for the Operations and Maintenance building. As there will be fewer than 10 part-time personnel at the facility on a part-time basis it is expected that only small quantities of water will be used. It is estimated using a low-flow toilet and faucet for the restroom facilities that 50 litres of water would be required per day, with an average annual use of less than 50,000 litres.

5.5 Water Crossings

Permanent culvert installation will be required along the turbine access roads. The assessment of the potential effects of culvert construction has been documented in the *Construction Plan Report*, the *Waterbodies Assessment Report* and the *Water Bodies Report*.

5.6 Equipment Related to Stormwater Management

No stormwater management or sediment control is required during the operation and maintenance phase of the facility. Thus no stormwater equipment is required. Stormwater management measures and equipment related to construction activities are discussed in the *Construction Plan Report*. As reported above, a concrete containment system would be installed to capture any leaks from the transformer. Water in the containment system would be visually inspected for any evidence of oil (as oil would float to the top). If oil is present, a tank truck would be brought to site to pump the water/oil mix into it. The water/oil mix will then be disposed of off-site at a licensed facility. If no oil is detected in the water, the water would be pumped out to an adjacent swale and then allowed to infiltrate into the ground.

Further Best Management Practices and Environmental Monitoring are included in **Appendix C:** *Environmental Management and Protection Plan* (EMPP).

5.7 Other Equipment

During the operation and maintenance phases the wind energy facility will not engage in, nor will any equipment be required for, the following activities:

- the use of surface water;
- the generation, collection, transmission or treatment of sewage;
- the production, handling, storing or processing of any waste, biomass, source separated organics, farm material or biogas;
- discharges of contaminants to air; and
- dewatering.

6. FACILITY OPERATIONS PLAN FOR THE PROJECT

6.1 Wind Turbine Operation

The wind turbines will be operated in a manner consistent with nationally recognized standards for operation of wind turbine facilities in Canada. The project will be operated by a staff of 10 people who would work out of the on-site operations building. Typical generated traffic would be low and include staff traveling to and from the operations building to visit/inspect the turbines, as required.

A communication system will be installed that will provide on-site notification and also allow remote monitoring of the status of the turbines. Components defined as critical, such as the rotor, generator, gearbox and cooling system, will be monitored using a supplier designed system to ensure safe shutdown. Controls will be implemented for fail safe action in the event of electrical or instrument losses.

The wind turbine system will be integrated with the electric interconnection Supervisory Control and Data Acquisition (SCADA) to ensure that the project critical controls, alarms and functions are properly coordinated for safe, secure and reliable operation.

At least one (1), but possibly all, of the existing four (4) currently installed meteorological monitoring towers will continue to be operated throughout the operation of the wind farm to assist MMWLP in assessing the performance of the turbines.
Wind Turbine and Ancillary Facilities MMWLP for the planned and unplanned service and maintenance of the wind turbines. MMWLP will employ two (2) local operators and there will be up to eight (8) GE staff onsite for a total of ten (10) operators to monitor and co-ordinate routine maintenance activities of the wind farm (e.g., line maintenance and inspection, snow clearing, etc.).

Normal maintenance on the individual wind turbines occurs twice per year. It involves complete checks of structural soundness, checks of the electronics systems, changing of hydraulic and lubricating fluids, etc. Two person teams, for safety reasons, conduct maintenance. The expected maintenance time involved is two days per turbine. Unexpected maintenance occurs infrequently and typically involves the replacement of a major component, such as a gearbox, transformer or blade. In the event of a major malfunction, a crane may be required to lift the affected component.

6.2 Stormwater

The project does not include any permanent stormwater treatment facilities. Stormwater collected within the sub-station transformer containment basin would be manually pumped out to a tanker truck (for off-site treatment), if oil is detected in the water. Uncontaminated water would be pumped out to a swale for ground infiltration.

6.3 Waste Management

Project operations will result in the generation of solid waste (i.e. office waste, materials packaging, used mechanical parts, etc.) and used turbine lubricant and oils. The daily expected quantity of waste to be generated is less than 5 kilograms of office waste.

The wind turbines need to be serviced annually. Approximately six oil or air filters will have to be replaced annually. The amount of spent oil is only about 1 litre of oil per turbine. The turbines may also need new brake pads, pitch batteries and pre-contacts for proper functioning. Every three years the turbines will need a complete set of oil changes, for the yaw drive, gearbox and pitch drives, which will accumulate about 900-1000 litres of waste oil. Every five years the converter coolant will need to be exchanged. The waste coolant, about 60 litres per turbine, will need to be disposed of.

Waste will be stored in a secured area of the Operations and Maintenance Building. Solid waste would be collected and transported off-site for disposal at the Town of Northeastern Manitoulin and the Islands (NEMI) landfill site, located at 9571 Highway 6 south, Little Current. The Town's landfill is equipped to deal with hazardous wastes. Liquid and hazardous industrial waste (oils etc.) will be disposed in accordance with Ont. Regulation 347.

7. ENVIRONMENTAL EFFECTS MONITORING PLAN

Section 6 of the *McLean's Mountain Wind Farm ESR* (July 2009) and the *Environmental Management and Protection Plan* (**Appendix C** to this report) and the *Avian and Bat Post-Construction Monitoring Plan* **(Appendix F)** reports outline the project environmental monitoring activities to be undertaken during the operations period. These plans should be considered as supporting documents to the rest of the *Design and Operations Report* and fulfills the requirements outlined by Ontario Regulation 359/09. These plans also outline the actions to be taken in the event that unanticipated events occur. This plan is applicable to all employees of MMWLP and provides guidance to all contractors and subcontractors on environmentally safe standards for project activities during operation and environmental monitoring of the project.

Table 7-1 presents a summary of the potential negative effects, performance objectives, mitigation strategies and the proposed monitoring plan for each environmental feature.

7.1 Project Commissioning and Schedule

McLean's Mountain Wind Farm is anticipated to be operational by November 2012 and is expected to be operational for 20-25 years. Environmental monitoring procedures will be implemented through each of the construction, operations and decommissioning phases of the project.

7.2 Avian and Bat Post-Construction Monitoring Plan (PCMP)

This monitoring plan has been designed to evaluate the accuracy of the predicted environmental impacts on birds and bats and to meet requirements set out in Regulation 359/09. Environment Canada and the Ontario Ministry of Natural Resources (MNR) are being consulted to confirm this monitoring strategy.

The project area has been assigned a Sensitivity Rating of 3 (High) in relation to bats, based on criteria provided by the MNR (MNR 2007). The major concern for the project area is the proximity to the North Channel shoreline, the presence of a forested ridge feature and the potential for these features to concentrate migrating bats. The closest turbine to the North Channel shoreline is 1.5 kilometres away.

Details of bird and bat pre-construction surveys are provided in sections 6.6 and 6.7, and Appendices D and E, of the *Environmental Study Report* (ESR) respectively. As stated in these sections, the expected level of impact to all guilds of birds and bats, after protection and mitigation measures have been implemented, is considered to be low. A list of setbacks protecting sensitive natural features and habitats is provided in Table 1, Item 1 of the concordance table outlining project fulfillment of REA requirements.

Concerns that have been identified and will require specific monitoring include:

- Potential mortality effects to birds and bats in the project area (ESR Sections 6.6.2 and 6.7.2).
- Potential risk of disturbance impacts to the 17 BCR 13 priority species that were observed during fieldwork in the Study Area (which includes 8 forest species, 7 open country species and 2 marsh/water species) and other sensitive species occurring, including sharp-tailed grouse, upland sandpiper and Wilson's snipe. A full list of the BCR 13 priority species observed in the Study Area can be found in Table 7 (p.28) of the Bird Study Report, *Appendix D* in the ESR, and in Section \ 6.9 of the ESR.

Species or groups that were determined to be of limited concern, and therefore not requiring specific monitoring, include:

- Fall migration of raptors, waterbirds and sandhill cranes (ESR Sections 6.6.2).
- Species at Risk not observed during surveys but potentially present including short-eared owl and golden-winged warbler, whip-poor-will; Canada warbler, common nighthawk and chimney swift, which were rarely observed; and loggerhead shrike which was historically observed in 1999 and 2000 (ESR Section 6.9).

Because large wind farm facilities are a relatively new addition to Ontario's infrastructure, large datasets with multiple years of study relating to environmental impacts do not exist to inform the accurate prediction of impacts. To address this uncertainty an adaptive monitoring and management plan has been developed. In the event that unexpected negative impacts occur, employment of this plan will allow for flexibility in the operation of the wind farm in an attempt to reduce these negative impacts and the likelihood of their future occurrence.

7.3 Purpose and Objectives of the Environmental Management and Protection Plan

The EMPP has been developed to provide the required protection measures for the activities associated with the construction, maintenance and operation phases of the McLean's Mountain Wind Farm, as such these are long term initiatives. The EMPP will be maintained by the Project Manager and is meant to be a living document, and such, will be updated from time to time when new technologies or best practices emerge that would further mitigate any potential adverse effects from all stages of the project.

This EMPP forms an integral component of all construction work to be done on this project. The purpose of the EMPP is to:

- Ensure that commitments to minimize environmental effects in general, and specific regulatory requirements, will be met;

- Provide concise and clear instructions regarding measures for protecting the environment and archaeological resources, and minimizing potential adverse environmental effects;
- Document environmental concerns and describe appropriate protection measures associated with Project construction;
- Provide a reference document for planning and/or conducting specific activities that may have an effect on the environment;
- Function as a training aid for environmental education and orientation; and,
- Communicate changes in the program through a revision process.

7.4 Performance Objectives

The key performance objective for each of the features elaborated on below is avoidance and/or minimization of potential effects through the appropriate use of mitigation measures throughout the operations phase of the Project. All mitigation measures assist in achieving these performance objectives.

7.4.1 Wind Farm Maintenance Activities and Operation

Regular wind turbine maintenance generally occurs twice every year. Regular maintenance includes mechanical inspections of the tower, turbine and transformer, as well as changing of hydraulic and lubricating fluids. Inspections for leaks of hydraulic and lubricating oils will be performed during routine maintenance. Generally turbine maintenance takes between 2-4 days per turbine depending on weather conditions. A summary of potential adverse effects, performance objectives, mitigation measures and the monitoring and contingency plan related to maintenance activities and operation of the wind farm are listed below in **Table 7-1. Section 6.4** discusses the wastes associated with regular turbine maintenance. Please see **Appendix G:** GE Maintenance Checklist for routine maintenance required for the turbines.

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Water Bodies and Aquatic Resources				
Surface Water	• Potential contamination from accidental spills • Erosion, sedimentation and surface water turbidity during maintenance activities	• No spills • No erosion or sediment transport • No surface water turbidity	• Following completion of the maintenance activity stream banks would be restored to original state • Siltation to a watercourse occurs, activities should cease immediately until the situation is rectified • Best Management Practices as described in the EMPP • See "Accidental Spills'	• See Accidental Spills
Groundwater	• Potential contamination from accidental spills	• No spills	• See Accidental Spills	• See Accidental Spills
Natural Heritage Resources				
Woodlands	• Dust emissions from road use to access turbines for maintenance • Contamination through accidental spills	• No Spills • Minimize magnitude and duration of emissions	• See Accidental Spills • See Dust and Odour Emissions	• See Accidental Spills • See Dust and Odour Emissions
Valleylands and Hazard Lands	There are no Valleylands or Hazard Lands within 120 metres of the project	N/A	N/A	N/A

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Areas of Natural and Scientific Interest	• There are no ANSI's within 120 metres of the project	N/A	N/A	N/A
Wetlands	• Contamination through accidental spills • Dust emissions from road use	• No spills • Minimize magnitude and duration of dist emissions	• See Accidental Spills • See Dust and Odour Emissions	• See Accidental Spills • See Dust and Odour Emissions
Provincial Parks and Conservation Reserves	None	N/A	N/A	N/A
Other Designated Natural Areas	None	N/A	N/A	N/A
Significant Wildlife and Wildlife Habitat	• Possible disturbance to use of adjacent bird habitat from operating turbines • Possible disturbance to wildlife movement from human activity/vehicles	• Minimize disturbance to threatened and endangered species, wildlife and amphibians. • No wildlife road kills	• Obtain all applicable permits for threatened and endangered species. • Maintenance vehicles restricted to primarily to daytime hours • Vehicle speeds in project areas restricted to 30 km/h with signage • See Environmental Noise • See Local Traffic • See Dust and Odour Emissions	• See Bird and Bat Post-Construction Monitoring Plan • Post-construction monitoring to assess the displacement effect on open country grassland and area-sensitive forest breeding bird species for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Significant Flora and Vegetation Communities	• Potential for effects in area of turbine by crane if needed for maintenance activities • Potential disturbance from vehicle generated dust	• Minimize disturbance to flora and vegetation communities.	• See 'Dust and Odour Emissions'	• See 'Dust and Odour Emissions'
Birds	• Mortality of birds due to contact with wind turbines • Reduction in breeding area	• Meet mortality threshold level as outlined in the Avian Post Construction Monitoring Plan (PCMP) (Table 3)	• Post-construction monitoring to assess impacts of turbines on bird populations for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan • Turbines have been well spaced apart to allow passage around turbines	• A 3-year post construction avian monitoring plan will be implemented • In the event that bird/bat mortality levels exceed threshold levels, an adaptive management plan will be implemented with the input of the MNR as outlined in the Avian PCMP
Bats	• Mortality of bats due to contact with turbines	• Meet mortality threshold level as outlined in the Avian Post Construction Monitoring Plan (PCMP) (Table 3)	• Post-construction monitoring to assess impacts of turbines on bat populations for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan • Turbines have been well spaced apart to allow passage around turbines.	• A 3-year post construction avian monitoring plan will be implemented. • In the event that bird/bat mortality levels exceed threshold levels, an adaptive management plan will be implemented with the input of the MNR as

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
				outlined in the Avian PCMP.
Air Quality and Environmental Noise				
Air Quality	• Emissions from equipment and vehicles	• Minimize duration and magnitude of emissions	• Maintenance workers would maintain and operate vehicles in a manner that reduces air emissions to the extent practical, including, avoiding idling times and performing regular maintenance on vehicles	• None Required
Dust and Odour Emissions	• Dust emissions from operation and maintenance vehicles	• Reduce dust emissions to the greatest extent possible	• Maintain all vehicles and equipment in good running condition and in compliance with regulatory requirement • Suppress road dust with water if necessary • Cover loads of materials that could create dust	• Adherence to Complaint Resolution Process
Environmental Noise	• Noise emitted from transformer and turbines. • Noise emitted from traffic and/or vehicles	• Maintain noise levels at receptor locations no greater than 40 dBA.	• Adherence to the receptor setback distance as outline in the project site plan • Maintain the turbines in good operating condition	• Monitoring of turbines and replacement of damaged blades • Public noise complaints monitoring and follow-up. • Adjust turbine operation to ensure applicable noise limits are met • Turbine Maintenance to ensure turbine are functioning properly

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Heritage and Archaeological Resources				
Protected Properties and Heritage Resources	None	None	None	• See Cultural Heritage Self-Assessment Report
Archaeological Resources	None	N/A	N/A	• See Stage 1 and Stage 2 Archaeological Assessment for Monitoring and Contingency Plans
Land Use and Socio-Economic Resources				
Existing Land Uses	• Temporary increase in noise and dust levels during maintenance	• Minimize disturbance to existing land uses, including local businesses	• See Environmental Noise • See Dust and Odour Emissions	• See Environmental Noise • See Dust and Odour Emissions
Recreation Areas and Cultural Features	• There are no public recreation spaces in the project area • The surrounding private lands are used for Fall hunting activity • The operating wind farm could have a minor disturbance effects to hunting activity (e.g. from turbine noise, traffic)	• Minimized disturbance to recreation areas	• See Local Traffic • See Environmental Noise • See Dust and Odour Emissions	• See Local Traffic • See Environmental Noise

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Mineral, Aggregate and Petroleum Resources	None	N/A	N/A	N/A
Game and Fishery Resources	• Disturbance to game species from noise and maintenance activities	• Minimize disturbance to game species.	• Keep equipment in good condition to minimize noise effects	• Complaint Resolution Process
Local Traffic	• There will be a negligible increase in local traffic during operations	• Minimize disturbance to local traffic	• None required during the operations and maintenance phase of the project	• Complaint Resolution Process
Viewscape	• Disruption in the local viewscape	• Minimize potential for disruption of local viewscape	• MMWLP has undertaken a visual assessment of the wind turbines. • Use of landscaping to mitigate any potential disruption in viewscapes from the Operations and Maintenance building and the transformer station. • Turbines to be coloured in such a way that they will blend into the surrounding environment as much as possible.	• Complaint Resolution Process
Local Economy	• There will be an increase in direct and indirect employment over the operations and maintenance phase of the project	• Create positive effects on the local economy	• MMWLP will locally source all required goods and services from qualified local suppliers whenever possible.	• None required

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
	• Local economic benefits from an increase in municipal taxes and landowner lease payments.			
Existing Infrastructure				
Provincial and Municipal Infrastructure	• There will be a negligible increase in truck traffic during the operations and maintenance phase	• Minimize disturbance to Provincial and Municipal Infrastructure	• Local residents would be notified of unconventional load movements if they occur • Any necessary permits would be obtained for unconventional loads	• See Local Traffic
Telecommunication Networks	• Potential interference with TV or radio signals	• Minimize any disturbance effects to TV and radio signals	• NPI has consulted with all agencies and licensed providers to identify any likely effects to telecommunications networks	• Complaint Resolution Process • MMWLP will review all complaints of interference on a case by case basis
Aeronautical Systems	• Aeronautical obstruction	• Minimize the potential to low flying aircraft	• Turbine lighting will conform to Transport Canada standards • To reduce rural light pollution lights with the minimal allowable flash duration, narrow beam and would be synchronized • NAV Canada has been consulted and will be responsible for updating all aeronautical charts with turbine locations	• Routine maintenance of the turbines and replacement of any safety lighting in the event of malfunction

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Waste Management				
Waste Generation	• Improper disposal of waste material might result in contamination to water resources and soil on and off project site	• Ensure the proper disposal of waste material	• Contractor will be required to remove all waste materials during maintenance activities • There will be a systematic collection and separation of waste materials within on-site storage areas in weather protected areas located at the operations and maintenance building	• See Accidental Spills
Accidental Spills	• Potential contamination of groundwater, surface water and wetland features from accidental spills	• No accidental spills to occur	• Labelling and proper storage of liquid wastes in secure areas of the operations and maintenance building that would ensure containment in the event of a spill • Septic tank design for the operations and maintenance building would conform to local building code requirements • As per section 13 of the EPA, all spills that could have a potentially adverse environmental effect would be reported to the MOE's Spills Action Centre • Spill kits would be provided on-site during maintenance activities at the operations building • Refuelling and equipment maintenance would occur in designated areas	• Monitoring would be required in the event of contamination from an accidental spill or leak • Contaminated soils would be removed and replaced as required

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Public Health and Safety				
Structural Failure	• Public health and safety issue from falling ice from turbine collapse	• No structural failure of the turbines or ancillary equipments	• Adherence to required setbacks. • Install, operate and maintain turbines according to applicable industry standards • Use of lightning protection systems	• Inspections of turbines to occur after extreme weather events and contingency measures such as turbine shutdown to be implemented in the event of structural damage • Routine turbine maintenance to ensure turbines are functioning properly
Ice Fall	• Public health and safety issue from falling ice from turbine blades	• Limit potential for ice throw to impact pedestrians and automobiles	• Adherence to required setbacks • Automatic turbine shutdown due to weight imbalances • Signage in areas where potential icing could occur • Design of the turbine tower reduces ice accumulation	• Inspections of turbines after extreme weather events and contingency measures such as turbine shutdown would occur in the event of structural damage or icing of the turbine blades • Routine turbine maintenance to ensure turbines are functioning properly
Extreme Weather Events	• Potential damage to wind turbines and ancillary infrastructure from extreme weather events	• No structural failure of the turbines or ancillary equipment	• Project components have been designed to withstand the effects of extreme weather events • Install, operate and maintain turbines according to all applicable industry standards	• Inspections of turbines would occur after all extreme weather events and contingency measures such as turbine shutdown would be implemented in

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
			• Failsafe devices are capable of shutting down turbines in the event of excessive wind or malfunction of turbine components	the event of structural damage • Routine turbine maintenance to ensure turbines are functioning properly

8. EMERGENCY RESPONSE AND COMMUNICATIONS PLAN

MMWLP will provide information releases to the community in the event of an emergency, if new issues arise, or if the community has specific concerns. NPI representative contact information will be available to the public to address concerns and questions during the life of the project including construction, operation, and decommissioning.

8.1 Contingency Plans for Unplanned Events

Please refer to **Appendix C: EMPP**, *Section 5*: Contingency Plans for Unplanned Events" for descriptions of the following contingencies:

- Emergency Response Plan;
- Erosion Control Plan;
- Fuel and Hazardous Materials Spills;
- Archaeological and Heritage Resources;
- Wildlife Encounters; and
- Fires.

8.2 Communications Plan for Project Updates and Activities

MMWLP will continue its stakeholder engagement activities through operations phases. This could include some of the communications activities planned for the construction period as outlined in the *Construction Plan Report*.

Broad community relations activities are also seen as essential to the implementation of a successful project. To this end, the following activities will be undertaken:

a) offers to conduct on-site tours with community leaders, local media and other interested parties during construction and periodically during operations;

b) erect signs; and

c) establish a project reporting mechanism for status reports with key regulatory stakeholders.

MMWLP will engage and inform the public, identified Aboriginal communities, Local Services Boards, the Municipality of Northeastern Manitoulin and the Islands, and related Provincial Ministries (i.e., Ministry of the Environment) in the following manner:

1) In the event of an emergency a log book including key contact and their information (names, emergency phone numbers) will be posted at the Project Office. This log book will also include description of the chain of communications between the proponent and relevant responders under emergency scenarios applicable to the project.Technical staff will recommend resolution

actions and assist with response to public and stakeholders such as the local fire department.

2) The non-emergency communications related to the project will be dealt with via update bulletins will be posted at the Project Office and distributed to the local Aboriginal communities' offices as well as to the Municipal Town Office and relevant stakeholders. This could, for example, include notification of project changes or results of the ongoing project monitoring.

3) Throughout the life of the project, MMWLP will maintain detailed "issues identification and resolution tracking tables". The issues/resolution tables will record key information such name, address and the telephone number of the complainant; time and date of the complaint, details of the complaint; actions taken to remediate the cause of the complaint; and proposed actions to be taken to prevent reoccurrence in the future. This document would be available in a log book electronic file.

4) All correspondence regarding the proposed project will be directed to the main project contact – the Project Manager who will be available via the project office and may be contacted as follows:

Rick Martin, Project Manager
Northland Power Inc. Little Current Office/
McLean's Mountain Wind Limited Partnership
McLean's Mountain Wind Farm Office
P.O. Box 73
Little Current ON, P0P 1K0
Mobile: 705-271-5358, Manitoulin Island Office: 705-368-0303
E-mail: rickmartin@northlandpower.ca

All correspondence and concerns raised will be received through the Project Manager and will be recorded in a form of a log book in an electronic file including: detailed information (name, address and the telephone number of the complainant), response to concerns and methods addressing the concerns. The procedure for recording any complaints from the public would also include notifying the Ministry's Spills Action Centre at 1-800-268-6060 of the receipt of the complaint.

8.3 Complaints Resolution Process

MMWLP acknowledges that some members of the community may have negative reactions to some of the construction activities and long term wind farm operations. Both the complainants and MMWLP have a stake in collaborating to resolve issues. A solution, in which both parties have had input, is more likely to constitute a long-term solution and is one that can often be implemented more effectively and efficiently than a decision rendered through an adjudicative process. To resolve disputes in a collaborative manner MMWLP will establish a Complaint Resolution Process (CRP). The Construction Manager will be responsible for the implementation of the CRP, including

the documentation of all complaints and inquiries from the public in relation to Project construction and operations. The Construction Manager will attempt respond to initially response complaints within a one or two day period following receipt. At a minimum, the CRP shall include provisions for the following:

1. Direct communications between the complainant and the receiver of the complaint (if not MMWLP), and MMWLP as the project proponent.
2. Fact-finding concerning the complaint, including:
    a) the area affected by the construction or operation activity, the area's zoning and its occupation, and the proximity of the affected persons as well as their sensitivities;
    b) the characteristics and magnitude of the effect;
    c) the impact on the persons affected;
    d) any existing goals or standards acceptability;
    e) the history of operations in the affected area;
    f) any changes in existing conditions (e.g., changes to land use);
    g) the availability of additional mitigation measures;
    h) a balance between the needs of the community and those of MMWLP;
    i) technically, operationally, and economically feasible solutions;
    j) regulatory precedents regarding the effect; and
    k) other issues specific to the complaint.
3. All parties would have the ability propose constructive and feasible solutions and should be receptive to the solutions proposed by the other party.
4. Should the parties be unsuccessful in their attempts to resolve an issue through collaborative measures, they may, on agreement, request the services of a mediator.

9. CONSIDERATION FOR PROJECTS SUBJECT TO LAND USE PLANS

The Project lands, local and surrounding do not fall within any of the following:

- Greenbelt Plan Protected Countryside;
- Greenbelt Plan Natural Heritage System;
- Oak Ridges Moraine Conservation Plan Area;
- Niagara Escarpment Plan Area; and
- Lake Simcoe Watershed Plan Area.

10. SUMMARY AND CONCLUSIONS

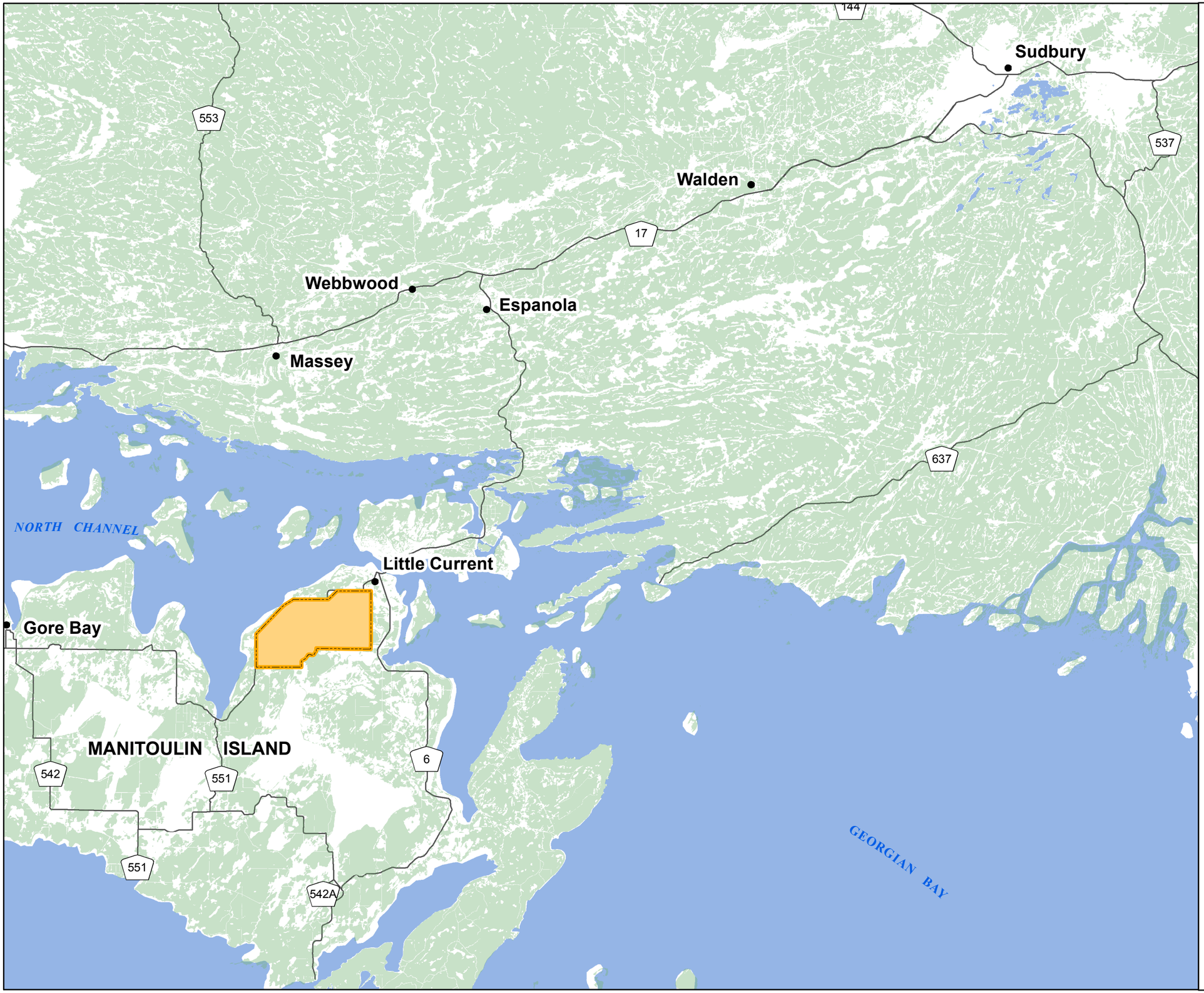
Significant adverse effects to the natural and social environment have been avoided through careful site selection, facility layout planning and strict adherence to all regulatory requirements. All turbines, access roads and ancillary facilities have been sited with landowner consultation to minimize the impact to current agricultural operations. No significant adverse environmental effects are anticipated.

The overall conclusion of this Design and Operations Report is that this project can be operated without any significant adverse residual effects to the natural or social environment.

There are net benefits of this project resulting from an increased municipal tax base for NEMI, increased number of employment opportunities (especially during the construction stage) and the generation of clean, renewable electricity from wind power. The operation of the wind farm will also provide annual economic benefits through royalties to landowners and a continuing need for supplies and services in the local and regional rural economies.

APPENDIX A

Site Plan & Mapping



NORTHLAND POWER

Mclean's Mountain Wind Farm
Figure A-1: General Location of Project

Legend

- Communities
- Highway
- Project Area
- Waterbody
- Woodlots

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DILLON CONSULTING

Created By: SFG
Checked By:
Date Created: May 27, 2008
Date Modified: July 21, 2011
File Path: I:\GIS\Northland Power\Mapping\Figure 4-1 General Site Plan.mxd

NORTHLAND POWER

McLean's Mountain Wind Farm
Figure A-2: Project Components Site Plan

Legend

- Noise Receptor
- Local Roads
- Highway
- 120 m Project Component Setback
- Lots/Concessions
- Water Body
- Watercourse
- Woodland
- Unevaluated Wetland
- 550m Noise Receptor Setback

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Access Road
- Feeder Lines
- Transmission Line
- Construction Staging Area

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NORTHLAND POWER

McLean's Mountain Wind Farm
Figure A-3: Natural Features and REA Setbacks Site Plan

Legend

- Residence
- Local Roads
- Highway
- 5 m Contours
- 40 dBA Noise Contour
- Lots/Concessions
- Water Body
- Watercourse
- First Nation Reserve
- Woodland
- Wetlands

Area of Natural and Scientific Interest, Life Science

- Sheguiandah Hill
- Sheguiandah Quartzite Quarry
- Bass Lake Marsh/Swamp

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Access Road
- Feeder Lines
- Transmission Line
- Construction Staging Area

REA Constraints

- 30m Watercourse Setback
- 120m River/Stream Setback
- 61.5m Non Participating Lot Setback
- 61.5m Road Setback
- Perch Lake Setback
- 120m Wetlands Setback
- 120m Life Science Area of Natural and Scientific Interest (ANSI) Setback
- 550m Noise Receptor Setback

N W E S

1:55,000

0 1 2 3

DILLON CONSULTING

Created By: KWR
Checked By: DM
Date Created: May 27, 2008
Date Modified: July 21, 2011
File Path: I:\GIS\091983 - Northland Power\Mapping\Design and Operations Report\Figure 4-3 Natural Features and REA Setbacks Site Plan.mxd

APPENDIX B

Environmental Noise Impact Assessment Report

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

McLEANS MOUTAIN WIND FARM
MANITOULIN ISLAND, ONTARIO

PREPARED FOR:

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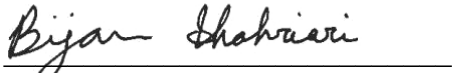
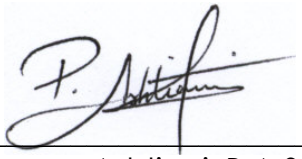


Bijan Shahriari



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22 July 2009
Revised 14 September 2011

Executive Summary

The purpose of this environmental noise impact assessment, prepared for the Northland Power Inc ("NPI") M1 Wind Project (the "Project"), is to fulfill NPI's requirements under Ontario Regulation 116/01 of the *Environmental Assessment Act* and to provide the basis for the Certificate of Approval – Air ["C of A (Air)"] under Section 9 of the *Environmental Protection Act* ("EPA"). The objective of this assessment is to demonstrate, by means of technical assessment, that the noise impact from the operation of the Project will comply with the Ministry of the Environment's ("MOE") environmental noise guidelines for wind turbines.

Building upon the project specific guidelines, noise impact prediction modelling was undertaken. The noise impact from the Project's wind turbine array and transformers and including neighbouring wind turbines operating at maximum rated power on the nearest points of reception was predicted using an acoustic model, ISO 9613, as required by the MOE.

The analysis shows that the noise impact from the Project does not exceed the most restrictive noise limits that apply for areas with acoustic designation of Class 3 (Rural) as defined by the MOE. Consequently, there is no need for the application of any additional mitigation measures and no further studies are contemplated for environmental noise in relation to the Project.

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GLOSSARY

agl	above ground level
C of A (Air)	Certificate of Approval – Air
Northland	Northland Power Inc.
M1	Northland Power McLean's Mountain Wind Farm
dBA	decibel A-weighted
ENIA	Environmental Noise Impact Assessment
EPA	*Environmental Protection Act*
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
kW	kilowatt
kV	kilovolt
LLA	Licence and Option to Lease Agreement
m	metre
m/s	metres per second
MOE	Ontario Ministry of the Environment
MW	Megawatt
PWL	Sound Power Level

1.0 INTRODUCTION

Northland Power Inc. ("NPI") has retained Aercoustics Engineering Limited ("Aercoustics") to prepare an environmental noise impact assessment ("ENIA") of the proposed 72 megawatt ("MW") M1 Manitoulin Island Wind Project ("Project"). The Project is situated near little current, in the Municipality of North-eastern Manitoulin and the Islands, Ontario.

The purpose of this ENIA is to fulfill NPI's requirements under Ontario Regulation 116/01 of the *Environmental Assessment Act* and to provide the basis for the Certificate of Approval – Air ["C of A (Air)"] under Section 9 of the *Environmental Protection Act* ("EPA"). Consequently, in fulfilling these requirements, the objective of this assessment is to:

> Predict the noise impacts from the Project at the nearest points of reception and to demonstrate, by means of technical assessment, that the noise impact from the operation of the Project will comply with the Ministry of the Environment's ("MOE") environmental noise guidelines for wind turbines.

The sound level limits and the noise assessment procedures are defined by the MOE in their October 2008 publication: "*Noise Guidelines for Wind Farms, Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities"* [17]. For continued reference, the MOE Interpretation (Attachment A) was prepared to assist proponents of wind turbine installations in determining what information should be submitted when applying for a C of A (Air), under the EPA.

The noise assessment was based on all of the recommended procedures outlined in the MOE's "Noise Guidelines for Wind farms, October 2008" [17].

2.0 DISCUSSION OF ACOUSTIC TERMINOLOGY

In order to fully understand the analysis presented in this ENIA, a brief discussion of the technical terms utilized throughout the report is included below.

The noise data presented in this report has been given in terms of sound pressure level. Sound pressure levels are measured in decibels ("dB"). It is common practice to sum sound pressure levels over the entire audible spectrum to give an overall sound pressure level.

The MOE requires that instantaneous sound pressure be processed by a special filter (i.e., A-weighting). As human hearing is less sensitive to low frequency sound, the weighting emphases the frequencies in the range 500 Hertz ("Hz") to 4000 Hz; while progressively diminishing the relative contributions at high and low frequencies. This corresponds approximately to the hearing response to humans at normal sound levels (e.g., 50 dB). The resulting "A-weighted" sound level is often used as a criterion to indicate a maximum allowable sound level.

The MOE defines a "point of reception" as any point on the premises of a person within 30 m of a dwelling or camping area, where sound or vibration originating from other than those premises is received. The MOE designates points of reception into three classes:

- Class 1 refers to an acoustical environment typical of a major population centre where the background noise is dominated by the urban hum. These areas are highly urbanized and have moderate to high noise levels throughout the day and night.
- Class 2 means an area with an acoustic environment that has low ambient sound levels between 19:00 hours and 07:00 hours; where the evening and night-time levels are defined by natural sounds and infrequent human activity and there are no clearly audible sounds from stationary sources (e.g., industrial, commercial, etc,).
- Class 3 refers to areas that are rural and/or small communities with a population of less than 1,000 with an acoustic environment that is dominated by natural sounds and has little or no road traffic during the night-time period.

3.0 DESCRIPTION OF WIND TURBINE SITE AND SURROUNDS

The Project is located near Little Current, in the town of North Eastern Manitoulin and the Islands, Ontario. The closest community in the vicinity of the Project is the Town of Little Current. The dominant environmental feature in the vicinity of the Project is the North Channel in Georgian Bay, located north and east of the study area. (Figure 1).

The wind plant will have a nominal rated nameplate capacity of 72 MW and will include one transformer at a substation near Green Bush Rd between McLean's Mountain Rd and Columbas Mountain Rd (Figure 2).

Within this agricultural / rural area, the main sources of ambient sound that currently exist include:

1. Vehicular traffic on County and Concession roads.
2. Sounds due to human activity as well as agricultural and rural activities.
3. Sounds due to human domestic activities such as property maintenance and recreation.
4. Natural sounds from wind noise, insects, wildlife, atmospheric effects, etc.

The acoustic classification of the area is generally Class 3 (rural).

3.1 Description of Receptors

Noise receptors have been selected for this analysis based on two criteria: i) their spatial proximity to the Project (i.e., receptors within about 1.5 kilometers of a wind turbine); and ii) level of benefit derived from the Project (e.g., participating or non-participating receptors). However, it should be noted that this project does not include any participating receptors. In addition, vacant lots have been considered as containing receptors if they are accessible – i.e., if they are adjacent to a road. The location of the receptor within each vacant lot has been chosen to be consistent with the typical building pattern in the area (e.g., close to adjacent roads) or at the centre of the vacant lot as per MOE documentation (see Attachment A). A total of 297 receptor dwellings and 49 vacant lots have been included as receptors for this assessment.

All receptors in the study area were provided to Aercoustics by NPI. Each receptor has been assigned a unique identifier for modelling and reporting purposes. Their locations relative to the wind turbines and transformer station are shown in Figure 2.

For the purposes of this ENIA, points of reception have been modelled at the worst case scenario of either two storey dwelling, or single storey dwelling with one point of reception 4.5m above the centre of the house.

3.2 MOE Environmental Noise Limits

The sound limit requirements for a wind turbine or an array of such units, termed a "wind plant", have been established in accordance with the existing MOE publications (NPC-205/232/233) as well as the wind induced background noise level. The specific definition of sound limits, expressed as a function of wind speed and ambient noise levels, as outlined in the MOE Interpretation, includes the following:

3.2.1 Wind Turbine Installations in Class 1 & 2 Areas (Urban): Wind Speeds Below 8m/s

The lowest sound level limit at a Point of Reception in Class 1 and 2 Areas (Urban), under conditions of average wind speed up to 8 m/s (i.e., 29km/h), expressed in terms of the hourly L_{eq} is 45.0 dBA or the minimum hourly background sound level established in accordance with requirements in Publications NPC-205/NPC-233, whichever is higher.

3.2.2 Wind Turbine Installations In Class 3 Areas (Rural): Wind Speeds Below 6m/s

The lowest sound level limit at a Point of Reception in Class 3 Areas (Rural), under conditions of average wind speed up to 6 m/s (i.e., 22km/h), expressed in terms of the hourly L_{eq} is 40.0 dBA or the minimum hourly background sound level established in accordance with requirements in Publications NPC-232/NPC-233, whichever is higher.

3.2.3 Wind Turbine Installations In Class 1 & 2 and Class 3 Areas: Wind Speeds Above 8m/s and 6m/s Respectively

The sound level limit at a Point of Reception in Class Areas 1 & 2 (Urban) or in Class 3 Areas (Rural), under conditions of average wind speed above 8 m/s and 6m/s respectively, expressed in terms of the hourly L_{eq}, is the wind induced background sound level, expressed in terms of ninetieth percentile sound level (L_{A90}) plus 7 dB, or the minimum hourly background sound level established in accordance with requirements in Publications NPC-205/NPC-232/NPC-233, whichever is higher. A summary of the above limits is shown in Table 1 for continued reference.

Table 1: MOE Sound Level Limits at Points of Reception for Wind Plants

Wind Speed (m/s)	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
Wind Turbine Noise Criterion NPC-232 (dBA) Class 3	40.0	40.0	40.0	43.0	45.0	49.0	51.0
Wind Turbine Noise Criterion NPC-205 (dBA) Class 1 & 2	45.0	45.0	45.0	45.0	45.0	49.0	51.0

Notes:

1. The measurement of wind induced background sound level is not required to establish the applicable criterion. The wind induced background sound level reference curve was determined by correlating the ninetieth percentile sound level (L_{A90}) with the average wind speed measured at a particularly quiet site.
2. If the existing minimum hourly background sound level, established in accordance with requirements in Publications NPC-205/NPC-232/NPC-233, is selected as the sound level limit, the measurement of wind speed (for the purpose of determination of wind induced background sound level) is not required. The selected limit applies in the entire range of wind speed under consideration from 4m/s to 11m/s with the exception of wind turbine noise criterion values higher than the existing minimum hourly background sound level.
3. Wind Turbine Noise Criterion at wind speeds expressed as fractional values of m/s should be interpolated from the above table.

The Project sound limits are ultimately a function of several variables:
1. Current ambient levels due to sound levels caused by both natural and human activity (e.g., traffic) sounds.
2. Acoustic classification of the study area (e.g., Class 2 and/or Class 3 as defined by MOE).
3. Wind induced background sound levels.

It should be noted that the ENIA has opted to apply the more conservative Class 3 (Rural) values to all territories within the study area. Table 2 summarizes the sound level limits for Class 3 areas.

Table 2: Sound Level Limits for Class 3 Areas							
Wind Speed (m/s)	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
Wind Turbine Sound Level Limit (dBA) (Class 3 Area, NPC-232)	40.0	40.0	40.0	43.0	45.0	49.0	51.0

4.0 DESCRIPTION OF SOURCES

4.1 M1 Transformer Station

NPI plans to build a transformer substation near Green Bush Rd between McLean's Mountain Rd and Columbas Mountain Rd as part of the Project. This substation will contain one transformer unit.

The transformer proposed to be used is a unit rated at 66 MVA (ONAF). The overall dimension of the unit is 8.9m x 6.1m x 3.9m (length x width x height), and drawings are included in Figure 3 The sound power level of this unit has been determined to be 89.4 dBA, based on IEEE standard C57.12.90-1993 – Part I [15].

Transformer noise is comprised of casing noise emitted from the operating transformer itself and cooling fan noise. Transformer noise has a pronounced audible tonal quality and therefore incurs a 5dB penalty, as per MOE publication NPC-104[7]. The overall sound power level of the transformer, including this penalty, is 94.4 dBA.

The noise contribution from the substation is calculated using the DataKustik CadnaA version 3.7 environmental noise prediction software. The calculations are based on established prediction methods approved by the MOE: ISO 9613-2 standard entitled "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation". For this analysis, the noise contribution from the substation was added to the noise contributions of the wind turbines to assess the total cumulative effect of the Project.

Table 3 lists the location of the transformer.

Table 3: Transformer Location

Identifier	UTM Coordinates		Remarks
	X (m)	Y (m)	
Xfrmr	423616	5087363	M1 Windfarm

4.2 Wind Turbine Generators

The Project will utilize GE model 2.5-103 2.5MW wind turbines. Each turbine has three blades, a 103m rotor diameter, and a hub height of 100m.

The turbines are capable of operating in seven modes – Normal Operation (NO) mode and Noise Reduced Operation (NRO) mode 103 to 100. Normal Operation corresponds to the most favourable power curve, but also the highest nominal sound power level at 104 dBA. NRO 103 to 100 corresponds to nominal calculated sound power levels from 103 dBA to 100 dBA. All turbines in the Project will operate using NO mode, corresponding to a nominal sound power level of 104 dBA.

Additional information on the GE 2.5-103 turbines is provided in Attachment B. Turbine coordinates are listed in Table 4.

4.2.1 Potential Sources of Noise

There are several sources that contribute to the sound emitted by a typical wind turbine. As the rotating blades of the turbine extract power from the air-stream, the blades experience lift and drag forces. These forces generate sound, much in the same manner as a rotating propeller or fan – also known as aerodynamic noise

INFRASOUND

Sounds with frequency contents below 20 Hz are referred to as infrasound. There are many other sources of infrasound such as those generated by winds, waterfalls, and the sound of waves breaking on the beach. Measurements at 200 m from typical units have shown that the infrasound levels are well below the level of perceptibility [1], [2]. As noted above, there are no non-participating Points of Reception within 400 m of a wind turbine and thus the potential effect of infrasound is not anticipated.

AMPLITUDE MODULATION

Perceptible sounds are generated predominantly by mechanical bearings, the electric generator and a characteristic “swoosh” which is essentially higher frequency broadband noise that is amplitude modulated at a low frequency [3]. In contrast to the first-generation wind turbines, some 30 years ago, innovations in blade geometry, materials, and mechanical systems have significantly lowered the sound power levels of present generation wind turbines. A recent study of wind turbine noise amplitude modulation [3] by the University of Salford, UK found that

amplitude modulation occurs between 7% and 15% of the time, but the causes of amplitude modulation are still open to debate therefore the causes are not fully understood and that amplitude modulation cannot be fully predicted by current state of the art. The Salford study concludes that further research is recommended to improve understanding of amplitude modulation. The MOE does not impose a penalty applied to wind turbine noise due to amplitude modulation [17].

WIND SHEAR EFFECTS

Vertical Wind shear, sometimes referred to as wind shear or wind gradient, is a vertical difference in wind speed and direction over a relatively short distance in the atmosphere. For acoustic purposes, vertical wind shear is used as a measure of the change in wind speed at various vertical heights above ground level. Wind shear has been accounted for in the M1 noise assessment by adjusting the standard neutral stability wind turbine emission to an emission which accounts for the site specific average summer night time wind shear exponent. This approach is consistent with the recommendations of the MOE's Noise Guidelines for Wind Farms [17].

4.2.2 M1 Wind Turbine Noise Emission Rating

GE has provided NPI with noise emission performance for the GE 2.5-103 wind turbines (NO mode) for wind speeds of 6ms/ to 10m/s at a reference height of 10m. See Attachment B and Table 4 below.

Table 4: GE 2.5-103, Sound Power Spectrums at wind speeds from 6m/s to 10m/s

GE 2.5-103
Electrical Rating: 2.5 MW
Hub Height (m): 100m
Wind Shear coefficient: 0.435

	Octave Band Sound Power Level (dB)									
	Manufacturer's Emission Levels					Adjusted Emission Levels**				
Wind Speed* (m/s)	6	7	8	9	10-cutout	6	7	8	9	10
Frequency (Hz)										
31.5	78.4	80.8	80.9	81.1	81.1	81.1	81.1	81.1	81.1	81.1
63	88.1	90.5	90.5	90.7	90.8	90.8	90.8	90.8	90.8	90.8
125	92.3	94.6	94.7	94.9	94.9	94.9	94.9	94.9	94.9	94.9
250	94.7	96.4	95.7	95.9	95.9	95.9	95.9	95.9	95.9	95.9
500	95.7	97.3	96.2	95.4	95.2	95.2	95.2	95.2	95.2	95.2
1000	96.6	98.4	98.7	98.6	98.4	98.4	98.4	98.4	98.4	98.4
2000	93.2	95.7	96.9	97.3	97.6	97.6	97.6	97.6	97.6	97.6
4000	86.2	87.5	88.1	89.0	89.4	89.4	89.4	89.4	89.4	89.4
8000	70.3	71.6	71.4	71.4	71.0	71.0	71.0	71.0	71.0	71.0
Total dBA	**102.1**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**

* At 10m reference height.

** The site specific average summer night time wind shear exponent was provided by AWS Truewind, wind engineering consultants for Northland Power Inc on this project. Given the wind shear coefficient of 0.435, the cut-out sound power level of 104 dBA corresponding to a wind speed of 10 m/s was used for all wind speeds. i.e. the highest noise emission from the turbines is used for all the wind speed cases. It should be

noted that the overall total sound emission is guaranteed by GE. The spectral data is for modelling purposes only and is not explicitly guaranteed.

Table 5 shows the proposed wind turbine locations.

Table 5: Wind Turbine Locations

Identifier	Equipment Make, Model	UTM Coordinates		Remarks
		X (m)	Y (m)	
T05	GE 2.5-103 2.5MW	425967	5088867	M1 Windfarm
T06	GE 2.5-103 2.5MW	425374	5088648	M1 Windfarm
T09	GE 2.5-103 2.5MW	426960	5088349	M1 Windfarm
T10	GE 2.5-103 2.5MW	426243	5088273	M1 Windfarm
T11	GE 2.5-103 2.5MW	423155	5087692	M1 Windfarm
T12	GE 2.5-103 2.5MW	424685	5087875	M1 Windfarm
T13	GE 2.5-103 2.5MW	425578	5087836	M1 Windfarm
T14	GE 2.5-103 2.5MW	424005	5087874	M1 Windfarm
T15	GE 2.5-103 2.5MW	426514	5087605	M1 Windfarm
T16	GE 2.5-103 2.5MW	423976	5085277	M1 Windfarm
T17	GE 2.5-103 2.5MW	421160	5086508	M1 Windfarm
T18	GE 2.5-103 2.5MW	423020	5086314	M1 Windfarm
T19	GE 2.5-103 2.5MW	426002	5086354	M1 Windfarm
T20	GE 2.5-103 2.5MW	425263	5086379	M1 Windfarm
T21	GE 2.5-103 2.5MW	420869	5086170	M1 Windfarm
T23	GE 2.5-103 2.5MW	423091	5085958	M1 Windfarm
T25	GE 2.5-103 2.5MW	415729	5084615	M1 Windfarm
T28	GE 2.5-103 2.5MW	424742	5084943	M1 Windfarm
T29	GE 2.5-103 2.5MW	423719	5084978	M1 Windfarm
T30	GE 2.5-103 2.5MW	424258	5084654	M1 Windfarm
T31	GE 2.5-103 2.5MW	416174	5082550	M1 Windfarm
T34	GE 2.5-103 2.5MW	423970	5084235	M1 Windfarm
T35	GE 2.5-103 2.5MW	415668	5083842	M1 Windfarm
T36	GE 2.5-103 2.5MW	416181	5083552	M1 Windfarm
T38	GE 2.5-103 2.5MW	415679	5083197	M1 Windfarm
T39	GE 2.5-103 2.5MW	417095	5082519	M1 Windfarm
T40	GE 2.5-103 2.5MW	416441	5082915	M1 Windfarm
T42	GE 2.5-103 2.5MW	415354	5082675	M1 Windfarm
T43	GE 2.5-103 2.5MW	416653	5082179	M1 Windfarm

4.2.3 Providence Bay Wind Farm

The Providence Bay Wind Farm is an operating 1.6 MW wind farm located near the towns of Providence Bay and Spring Bay, in the Township of Central Manitoulin, Manitoulin Island Ontario. Two Enercon E-48 800 kW wind turbine generators were commissioned and put into operation at Providence Bay on March 25, 2007. The related Providence Bay Expansion Project is in the Advanced-Stage of development.

As the Providence Bay is located more than 10km away from boundary of M1 wind farm, the total noise impact assessment on the M1 wind farm points of reception does not include the noise impact from Providence Bay wind farm

5.0 NOISE ASSESSMENT RESULTS

5.1 Transformer Station Impact Assessment

The overall sound power level of the transformer unit, including 5dB tonality penalty, is 94.4 dBA. DataKustik CadnaA environmental noise model generated the worst-case results shown in Table 6. These results include contributions of the wind turbines. As indicated in the table, and applying the conservative application of Class 3 (rural) areas to all Points of Reception, the transformer are expected to meet the applicable noise guidelines. The receptor identified in Table 6 is the worst-case receptor, closest to the transformer.

Table 6: Total Noise Impact, 6m/s wind speed

Receptor	Description	Distance to Transformer (m)	Calculated Sound Level (dBA)	Allowable Level
R289	Residence, (on Green Bush Road)	405	40.0 dBA	40.0 dBA

5.2 Wind Turbine Impact Assessment

The noise impact at 297 receptor dwellings and 49 vacant lots has been predicted using a formula based on ISO 9613-2 Part 2; consistent with the MOE's modelling requirements. The locations and sound power levels of all the wind turbine sources, the transformer station sources and the location of the receptors were integrated into a master data file.

Noise was predicted based on the following noise modelling protocol:

- Temperature = 10C
- Humidity = 70%
- G = 0.70 global ground attenuation factor
- Sound Level Limit = 40.0 dBA at 6m/s wind at 10m agl, i.e. precision to 1/10th of decibel
- Turbine noise emission corresponding to the manufacturer's cut-out sound power level at a wind speed of 10m/s at 10m agl, to account for M1 specific conditions of average summer night time wind shear exponent = 0.435
- Analysis to include only turbines within 5km of a receptor for those receptors whose closest turbine is within 1.5km
- Two storey dwelling = 4.5m receptor height at center of dwelling
- Single storey dwelling = 4.5m receptor height at center of dwelling
- Vacant lot = 4.5m receptor height at position described in section 3.1: Description of Receptors

The highest noise level for each receptor, which represents the worst-case prediction, is outlined in the assessment summary table at the end of this report.

The noise modelling software computes the octave band levels at the receptors from all the sound sources, including the transformer. The resultant A-weighted sound pressure levels are then transferred as a noise contour to the site map that shows both source and receiver locations. Refer to Figure 5 for the noise contour.

Worst-case sound levels have been predicted at all 297 dwellings and 49 vacant lots. A Sample detailed calculation is provided in Attachment C. The worst-case predicted sound levels at all receptors are predicted to be within the MOE environmental noise limits for Class 3 (rural) areas.

5.3 Wind Turbine Summary Tables

The sound power emitted by the wind turbines and transformer station, as well as their location with respect to the receptors determines the sound pressure levels induced by the operation of all Project components. The acoustic power of each wind turbine as provided by the manufacturer is shown in Attachment B.

The total noise impact at each receptor, including all wind turbines and transformer stations, has been summarized in the noise assessment summary table below for all 297 dwellings and 49 vacant lots. The noise impact from the simultaneous operation of all wind turbines and transformers is less than or equal to the sound level limit associated with NPC 232 (i.e., 40.0 dBA).

The closest receptor to a proposed M1 wind turbine is V229, which is located 562m from turbine T17. All other receptors are more than 562m from a turbine. The closest receptor dwelling (non-vacant lot) is R289 which is located 669m from turbine T11.

6.0 CONCLUSION

The project site is rural: therefore the MOE's Class 3 (rural) designation applies.

Building upon the project specific sound limit guidelines, noise impact prediction modelling was undertaken. The noise impact on the nearest points of reception was predicted using an acoustic model, ISO 9613, as required by the MOE, based on noise from the Project's wind turbine array, coupled with transformers with transformer tonality penalty.

The noise assessment was based on all of the recommended procedures outlined in the MOE's "Noise Guidelines for Wind farms, October 2008" [17].

The analysis shows that the cumulative noise impact from the Project does not exceed the most restrictive noise limits that apply for areas with an acoustic designation of Class 3 (Rural) as defined by the MOE. Consequently, there is no need for the application of any additional mitigation measures and no further studies are contemplated for environmental noise in relation to the Project.

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Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R001	4.5	Residence	425848	5083118	2134	T28	28.9	28.9	28.9	28.9	28.9	40	43	45	49	51	Yes
R002	4.5	Residence	425770	5083073	2134	T28	29.0	29.0	29.0	29.0	29.0	40	43	45	49	51	Yes
R003	4.5	Residence	425207	5083180	1626	T34	31.1	31.1	31.1	31.1	31.1	40	43	45	49	51	Yes
R004	4.5	Residence	424906	5082966	1577	T34	30.9	30.9	30.9	30.9	30.9	40	43	45	49	51	Yes
R005	4.5	Residence	424795	5083040	1452	T34	31.5	31.5	31.5	31.5	31.5	40	43	45	49	51	Yes
R006	4.5	Residence	424422	5082993	1322	T34	32.1	32.1	32.1	32.1	32.1	40	43	45	49	51	Yes
R007	4.5	Residence	424307	5083188	1100	T34	33.5	33.5	33.5	33.5	33.5	40	43	45	49	51	Yes
R008	4.5	Residence	423155	5083142	1363	T34	31.7	31.7	31.7	31.7	31.7	40	43	45	49	51	Yes
R009	4.5	Residence	422309	5083084	2021	T34	28.3	28.3	28.3	28.3	28.3	40	43	45	49	51	Yes
R010	4.5	Residence	421365	5083081	2849	T34	24.5	24.5	24.5	24.5	24.5	40	43	45	49	51	Yes
R011	4.5	Residence	414344	5081036	1925	T42	29.3	29.3	29.3	29.3	29.3	40	43	45	49	51	Yes
R012	4.5	Residence	414311	5081196	1810	T42	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R013	4.5	Residence	414299	5081242	1779	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R014	4.5	Residence	414412	5081942	1194	T42	32.9	32.9	32.9	32.9	32.9	40	43	45	49	51	Yes
R015	4.5	Residence	414235	5081847	1392	T42	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
R016	4.5	Residence	414339	5082499	1030	T42	33.6	33.6	33.6	33.6	33.6	40	43	45	49	51	Yes
R017	4.5	Residence	414409	5082880	967	T42	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	Yes
R018	4.5	Residence	414380	5082933	1008	T42	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
R019	4.5	Residence	414270	5083098	1164	T42	33.9	33.9	33.9	33.9	33.9	40	43	45	49	51	Yes
R020	4.5	Residence	413725	5082956	1653	T42	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R021	4.5	Residence	413701	5082942	1674	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R022	4.5	Residence	413750	5082896	1619	T42	27.4	27.4	27.4	27.4	27.4	40	43	45	49	51	Yes
R023	4.5	Residence	413784	5082742	1571	T42	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R024	4.5	Residence	413775	5082673	1579	T42	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R025	4.5	Residence	413675	5082506	1687	T42	25.0	25.0	25.0	25.0	25.0	40	43	45	49	51	Yes
R026	4.5	Residence	413581	5082369	1799	T42	27.0	27.0	27.0	27.0	27.0	40	43	45	49	51	Yes
R027	4.5	Residence	413606	5082202	1811	T42	24.3	24.3	24.3	24.3	24.3	40	43	45	49	51	Yes
R028	4.5	Residence	413448	5082021	2015	T42	24.8	24.8	24.8	24.8	24.8	40	43	45	49	51	Yes
R029	4.5	Residence	413396	5081968	2082	T42	24.5	24.5	24.5	24.5	24.5	40	43	45	49	51	Yes
R030	4.5	Residence	413345	5081912	2149	T42	25.2	25.2	25.2	25.2	25.2	40	43	45	49	51	Yes
R031	4.5	Residence	413290	5081850	2223	T42	23.9	23.9	23.9	23.9	23.9	40	43	45	49	51	Yes
R032	4.5	Residence	413255	5081810	2270	T42	23.8	23.8	23.8	23.8	23.8	40	43	45	49	51	Yes
R033	4.5	Residence	413185	5081718	2371	T42	23.4	23.4	23.4	23.4	23.4	40	43	45	49	51	Yes
R034	4.5	Residence	413172	5081643	2414	T42	22.4	22.4	22.4	22.4	22.4	40	43	45	49	51	Yes
R035	4.5	Residence	413128	5081605	2470	T42	22.2	22.2	22.2	22.2	22.2	40	43	45	49	51	Yes
R036	4.5	Residence	413108	5081561	2507	T42	22.1	22.1	22.1	22.1	22.1	40	43	45	49	51	Yes
R037	4.5	Residence	413089	5081537	2535	T42	22.0	22.0	22.0	22.0	22.0	40	43	45	49	51	Yes
R038	4.5	Residence	413062	5081495	2578	T42	21.8	21.8	21.8	21.8	21.8	40	43	45	49	51	Yes
R039	4.5	Residence	413030	5081446	2629	T42	21.6	21.6	21.6	21.6	21.6	40	43	45	49	51	Yes
R040	4.5	Residence	413002	5081405	2673	T42	21.5	21.5	21.5	21.5	21.5	40	43	45	49	51	Yes
R041	4.5	Residence	412988	5081382	2696	T42	21.4	21.4	21.4	21.4	21.4	40	43	45	49	51	Yes
R042	4.5	Residence	412964	5081349	2733	T42	21.3	21.3	21.3	21.3	21.3	40	43	45	49	51	Yes
R043	4.5	Residence	412949	5081327	2757	T42	21.2	21.2	21.2	21.2	21.2	40	43	45	49	51	Yes
R044	4.5	Residence	412942	5081315	2769	T42	21.2	21.2	21.2	21.2	21.2	40	43	45	49	51	Yes
R045	4.5	Residence	413762	5083132	1656	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R046	4.5	Residence	413720	5083178	1710	T42	30.0	30.0	30.0	30.0	30.0	40	43	45	49	51	Yes
R047	4.5	Residence	413696	5083199	1739	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R048	4.5	Residence	413683	5083273	1775	T42	30.1	30.1	30.1	30.1	30.1	40	43	45	49	51	Yes
R049	4.5	Residence	413601	5083352	1879	T42	30.1	30.1	30.1	30.1	30.1	40	43	45	49	51	Yes
R050	4.5	Residence	413574	5083324	1895	T42	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R051	4.5	Residence	413495	5083401	1996	T42	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R052	4.5	Residence	413491	5083827	2177	T35	29.4	29.4	29.4	29.4	29.4	40	43	45	49	51	Yes
R053	4.5	Residence	413825	5084524	1906	T25	30.0	30.0	30.0	30.0	30.0	40	43	45	49	51	Yes
R054	4.5	Residence	414213	5084742	1521	T25	31.3	31.3	31.3	31.3	31.3	40	43	45	49	51	Yes
R055	4.5	Residence	414370	5083886	1299	T35	33.9	33.9	33.9	33.9	33.9	40	43	45	49	51	Yes
R056	4.5	Residence	414371	5083958	1302	T35	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	Yes
R057	4.5	Residence	414879	5085178	1020	T25	32.6	32.6	32.6	32.6	32.6	40	43	45	49	51	Yes
R058	4.5	Residence	414972	5085133	917	T25	33.1	33.1	33.1	33.1	33.1	40	43	45	49	51	Yes
R059	4.5	Residence	414307	5085243	1554	T25	30.3	30.3	30.3	30.3	30.3	40	43	45	49	51	Yes
R060	4.5	Residence	414272	5085861	1917	T25	28.0	28.0	28.0	28.0	28.0	40	43	45	49	51	Yes
R061	4.5	Residence	414215	5085774	1907	T25	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R062	4.5	Residence	414183	5085687	1881	T25	28.3	28.3	28.3	28.3	28.3	40	43	45	49	51	Yes
R063	4.5	Residence	414143	5085669	1904	T25	28.2	28.2	28.2	28.2	28.2	40	43	45	49	51	Yes
R064	4.5	Residence	414087	5085618	1924	T25	28.2	28.2	28.2	28.2	28.2	40	43	45	49	51	Yes
R065	4.5	Residence	414056	5085605	1944	T25	27.2	27.2	27.2	27.2	27.2	40	43	45	49	51	Yes
R066	4.5	Residence	415497	5086237	1639	T25	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R067	4.5	Residence	415594	5086574	1964	T25	24.9	24.9	24.9	24.9	24.9	40	43	45	49	51	Yes
R068	4.5	Residence	415432	5086625	2032	T25	24.5	24.5	24.5	24.5	24.5	40	43	45	49	51	Yes
R069	4.5	Residence	415396	5086649	2061	T25	24.4	24.4	24.4	24.4	24.4	40	43	45	49	51	Yes
R070	4.5	Residence	415344	5086540	1963	T25	24.9	24.9	24.9	24.9	24.9	40	43	45	49	51	Yes
R071	4.5	Residence	415301	5086495	1928	T25	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R072	4.5	Residence	415476	5086730	2130	T25	24.1	24.1	24.1	24.1	24.1	40	43	45	49	51	Yes
R073	4.5	Residence	415503	5086756	2153	T25	24.0	24.0	24.0	24.0	24.0	40	43	45	49	51	Yes
R074	4.5	Residence	415549	5086772	2164	T25	23.9	23.9	23.9	23.9	23.9	40	43	45	49	51	Yes
R075	4.5	Residence	415571	5086817	2208	T25	23.7	23.7	23.7	23.7	23.7	40	43	45	49	51	Yes
R076	4.5	Residence	415627	5086826	2213	T25	23.7	23.7	23.7	23.7	23.7	40	43	45	49	51	Yes
R077	4.5	Residence	415617	5086891	2279	T25	23.4	23.4	23.4	23.4	23.4	40	43	45	49	51	Yes
R078	4.5	Residence	415731	5086962	2347	T25	23.1	23.1	23.1	23.1	23.1	40	43	45	49	51	Yes
R079	4.5	Residence	415781	5087030	2416	T25	22.9	22.9	22.9	22.9	22.9	40	43	45	49	51	Yes
R080	4.5	Residence	415836	5087086	2473	T25	22.6	22.6	22.6	22.6	22.6	40	43	45	49	51	Yes
R081	4.5	Residence	415995	5087198	2597	T25	22.2	22.2	22.2	22.2	22.2	40	43	45	49	51	Yes
R082	4.5	Residence	415941	5087220	2614	T25	22.0	22.0	22.0	22.0	22.0	40	43	45	49	51	Yes
R083	4.5	Residence	415453	5087273	2672	T25	22.9	22.9	22.9	22.9	22.9	40	43	45	49	51	Yes
R084	4.5	Residence	416012	5087285	2685	T25	21.8	21.8	21.8	21.8	21.8	40	43	45	49	51	Yes
R085	4.5	Residence	416038	5087334	2737	T25	21.7	21.7	21.7	21.7	21.7	40	43	45	49	51	Yes
R086	4.5	Residence	416093	5087356	2765	T25	21.6	21.6	21.6	21.6	21.6	40	43	45	49	51	Yes
R087	4.5	Residence	416094	5087400	2809	T25	21.4	21.4	21.4	21.4	21.4	40	43	45	49	51	Yes
R088	4.5	Residence	416150	5087427	2843	T25	21.1	21.1	21.1	21.1	21.1	40	43	45	49	51	Yes
R089	4.5	Residence	416234	5087588	3016	T25	20.4	20.4	20.4	20.4	20.4	40	43	45	49	51	Yes
R090	4.5	Residence	419777	5089027	2874	T17	21.0	21.0	21.0	21.0	21.0	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R091	4.5	Residence	419708	5089143	3009	T17	19.9	19.9	19.9	19.9	19.9	40	43	45	49	51	Yes
R092	4.5	Residence	419681	5089119	3001	T17	19.9	19.9	19.9	19.9	19.9	40	43	45	49	51	Yes
R093	4.5	Residence	419277	5090192	4137	T17	19.2	19.2	19.2	19.2	19.2	40	43	45	49	51	Yes
R094	4.5	Residence	419206	5090217	4192	T17	19.1	19.1	19.1	19.1	19.1	40	43	45	49	51	Yes
R095	4.5	Residence	418890	5089158	3489	T17	17.1	17.1	17.1	17.1	17.1	40	43	45	49	51	Yes
R096	4.5	Residence	418649	5089115	3620	T17	16.7	16.7	16.7	16.7	16.7	40	43	45	49	51	Yes
R097	4.5	Residence	418572	5089260	3778	T17	16.3	16.3	16.3	16.3	16.3	40	43	45	49	51	Yes
R098	4.5	Residence	418439	5089067	3735	T17	16.3	16.3	16.3	16.3	16.3	40	43	45	49	51	Yes
R099	4.5	Residence	418387	5089036	3752	T17	16.2	16.2	16.2	16.2	16.2	40	43	45	49	51	Yes
R100	4.5	Residence	418218	5088922	3806	T17	14.2	14.2	14.2	14.2	14.2	40	43	45	49	51	Yes
R101	4.5	Residence	418170	5088875	3814	T17	14.2	14.2	14.2	14.2	14.2	40	43	45	49	51	Yes
R102	4.5	Residence	418135	5088810	3801	T21	14.3	14.3	14.3	14.3	14.3	40	43	45	49	51	Yes
R103	4.5	Residence	418091	5088876	3876	T17	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R104	4.5	Residence	418054	5088846	3884	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R105	4.5	Residence	418002	5088790	3884	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R106	4.5	Residence	417938	5088736	3896	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R107	4.5	Residence	417895	5088692	3899	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R108	4.5	Residence	417814	5088726	3983	T21	13.9	13.9	13.9	13.9	13.9	40	43	45	49	51	Yes
R109	4.5	Residence	417813	5088662	3943	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R110	4.5	Residence	417775	5088658	3970	T21	14.0	14.0	14.0	14.0	14.0	40	43	45	49	51	Yes
R111	4.5	Residence	417685	5088674	4051	T21	13.8	13.8	13.8	13.8	13.8	40	43	45	49	51	Yes
R112	4.5	Residence	417653	5088682	4081	T21	13.8	13.8	13.8	13.8	13.8	40	43	45	49	51	Yes
R113	4.5	Residence	417684	5088577	3992	T21	14.0	14.0	14.0	14.0	14.0	40	43	45	49	51	Yes
R114	4.5	Residence	417611	5088617	4075	T21	13.8	13.8	13.8	13.8	13.8	40	43	45	49	51	Yes
R115	4.5	Residence	417792	5088013	3587	T21	16.5	16.5	16.5	16.5	16.5	40	43	45	49	51	Yes
R116	4.5	Residence	417573	5088557	4070	T21	13.9	13.9	13.9	13.9	13.9	40	43	45	49	51	Yes
R117	4.5	Residence	417528	5088537	4095	T21	13.9	13.9	13.9	13.9	13.9	40	43	45	49	51	Yes
R118	4.5	Residence	417399	5088504	4182	T21	14.6	14.6	14.6	14.6	14.6	40	43	45	49	51	Yes
R119	4.5	Residence	417294	5088398	4094	T25	17.6	17.6	17.6	17.6	17.6	40	43	45	49	51	Yes
R120	4.5	Residence	417204	5088344	4010	T25	17.8	17.8	17.8	17.8	17.8	40	43	45	49	51	Yes
R121	4.5	Residence	417184	5088328	3988	T25	17.8	17.8	17.8	17.8	17.8	40	43	45	49	51	Yes
R122	4.5	Residence	416992	5088231	3830	T25	18.0	18.0	18.0	18.0	18.0	40	43	45	49	51	Yes
R123	4.5	Residence	417136	5088293	3938	T25	17.9	17.9	17.9	17.9	17.9	40	43	45	49	51	Yes
R124	4.5	Residence	417278	5088168	3876	T25	15.9	15.9	15.9	15.9	15.9	40	43	45	49	51	Yes
R125	4.5	Residence	417267	5088106	3815	T25	16.0	16.0	16.0	16.0	16.0	40	43	45	49	51	Yes
R126	4.5	Residence	416826	5088186	3736	T25	18.1	18.1	18.1	18.1	18.1	40	43	45	49	51	Yes
R127	4.5	Residence	416752	5088186	3715	T25	18.2	18.2	18.2	18.2	18.2	40	43	45	49	51	Yes
R128	4.5	Residence	416648	5087998	3506	T25	18.9	18.9	18.9	18.9	18.9	40	43	45	49	51	Yes
R129	4.5	Residence	416489	5087841	3314	T25	19.6	19.6	19.6	19.6	19.6	40	43	45	49	51	Yes
R130	4.5	Residence	416429	5087760	3222	T25	19.8	19.8	19.8	19.8	19.8	40	43	45	49	51	Yes
R131	4.5	Residence	416284	5087570	3007	T25	20.6	20.6	20.6	20.6	20.6	40	43	45	49	51	Yes
R132	4.5	Residence	416332	5087677	3121	T25	20.1	20.1	20.1	20.1	20.1	40	43	45	49	51	Yes
R133	4.5	Residence	428315	5088492	1363	T09	31.1	31.1	31.1	31.1	31.1	40	43	45	49	51	Yes
R134	4.5	Residence	427915	5089033	1175	T09	32.0	32.0	32.0	32.0	32.0	40	43	45	49	51	Yes
R135	4.5	Residence	427850	5089177	1216	T09	31.2	31.2	31.2	31.2	31.2	40	43	45	49	51	Yes

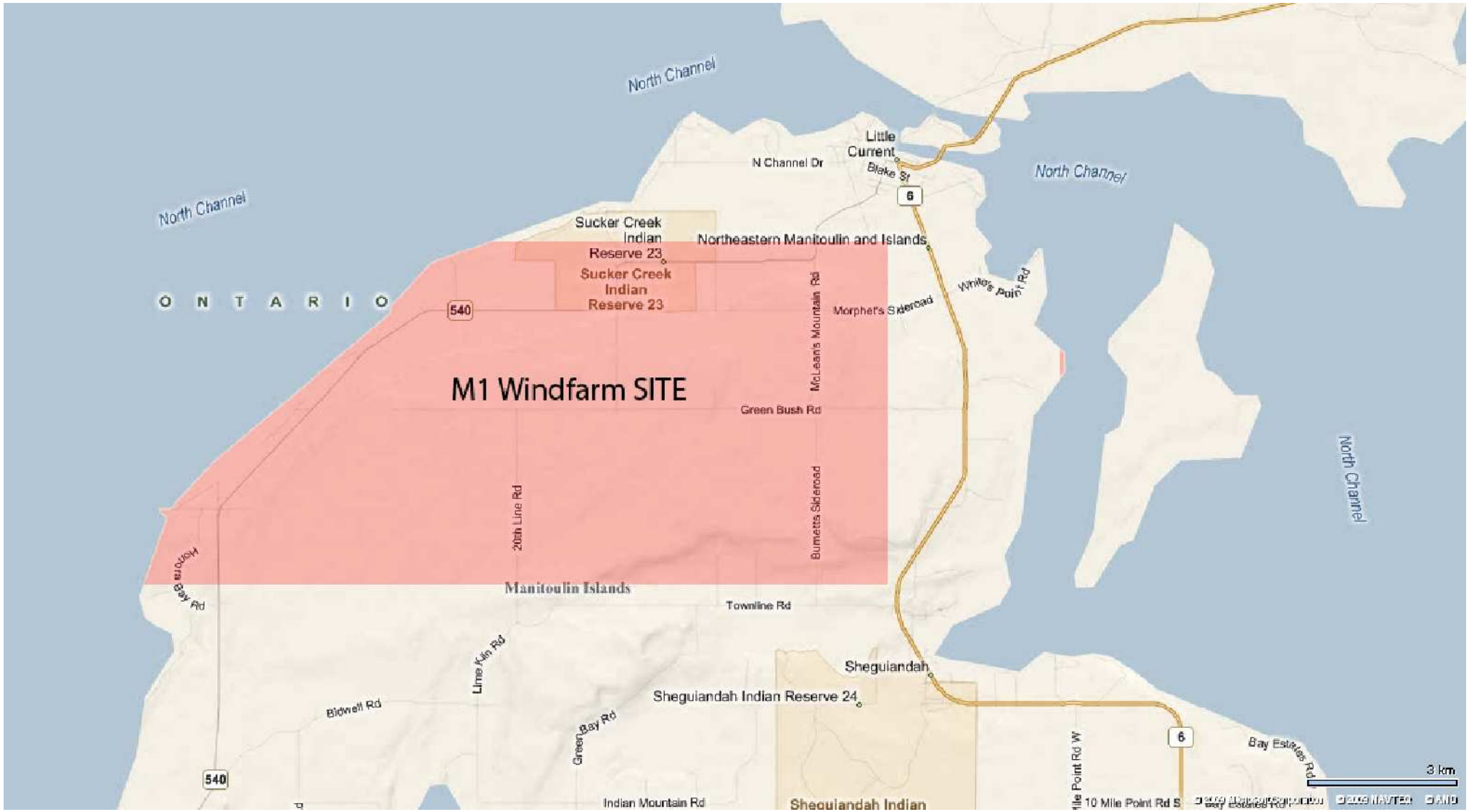
Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R136	4.5	Residence	427616	5089226	1095	T09	32.7	32.7	32.7	32.7	32.7	40	43	45	49	51	Yes
R137	4.5	Residence	427256	5087044	930	T15	35.8	35.8	35.8	35.8	35.8	40	43	45	49	51	Yes
R138	4.5	Residence	427499	5086978	1168	T15	34.3	34.3	34.3	34.3	34.3	40	43	45	49	51	Yes
R139	4.5	Residence	427540	5087122	1134	T15	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	Yes
R140	4.5	Residence	428065	5087013	1660	T15	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
R141	4.5	Residence	428189	5087035	1769	T15	31.0	31.0	31.0	31.0	31.0	40	43	45	49	51	Yes
R142	4.5	Residence	420751	5089072	2596	T17	21.9	21.9	21.9	21.9	21.9	40	43	45	49	51	Yes
R143	4.5	Residence	420871	5089092	2600	T17	22.1	22.1	22.1	22.1	22.1	40	43	45	49	51	Yes
R144	4.5	Residence	420985	5089087	2580	T11	22.1	22.1	22.1	22.1	22.1	40	43	45	49	51	Yes
R145	4.5	Residence	421348	5089190	2347	T11	22.8	22.8	22.8	22.8	22.8	40	43	45	49	51	Yes
R146	4.5	Residence	421557	5089211	2205	T11	23.2	23.2	23.2	23.2	23.2	40	43	45	49	51	Yes
R147	4.5	Residence	422092	5089042	1718	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R148	4.5	Residence	422176	5089170	1773	T11	25.1	25.1	25.1	25.1	25.1	40	43	45	49	51	Yes
R149	4.5	Residence	422257	5089097	1667	T11	25.5	25.5	25.5	25.5	25.5	40	43	45	49	51	Yes
R150	4.5	Residence	422606	5088962	1384	T11	32.1	32.1	32.1	32.1	32.1	40	43	45	49	51	Yes
R151	4.5	Residence	422536	5089145	1579	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R152	4.5	Residence	422516	5089548	1963	T11	25.0	25.0	25.0	25.0	25.0	40	43	45	49	51	Yes
R153	4.5	Residence	422511	5089612	2025	T11	24.8	24.8	24.8	24.8	24.8	40	43	45	49	51	Yes
R154	4.5	Residence	422460	5089645	2073	T11	24.6	24.6	24.6	24.6	24.6	40	43	45	49	51	Yes
R155	4.5	Residence	422502	5089691	2103	T11	25.2	25.2	25.2	25.2	25.2	40	43	45	49	51	Yes
R156	4.5	Residence	422501	5089754	2163	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R157	4.5	Residence	422590	5089829	2210	T11	25.6	25.6	25.6	25.6	25.6	40	43	45	49	51	Yes
R158	4.5	Residence	422596	5089787	2168	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R159	4.5	Residence	422609	5089684	2065	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R160	4.5	Residence	422680	5089676	2040	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R161	4.5	Residence	422678	5089714	2078	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R162	4.5	Residence	422675	5089755	2118	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R163	4.5	Residence	422680	5089791	2152	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R164	4.5	Residence	422707	5089868	2222	T11	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R165	4.5	Residence	422748	5089886	2231	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R166	4.5	Residence	422800	5089905	2241	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R167	4.5	Residence	422731	5089673	2026	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R168	4.5	Residence	422731	5089718	2070	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R169	4.5	Residence	422731	5089757	2108	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R170	4.5	Residence	422732	5089824	2174	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R171	4.5	Residence	422788	5089835	2174	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R172	4.5	Residence	422789	5089778	2118	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R173	4.5	Residence	422789	5089728	2069	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R174	4.5	Residence	422791	5089680	2021	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R175	4.5	Residence	422788	5089603	1946	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R176	4.5	Residence	422782	5089544	1889	T11	25.6	25.6	25.6	25.6	25.6	40	43	45	49	51	Yes
R177	4.5	Residence	422786	5089501	1846	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R178	4.5	Residence	422837	5089596	1930	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R179	4.5	Residence	423019	5089466	1779	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R180	4.5	Residence	422713	5089969	2320	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R181	4.5	Residence	422729	5090005	2352	T11	26.7	26.7	26.7	26.7	26.7	40	43	45	49	51	Yes
R182	4.5	Residence	422810	5090000	2334	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R183	4.5	Residence	422847	5090085	2413	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R184	4.5	Residence	422929	5090093	2412	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R185	4.5	Residence	422011	5090004	2580	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R186	4.5	Residence	422479	5090116	2516	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R187	4.5	Residence	422506	5090166	2558	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R188	4.5	Residence	422513	5090218	2606	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R189	4.5	Residence	422602	5090178	2547	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R190	4.5	Residence	422663	5090181	2537	T11	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R191	4.5	Residence	422739	5090180	2523	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R192	4.5	Residence	422656	5090359	2713	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R193	4.5	Residence	422623	5090394	2754	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R194	4.5	Residence	422589	5090438	2804	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R195	4.5	Residence	422822	5090202	2532	T11	27.3	27.3	27.3	27.3	27.3	40	43	45	49	51	Yes
R196	4.5	Residence	422903	5090183	2504	T11	27.0	27.0	27.0	27.0	27.0	40	43	45	49	51	Yes
R197	4.5	Residence	422960	5090180	2496	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R198	4.5	Residence	423010	5090182	2494	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R199	4.5	Residence	423041	5090182	2493	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R200	4.5	Residence	423104	5090182	2478	T14	27.4	27.4	27.4	27.4	27.4	40	43	45	49	51	Yes
R201	4.5	Residence	423190	5090177	2443	T14	27.6	27.6	27.6	27.6	27.6	40	43	45	49	51	Yes
R202	4.5	Residence	423098	5090087	2392	T14	27.0	27.0	27.0	27.0	27.0	40	43	45	49	51	Yes
R203	4.5	Residence	423147	5090088	2374	T14	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R204	4.5	Residence	423094	5090033	2342	T11	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R205	4.5	Residence	422948	5089472	1792	T11	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R206	4.5	Residence	422895	5089462	1789	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R207	4.5	Residence	422844	5089599	1932	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R208	4.5	Residence	422845	5089639	1972	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R209	4.5	Residence	422845	5089691	2023	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R210	4.5	Residence	422846	5089739	2070	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R211	4.5	Residence	422844	5089791	2122	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R212	4.5	Residence	422845	5089844	2174	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R213	4.5	Residence	422892	5089867	2191	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R214	4.5	Residence	422889	5089810	2135	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R215	4.5	Residence	422890	5089736	2061	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R216	4.5	Residence	422890	5089639	1965	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R217	4.5	Residence	422890	5089639	1965	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R218	4.5	Residence	422890	5089590	1916	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R219	4.5	Residence	422889	5089547	1874	T11	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R220	4.5	Residence	422948	5089552	1871	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R221	4.5	Residence	422946	5089602	1921	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R222	4.5	Residence	422948	5089653	1972	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R223	4.5	Residence	422948	5089704	2023	T11	26.7	26.7	26.7	26.7	26.7	40	43	45	49	51	Yes
R224	4.5	Residence	422948	5089749	2067	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R225	4.5	Residence	422948	5089815	2133	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes

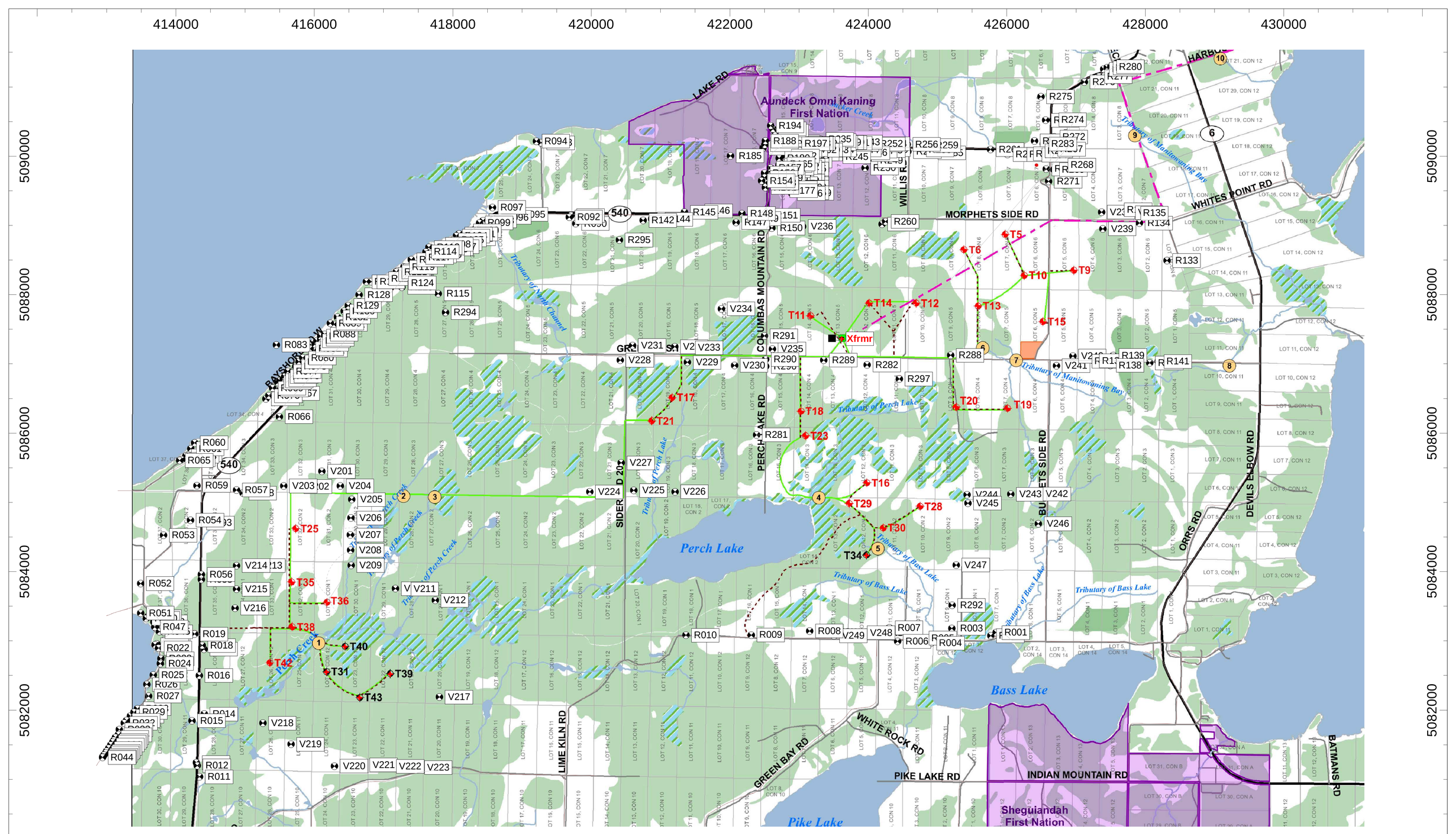
Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R226	4.5	Residence	422951	5089869	2187	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R227	4.5	Residence	422995	5089931	2245	T11	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R228	4.5	Residence	422932	5089974	2293	T11	26.9	26.9	26.9	26.9	26.9	40	43	45	49	51	Yes
R229	4.5	Residence	423145	5090030	2321	T14	27.2	27.2	27.2	27.2	27.2	40	43	45	49	51	Yes
R230	4.5	Residence	423146	5090090	2377	T14	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R231	4.5	Residence	423191	5090099	2369	T14	27.8	27.8	27.8	27.8	27.8	40	43	45	49	51	Yes
R232	4.5	Residence	423219	5090091	2352	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R233	4.5	Residence	423271	5090090	2334	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R234	4.5	Residence	423351	5090090	2310	T14	28.0	28.0	28.0	28.0	28.0	40	43	45	49	51	Yes
R235	4.5	Residence	423309	5090243	2469	T14	27.6	27.6	27.6	27.6	27.6	40	43	45	49	51	Yes
R236	4.5	Residence	423340	5090227	2445	T14	27.8	27.8	27.8	27.8	27.8	40	43	45	49	51	Yes
R237	4.5	Residence	423365	5090198	2411	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R238	4.5	Residence	423343	5090178	2397	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R239	4.5	Residence	423451	5090198	2389	T14	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R240	4.5	Residence	423498	5090196	2377	T14	28.2	28.2	28.2	28.2	28.2	40	43	45	49	51	Yes
R241	4.5	Residence	423572	5090189	2355	T14	28.4	28.4	28.4	28.4	28.4	40	43	45	49	51	Yes
R242	4.5	Residence	423672	5090170	2283	T06	28.6	28.6	28.6	28.6	28.6	40	43	45	49	51	Yes
R243	4.5	Residence	423723	5090202	2267	T06	28.6	28.6	28.6	28.6	28.6	40	43	45	49	51	Yes
R244	4.5	Residence	423707	5090089	2203	T06	29.0	29.0	29.0	29.0	29.0	40	43	45	49	51	Yes
R245	4.5	Residence	423552	5089992	2166	T14	28.8	28.8	28.8	28.8	28.8	40	43	45	49	51	Yes
R246	4.5	Residence	423828	5090048	2086	T06	29.4	29.4	29.4	29.4	29.4	40	43	45	49	51	Yes
R247	4.5	Residence	423935	5090074	2026	T06	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R248	4.5	Residence	423960	5090021	1971	T06	30.1	30.1	30.1	30.1	30.1	40	43	45	49	51	Yes
R249	4.5	Residence	424053	5089936	1845	T06	30.5	30.5	30.5	30.5	30.5	40	43	45	49	51	Yes
R250	4.5	Residence	423953	5089829	1848	T06	30.8	30.8	30.8	30.8	30.8	40	43	45	49	51	Yes
R251	4.5	Residence	424006	5090163	2041	T06	29.5	29.5	29.5	29.5	29.5	40	43	45	49	51	Yes
R252	4.5	Residence	424053	5090175	2019	T06	29.6	29.6	29.6	29.6	29.6	40	43	45	49	51	Yes
R253	4.5	Residence	424051	5090082	1951	T06	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R254	4.5	Residence	424114	5090178	1982	T06	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R255	4.5	Residence	424124	5090094	1911	T06	30.0	30.0	30.0	30.0	30.0	40	43	45	49	51	Yes
R256	4.5	Residence	424562	5090170	1725	T06	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R257	4.5	Residence	424572	5090066	1629	T06	30.7	30.7	30.7	30.7	30.7	40	43	45	49	51	Yes
R258	4.5	Residence	424757	5090092	1570	T06	30.7	30.7	30.7	30.7	30.7	40	43	45	49	51	Yes
R259	4.5	Residence	424854	5090155	1594	T06	30.5	30.5	30.5	30.5	30.5	40	43	45	49	51	Yes
R260	4.5	Residence	424251	5089057	1195	T06	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
R261	4.5	Residence	425766	5090096	1245	T05	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
R262	4.5	Residence	426208	5090025	1183	T05	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R263	4.5	Residence	426302	5090035	1215	T05	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R264	4.5	Residence	426427	5090016	1238	T05	27.8	27.8	27.8	27.8	27.8	40	43	45	49	51	Yes
R265	4.5	Residence	426470	5090076	1309	T05	27.3	27.3	27.3	27.3	27.3	40	43	45	49	51	Yes
R266	4.5	Residence	426400	5090220	1421	T05	29.1	29.1	29.1	29.1	29.1	40	43	45	49	51	Yes
R267	4.5	Residence	426654	5090101	1412	T05	26.8	26.8	26.8	26.8	26.8	40	43	45	49	51	Yes
R268	4.5	Residence	426803	5089870	1306	T05	27.7	27.7	27.7	27.7	27.7	40	43	45	49	51	Yes
R269	4.5	Residence	426680	5089805	1178	T05	28.5	28.5	28.5	28.5	28.5	40	43	45	49	51	Yes
R270	4.5	Residence	426571	5089815	1124	T05	28.7	28.7	28.7	28.7	28.7	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R271	4.5	Residence	426605	5089636	999	T05	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R272	4.5	Residence	426686	5090278	1584	T05	28.0	28.0	28.0	28.0	28.0	40	43	45	49	51	Yes
R273	4.5	Residence	426560	5090519	1755	T05	28.8	28.8	28.8	28.8	28.8	40	43	45	49	51	Yes
R274	4.5	Residence	426669	5090525	1800	T05	28.6	28.6	28.6	28.6	28.6	40	43	45	49	51	Yes
R275	4.5	Residence	426494	5090859	2061	T05	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R276	4.5	Residence	427119	5091071	2487	T05	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R277	4.5	Residence	427330	5091149	2658	T05	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R278	4.5	Residence	427400	5091255	2785	T05	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R279	4.5	Residence	427452	5091277	2831	T05	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R280	4.5	Residence	427503	5091292	2871	T05	25.6	25.6	25.6	25.6	25.6	40	43	45	49	51	Yes
R281	4.5	Residence	422388	5085974	703	T23	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	Yes
R282	4.5	Residence	423985	5086985	889	T14	38.8	38.8	38.8	38.8	38.8	40	43	45	49	51	Yes
R283	4.5	Residence	426527	5090176	1424	T05	26.7	26.7	26.7	26.7	26.7	40	43	45	49	51	Yes
R284	4.5	Residence	426010	5090024	1158	T05	31.1	31.1	31.1	31.1	31.1	40	43	45	49	51	Yes
R285	4.5	Residence	424926	5090047	1469	T06	31.2	31.2	31.2	31.2	31.2	40	43	45	49	51	Yes
R286	4.5	Residence	424200	5089019	1161	T14	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
R287	4.5	Residence	427148	5087039	850	T15	36.4	36.4	36.4	36.4	36.4	40	43	45	49	51	Yes
R288	4.5	Residence	425189	5087124	749	T20	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	Yes
R289	4.5	Residence	423357	5087054	669	T11	40.0	40.0	40.0	40.0	40.0	40	43	45	49	51	Yes
R290	4.5	Residence	422517	5087064	895	T11	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	Yes
R291	4.5	Residence	422500	5087404	716	T11	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	Yes
R292	4.5	Residence	425210	5083512	1435	T34	32.5	32.5	32.5	32.5	32.5	40	43	45	49	51	Yes
R293	4.5	Residence	414364	5084702	1367	T25	32.2	32.2	32.2	32.2	32.2	40	43	45	49	51	Yes
R294	4.5	Residence	417895	5087741	3363	T21	17.2	17.2	17.2	17.2	17.2	40	43	45	49	51	Yes
R295	4.5	Residence	420407	5088789	2402	T17	21.2	21.2	21.2	21.2	21.2	40	43	45	49	51	Yes
R296	4.5	Residence	422517	5086964	822	T18	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	Yes
R297	4.5	Residence	424447	5086782	910	T20	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	Yes
V201	4.5	Vacant Lot	416111	5085448	916	T25	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
V202	4.5	Vacant Lot	415772	5085228	614	T25	37.1	37.1	37.1	37.1	37.1	40	43	45	49	51	Yes
V203	4.5	Vacant Lot	415560	5085236	644	T25	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	Yes
V204	4.5	Vacant Lot	416378	5085236	898	T25	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	Yes
V205	4.5	Vacant Lot	416543	5085041	919	T25	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
V206	4.5	Vacant Lot	416530	5084775	817	T25	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	Yes
V207	4.5	Vacant Lot	416522	5084529	797	T25	37.3	37.3	37.3	37.3	37.3	40	43	45	49	51	Yes
V208	4.5	Vacant Lot	416526	5084309	831	T36	38.2	38.2	38.2	38.2	38.2	40	43	45	49	51	Yes
V209	4.5	Vacant Lot	416531	5084090	642	T36	39.4	39.4	39.4	39.4	39.4	40	43	45	49	51	Yes
V210	4.5	Vacant Lot	417174	5083754	1013	T36	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	Yes
V211	4.5	Vacant Lot	417314	5083750	1150	T36	35.9	35.9	35.9	35.9	35.9	40	43	45	49	51	Yes
V212	4.5	Vacant Lot	417746	5083584	1248	T39	34.2	34.2	34.2	34.2	34.2	40	43	45	49	51	Yes
V213	4.5	Vacant Lot	415097	5084087	621	T35	39.1	39.1	39.1	39.1	39.1	40	43	45	49	51	Yes
V214	4.5	Vacant Lot	414878	5084087	827	T35	37.1	37.1	37.1	37.1	37.1	40	43	45	49	51	Yes
V215	4.5	Vacant Lot	414878	5083745	796	T35	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	Yes
V216	4.5	Vacant Lot	414857	5083473	867	T38	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	Yes
V217	4.5	Vacant Lot	417808	5082187	786	T39	36.1	36.1	36.1	36.1	36.1	40	43	45	49	51	Yes
V218	4.5	Vacant Lot	415257	5081810	870	T42	36.3	36.3	36.3	36.3	36.3	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
V219	4.5	Vacant Lot	415663	5081506	1162	T31	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	Yes
V220	4.5	Vacant Lot	416293	5081191	1051	T43	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	Yes
V221	4.5	Vacant Lot	416719	5081207	974	T43	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
V222	4.5	Vacant Lot	417104	5081186	1090	T43	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
V223	4.5	Vacant Lot	417509	5081170	1323	T43	32.6	32.6	32.6	32.6	32.6	40	43	45	49	51	Yes
V224	4.5	Vacant Lot	419978	5085151	1354	T21	31.3	31.3	31.3	31.3	31.3	40	43	45	49	51	Yes
V225	4.5	Vacant Lot	420615	5085171	1031	T21	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	Yes
V226	4.5	Vacant Lot	421208	5085154	1071	T21	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	Yes
V227	4.5	Vacant Lot	420433	5085569	742	T21	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	Yes
V228	4.5	Vacant Lot	420419	5087052	920	T17	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
V229	4.5	Vacant Lot	421390	5087021	562	T17	38.4	38.4	38.4	38.4	38.4	40	43	45	49	51	Yes
V230	4.5	Vacant Lot	422068	5086978	1022	T17	36.3	36.3	36.3	36.3	36.3	40	43	45	49	51	Yes
V231	4.5	Vacant Lot	420597	5087265	943	T17	34.3	34.3	34.3	34.3	34.3	40	43	45	49	51	Yes
V232	4.5	Vacant Lot	421205	5087247	741	T17	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	Yes
V233	4.5	Vacant Lot	421420	5087234	771	T17	36.1	36.1	36.1	36.1	36.1	40	43	45	49	51	Yes
V234	4.5	Vacant Lot	421881	5087794	1278	T11	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	Yes
V235	4.5	Vacant Lot	422617	5087216	719	T11	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	Yes
V236	4.5	Vacant Lot	423052	5088985	1297	T11	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	Yes
V237	4.5	Vacant Lot	427368	5089192	937	T09	34.2	34.2	34.2	34.2	34.2	40	43	45	49	51	Yes
V238	4.5	Vacant Lot	427775	5089185	1168	T09	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
V239	4.5	Vacant Lot	427385	5088950	736	T09	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	Yes
V240	4.5	Vacant Lot	426953	5087112	660	T15	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	Yes
V241	4.5	Vacant Lot	426719	5086974	664	T15	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	Yes
V242	4.5	Vacant Lot	426443	5085121	1309	T19	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	Yes
V243	4.5	Vacant Lot	426058	5085116	1239	T19	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	Yes
V244	4.5	Vacant Lot	425429	5085108	706	T28	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	Yes
V245	4.5	Vacant Lot	425439	5084988	699	T28	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	Yes
V246	4.5	Vacant Lot	426457	5084691	1724	T19	32.2	32.2	32.2	32.2	32.2	40	43	45	49	51	Yes
V247	4.5	Vacant Lot	425270	5084096	999	T28	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	Yes
V248	4.5	Vacant Lot	423904	5083118	1119	T34	33.1	33.1	33.1	33.1	33.1	40	43	45	49	51	Yes
V249	4.5	Vacant Lot	423503	5083074	1252	T34	32.5	32.5	32.5	32.5	32.5	40	43	45	49	51	Yes

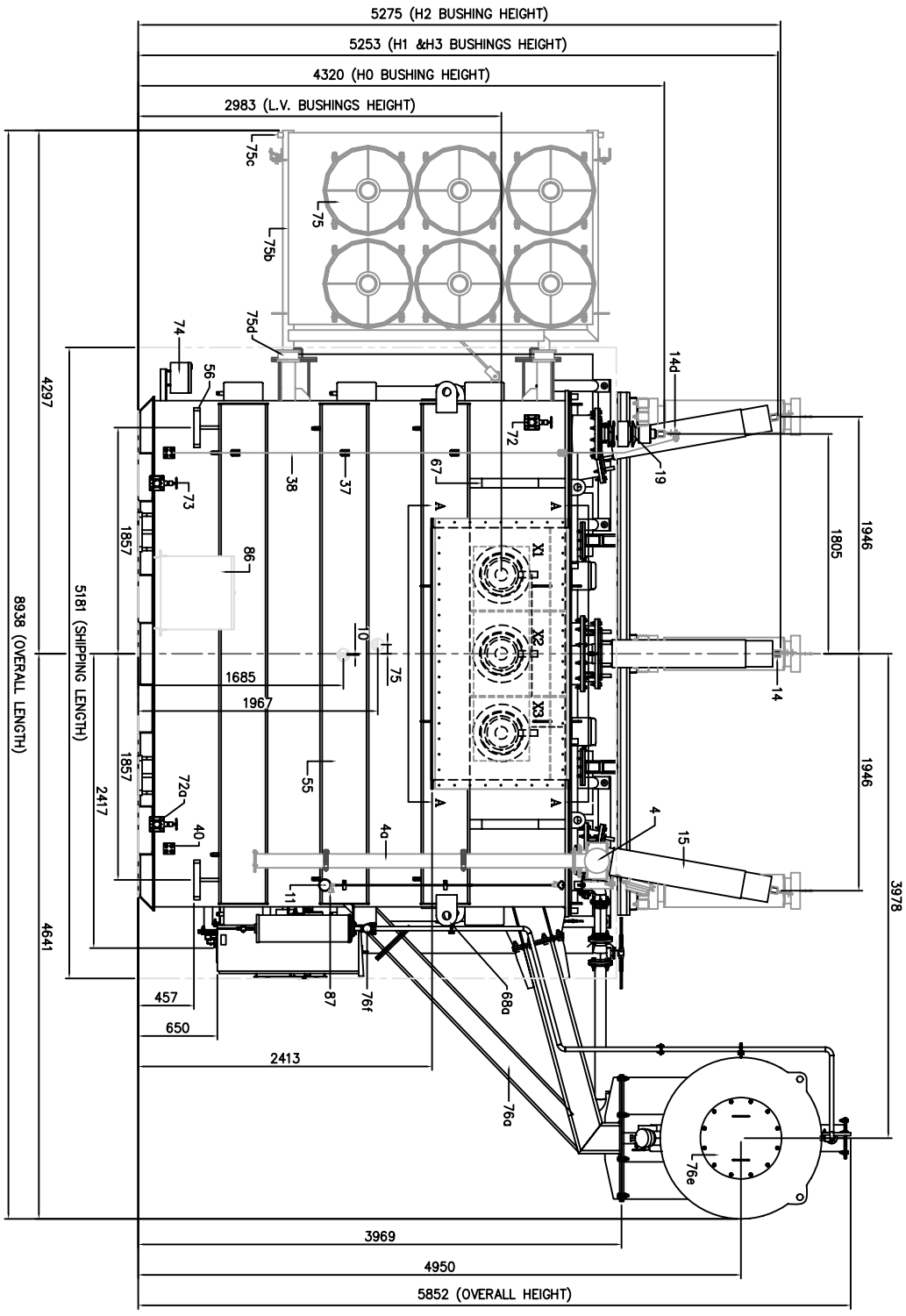


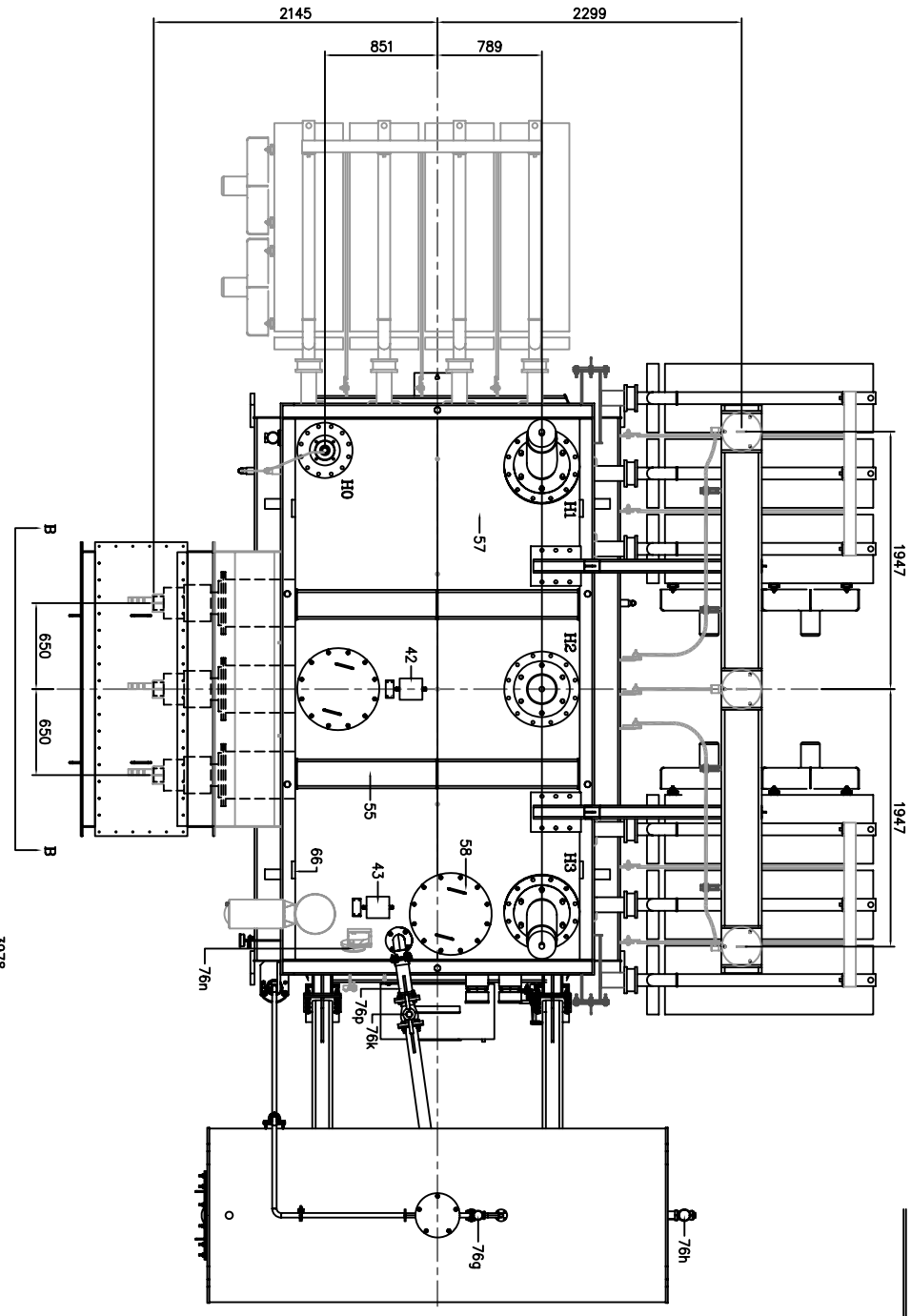
aercoustics engineering limited	M1 Manitoulin Island Wind Farm Key Plan	Drawn: BS	Eng: PA	Drawing: Key Plan	
	50 Ronson Drive Suite 165, Toronto, Canada M9W 1B3 T. 416 249 3361	Date: June 30, 2011		Scale: NTS	Fig: 1



aercoustics engineering limited	M1 Manitoulin Island Wind Farm Turbine, Transformer, and Receptor Layout GE 2.5-103 Turbines	Drawn: BS Eng: PA	Drawing: Turbine, Transformer, and Receptor Layout
	50 Ronson Drive Suite 165, Toronto, Canada M9W 1B3 T. 416 249 3361	Date: June 30, 2011	Scale: 1:25,000 if printed on A1 Fig: 2

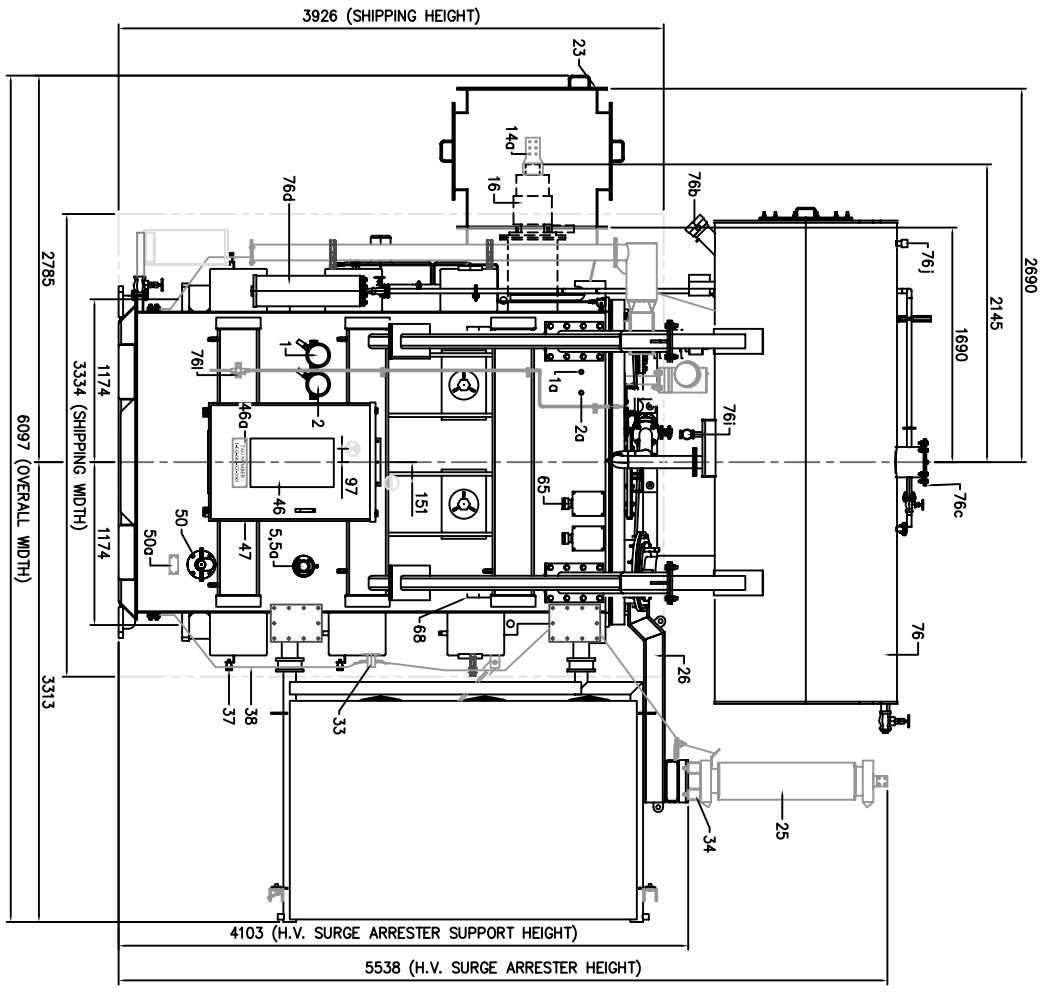
Figure 3 - Transformer Dimensions

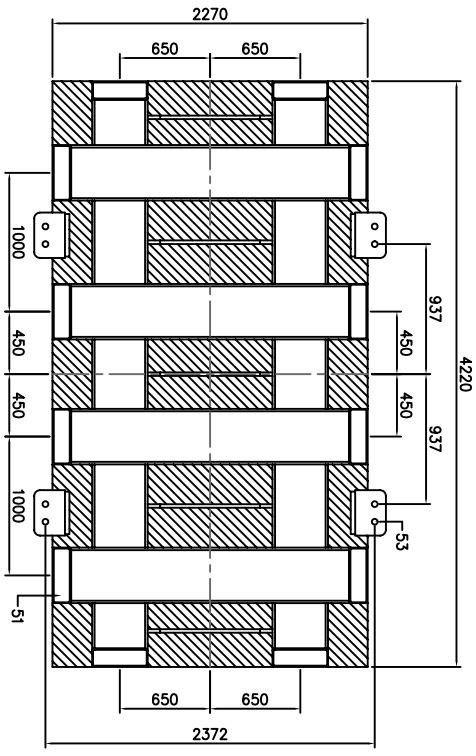




DETAIL "A-A"

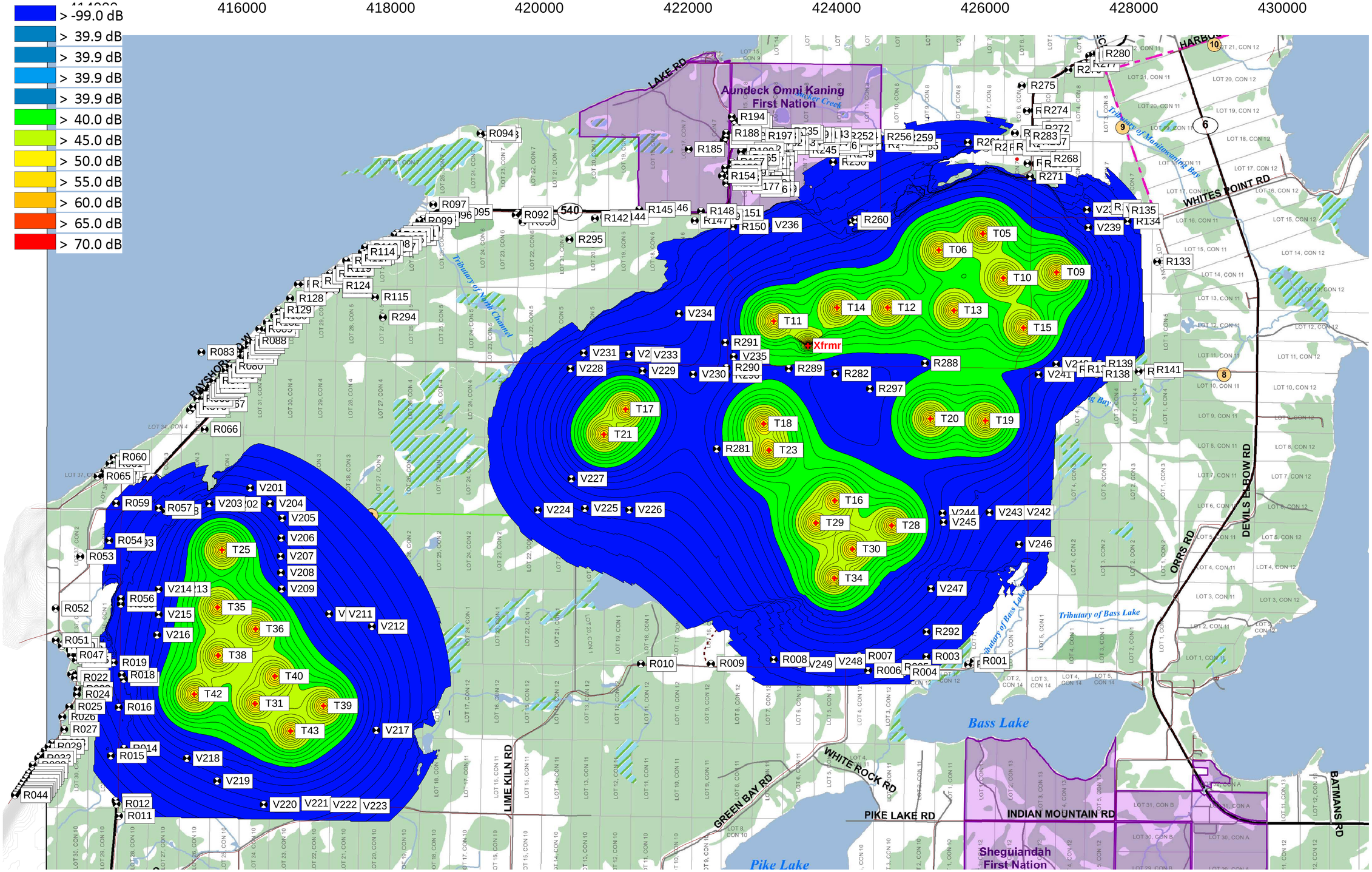
DETAIL "B-B"





"BOTTOM VIEW"

THE HATCHED AREA REPRESENT THE BOTTOM OF THE TRANSFORMER, THIS AREA DOESN'T SIT ON THE FLOOR.



aercoustics engineering limited

M1 Manitoulin Island Wind Farm
Noise Contour (4.5m high grid)
GE 2.5-103 Turbines

Windspeed: 6m/s Wind Shear = 0.435

50 Ronson Drive Suite 165, Toronto, Canada M9W 1B3 T. 416 249 3361

Drawn:	Eng:	Drawing:
BS	PA	Noise Contour (4.5m high grid)

Date:	Scale:	Fig:
June 30, 2011	1:25,000 if printed on A1	5

ATTACHMENT A

REPRINT OF MOE PUBLICATION, OCTOBER 2008

NOISE GUIDELINES FOR WIND FARMS
INTERPRETATION FOR APPLYING MOE NPC PUBLICATIONS TO
WIND POWER GENERATION FACILITIES

Noise Guidelines for Wind Farms

Interpretation for Applying MOE NPC Publications to
Wind Power Generation Facilities

Ministry of the Environment

October 2008

NOISE GUIDELINES FOR WIND FARMS

Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities

October 2008

This document establishes the sound level limits for land-based wind power generating facilities and describes the information required for noise assessments and submissions under the Environmental Assessment Act and the Environmental Protection Act. It replaces the document "Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators," Version 1.0, July 6, 2004.

Table of Contents

TABLES

FIGURE

1. SCOPE

Noise impacts of proposed land-based wind power generation facilities, i.e. Wind Farms, are considered in the course of assessing an application for a Certificate of Approval (Air/Noise), in accordance with section 9 of the *Environmental Protection Act*. Wind Farms two megawatts or more are subject to review under the Environmental Screening Process, in accordance with Ontario Regulation 116/01 under the *Environmental Assessment Act*, and noise impacts are also considered during review under the screening process. The purpose of this document is to describe the applicable sound level limits and to specify the information proponents are to submit to the Ministry of the Environment when seeking approval for a proposed land-based Wind Farm. This document has been developed to provide consistency in the submissions and to streamline the review and approval process. Accordingly, the guidance contained herein is intended to provide uniformity in planning of Wind Farms in Ontario.

Proponents of Wind Farms are to prepare and submit to the Ministry of the Environment (MOE) a Noise Assessment Report that includes details of the wind turbine design and operation, location of the wind turbine(s) within the specific site and surrounding area, as well as summary of compliance with the applicable sound level limits. If applicable, the Noise Assessment Report must also include similar details of the Transformer Substation used for transforming the power from the wind turbine units. This document defines a template for the Noise Assessment Report to be submitted to the MOE.

This document also provides guidance on the assessment of the combined noise impact produced by the proposed Wind Farm in combination with the noise impact of approved Wind Farms or Wind Farms that are in the process of being planned.

2. REFERENCES

Reference is made to the following publications:

[1] NPC-104, “Sound Level Adjustments,” Ontario Ministry of the Environment

[2] NPC-205, “Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban),” Ontario Ministry of the Environment

[3] NPC-206, “Sound Levels due to Road Traffic,” Ontario Ministry of the Environment

[4] NPC-232, “Sound Level Limits for Stationary Sources in Class 3 Areas (Rural),” Ontario Ministry of the Environment

[5] CAN/CSA-C61400-11-07, “Wind Turbine Generator Systems - Part 11: Acoustic Noise Measurement Techniques”

[6] ISO 9613-2, “Acoustics-Attenuation of sound during propagation outdoors - Part 2: General method of calculation”

[7] ANSI/IEEE C57.12.90, “Distribution, Power, and Regulating Transformers”

3. DEFINITIONS

For the purpose of this document, the following definitions apply:

“Environmental Screening Process” is a prescribed planning process for electricity projects set out in Part B of the Guide to Environmental Assessment Requirements for Electricity Projects. As set out in Ontario Regulation 116/01 under the *Environmental Assessment Act*, certain electricity projects are subject to review under the Environmental Screening Process.

"Noise Assessment Report" means a report for wind power electricity generation projects, prepared in accordance with the guidance described in this document.

"Participating Receptor" means a property that is associated with the Wind Farm by means of a legal agreement with the property owner for the installation and operation of wind turbines or related equipment located on that property.

"Switching Station" means a collection point for the outputs of the wind turbine generators. Switching Stations are not significant noise sources.

"Transformer Substation" means a central facility comprised of power transformer(s) and associated equipment such as cooling fans for transforming the electrical outputs from the wind turbine generators to a higher voltage for input to the grid transmission system. Transformer Substations are significant noise sources.

"Wind Farm" means an electrical generating facility comprised of an array of wind turbine generators and a common electrical connection point such as a Transformer Substation or a Switching Station.

The following definitions are also included in the current Publications NPC-205 and NPC-232, References [2] and [4]:

"Class 1 Area" means an area with an acoustical environment typical of a major population centre, where the background noise is dominated by the urban hum.

"Class 2 Area" means an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring only between 23:00 and 07:00 hours in Class 1 Areas, will typically be realized as early as 19:00 hours.

Other characteristics which may indicate the presence of a Class 2 Area include:

i. absence of urban hum between 19:00 and 23:00 hours;
ii. evening background sound level defined by natural environment and infrequent human activity; and
iii. no clearly audible sound from stationary sources other than from those under consideration.

"Class 3 Area" means a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as the following:

i. a small community with less than 1000 population;
ii. agricultural area;
iii. a rural recreational area such as a cottage or a resort area; or
iv. a wilderness area.

The following definition is also included in the current Publication NPC-232, Reference [4]:

"Point of Reception" means any point on the premises of a person within 30 m of a dwelling or a camping area, where sound or vibration originating from other than those premises is received.

For the purpose of approval of new sources, including verifying compliance with section 9 of the *Environmental Protection Act*, the Point of Reception may be located on any of the following existing or zoned for future use premises: permanent or seasonal residences,

hotels/motels, nursing/retirement homes, rental residences, hospitals, camp grounds, and noise sensitive buildings such as schools and places of worship.

For equipment/facilities proposed on premises such as nursing/retirement homes, rental residences, hospitals, and schools, the Point of Reception may be located on the same premises.

4. DESCRIPTION OF WIND FARM NOISE

A Wind Farm is a collection of wind turbines, located in the same area, used for the production of electric power. As the individual wind turbines are separated by several hundred metres from each other, a large wind farm covers an area of tens of square kilometres. Larger Wind Farms may include a Transformer Substation that collects and increases the voltage produced by the turbines to the higher voltage for the grid transmission system.

A typical wind turbine consists of a tall tower with a hub (nacelle or housing) containing the drive-train and generator mounted on top of the tower. Three rotating blades (typically) are connected to a horizontal hub. In general, the significant noise sources associated with the operation of a Wind Farm are the wind turbines and the Transformer Substation. Noise from wind turbines consists of the aerodynamic noise caused by blades passing through the air, and mechanical noise created by the operation of mechanical elements of the drive-train. Close to the turbine, the noise typically exhibits a swishing sound as the blades rotate; and the whirr of the drive-train and generator. However, as distance from the turbine increases, these effects are reduced. The wind turbine noise perceived at receptors is typically broadband in nature. Any tonal character associated with the wind turbine noise is generally associated with maintenance issues.

The Transformer Substation noise is produced by the vibration of the transformer core and associated components, and by the operation of other equipment such as cooling fans. The noise produced by a Transformer Substation generally exhibits a pronounced hum, associated with the fundamental electrical frequency and its harmonics. Consequently, the Transformer Substation noise perceived at receptors is typically tonal.

The noise produced by wind turbines, as well as the background noise, typically increases with wind speed. The noise produced by a Transformer Substation is unaffected by the wind speed.

5. SOUND LEVEL LIMITS FOR WIND FARMS

5.1 Limits for Wind Turbine Generators

The sound level limits for wind turbines are set relative to the existing MOE Noise Guidelines in Publications NPC-205 and NPC-232, References [2] and [4], as well as to a reference wind induced background sound level. Consistent with these guidelines, the sound level limits, expressed in terms of the hourly, “A-weighted,” equivalent sound level (L_{eq}), apply at Points of Reception.

a) Receptors in Class 1 & 2 Areas (Urban)

The sound level limits at a Point of Reception in Class 1 & 2 Areas (Urban) are given by the applicable values in Table 1 and Figure 1, or by the sound level limits, established in accordance with requirements in Publication NPC-205.

b) Receptors in Class 3 Areas (Rural)

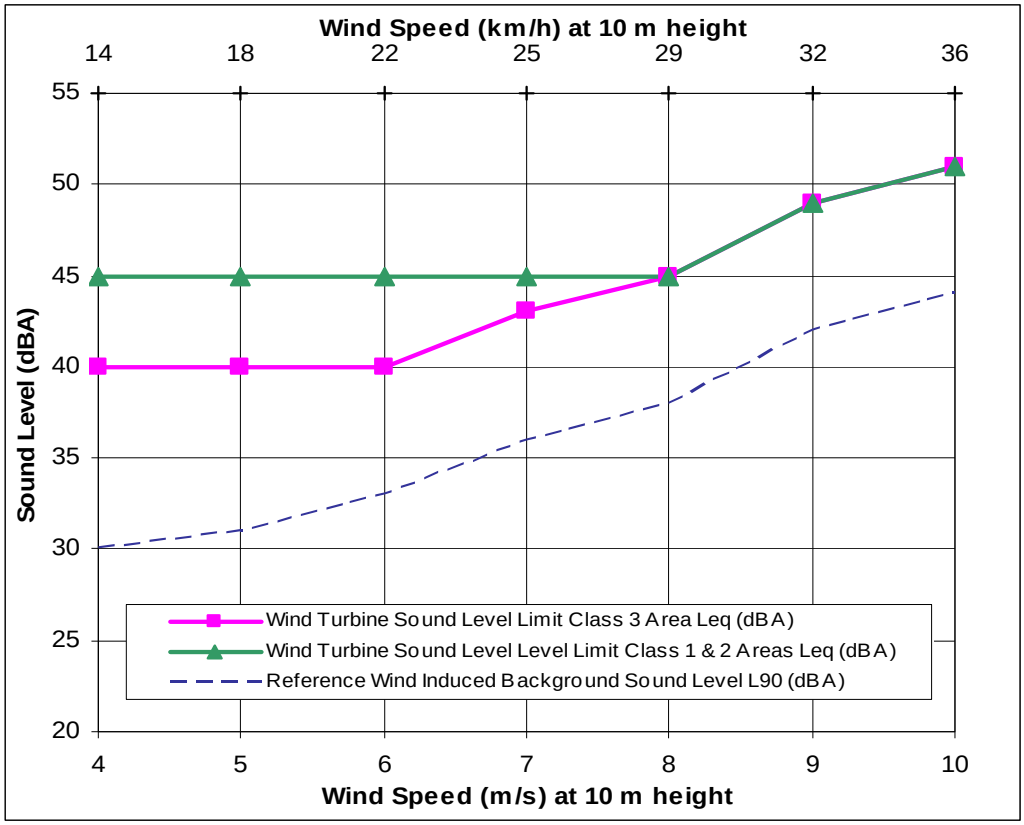
The sound level limits at a Point of Reception in Class 3 Areas (Rural) are given by the applicable values in Table 1 and Figure 1, or by the sound level limits, established in accordance with requirements in Publication NPC-232.

The wind turbine sound level limits are given at integer values of the wind speed and are shown as the solid lines in Figure 1. The dashed line in Figure 1 does not represent a limit and is included only for information purposes[1]. These sound level limits range from the lowest value of 40 dBA for Class 3 Areas and wind speeds at or below 4 m/s to the maximum value of 51 dBA for wind speeds at or above 10 m/s.

Table 1 Summary of Sound Level Limits for Wind Turbines

Wind Speed (m/s) at 10 m height	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Wind Turbine Sound Level Limits Class 3 Area, dBA	40.0	40.0	40.0	43.0	45.0	49.0	51.0
Wind Turbine Sound Level Limits Class 1 & 2 Areas, dBA	45.0	45.0	45.0	45.0	45.0	49.0	51.0

Figure 1 Summary of Sound Level Limits for Wind Turbines



[1] The measurement of wind induced background sound level is not required to establish the applicable limit. The wind induced background sound level reference curve, dashed line in Figure 1, was determined by correlating the A-weighted ninetieth percentile sound level (L_{90}) with the average wind speed measured at a particularly quiet site. The applicable L_{eq} sound level limits at higher wind speeds are given by adding 7 dB to the wind induced background L_{90} sound level reference values, using the principles for establishing sound level limits described in Publication NPC-232, Reference [4].

5.2 Limits for Wind Turbine Generators and Transformer Substations

In cases where the noise impact at a Point of Reception is composed of combined contributions due to the Transformer Substation as well as the wind turbine generators, the applicable limits are those shown in Table 1 and Figure 1, as described in Section 5.1.

The combined noise impact must comply with the limits at all the wind speeds from 0 m/s to 10 m/s. It should be noted that the acoustic emissions from a Transformer Substation are independent and unrelated to the wind speed, unlike the acoustic emissions from wind turbine generators which are wind speed dependent.

In determining the combined impact, a 5 dB adjustment must be added to the Transformer Substation noise in accordance with Publication NPC-104, Reference [1].

5.3 Limits for Transformer Substations

In unique cases where the noise impact assessment at a Point of Reception is limited to the operation of the Transformer Substation, as in a case described in Section 6.4.1, the sound level limit at a Point of Reception is given in the Publication NPC-205, Reference [2] or Publication NPC-232, Reference [4], whichever is applicable. The limit is independent of wind induced noise.

In order to account for the tonal characteristics of Transformer Substation noise, a 5 dB adjustment must be added to the acoustic emissions in accordance with Publication NPC-104, Reference [1].

6. NOISE ASSESSMENT REPORT

A Noise Assessment Report must be prepared for all proposed Wind Farms. The requirements for a detailed noise impact assessment depend on the proximity of the Wind Farm to receptors and are described in Section 6.4. The report must be submitted in a hard copy as well as in an electronic format.

The Noise Assessment Report must demonstrate compliance with the applicable sound level limits and the supporting information must be organized in a clear and concise manner. The report must be prepared by a qualified acoustical consultant and the cover document must be signed by the proponent for the project.

The Noise Assessment Report should be performed early in the planning of the project, as part of the Environmental Screening Process. The expectation of the MOE is that the submitted Noise Assessment Report be complete and accurate. Results of the Noise Assessment Report should be included in the Screening Report or Environmental Review Report prepared under the Environmental Screening Process. Any revisions to the Noise Assessment Report following the completion of the Environmental Screening Process should be very limited and clearly identified. In cases where complete information about the Wind Farm (e.g., information relating the transformer equipment) was not available at the environmental screening stage, such information must be provided to the MOE with the application for the Certificate of Approval under section 9 of the *Environmental Protection Act* for the Wind Farm.

As a minimum, the report must include the following sections in the given sequence:

6.1 Project Layout

The overall plan of the Wind Farm must be described in detail for the purpose of supporting the noise impact assessment calculations and for demonstrating compliance with the sound level

limits. General project layout description must be supported with clear maps of the site and surrounding area, complete with scale, northing, and legend information. A suitable minimum drawing scale for the overall plan of the project is 1 cm : 500 m.

The following details must be included:

a) Geographic location of the project study area;
b) Locations of wind turbines;
c) Location of Transformer Substation or Switching Station;
d) Locations of all receptors including buildings, dwellings, campsites, places of worship, and institutions, up to 2000 m from any wind turbine location; and
e) Property boundaries of lands associated with the project and location of dwellings therein.

The following additional information must be included, if applicable:

f) Municipal zoning and land-use plans;
g) Topographical features including roadways, terrain elevations, and ground cover; and
h) Available information regarding the location and scope of other approved[2] Wind Farms, and Wind Farms in the process of being planned[3], located within 5 km of any wind turbine generators of the proposed Wind Farm.

6.2 Noise Sources

For the purposes of this document, noise sources mean land-based wind turbine generators and Transformer Substations.

6.2.1 Description

The Noise Assessment Report must include the description of the wind turbine generators, including: manufacturer's make and model, maximum electrical output rating, hub height above grade, range of rotational speeds, and mode of operation.

The Noise Assessment Report must also include the description of the Transformer Substation, including all available information at the time of submission on the manufacturer's make and model designations, maximum electrical output rating, primary and secondary voltages, method of cooling, physical dimensions, drawing showing elevation and plan views of the unit, and any noise abatement measures.

Manufacturer's specifications should be included in an Appendix.

6.2.2 Wind Turbines

The acoustic emissions of the wind turbine must be specified by the manufacturer for the full range of rated operation and wind speeds. As a minimum, the information must include the sound power levels, frequency spectra in octave bands (63 to 8000 Hz), and tonality at integer

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[2] For the purposes of this document, a Wind Farm is considered to be "approved" if a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has been issued.

[3] For the purposes of this document, a Wind Farm is considered to be "in the process of being planned" if a Notice of Commencement has been issued for the project in accordance with the Environmental Screening Process prescribed under Ontario Regulation 116/01 under the *Environmental Assessment Act*, but for which a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has not yet been issued.

wind speeds from 6 to 10 m/s. The acoustic emission information must be determined and reported in accordance with the international standard CAN/CSA-C61400-11-07, Reference [5].

6.2.3 Adjustment to Wind Turbine Generator Acoustic Emissions for Wind Speed Profile

The wind speed profile on site of the Wind Farm may have an effect on the manufacturer's wind turbine acoustic emission data and, consequently, on the sound levels predicted at a Point of Reception. Therefore, the wind turbine generator acoustic emission levels must be consistent with the wind speed profile of the project area.

To address this issue, the assessment must use manufacturer's acoustic emission data adjusted for the average summer night time wind speed profile, representative of the site.

The adjusted acoustic emissions data must be used in the noise impact assessment at each receptor. The manufacturer's acoustic emissions data and the adjusted acoustic emission data used in the noise impact assessment must be tabulated in Table 3.

6.2.4 Transformer Substation

The acoustic emissions of each transformer unit must be specified by the manufacturer and conform to the standard ANSI/IEEE C57.12.90, Reference [7]. In cases where the specific information is not available in the early stages of planning the proposed Wind Farm, as described in the introduction to Section 6, proponents must submit a maximum rated value of the transformer acoustic emissions.

The requirements do not apply to the small transformer units attached to each wind turbine. These small transformers are insignificant noise sources and, therefore, their contributions do not require assessment.

The acoustic emissions data must be used in the noise impact assessment at each receptor.

6.2.5 Noise Sources and Locations

All wind turbine units and Transformer Substations must be assigned a unique source identification and must be listed along with their Universal Transverse Mercator (UTM) coordinates in a table in the report. The table should be provided in electronic form along with the report. A sample table format is shown in Table 4.

The source identifications should remain consistent throughout the submission and review process. Any changes to source identifications in revised versions of the Noise Assessment Report should be explicitly stated.

6.3 Receptors

For the purposes of this document, receptors mean Points of Reception and Participating Receptors, including vacant lots described in Section 6.3.3.

The definitions of a Point of Reception and a Participating Receptor are given in Section 3. The distance requirements for detailed noise assessments at receptors are described in Section 6.4.1. To provide clarity and consistency in the detailed noise assessments, the following describes the specific receptor locations for assessment purposes:

6.3.1 Wind Farm Does Not Include Transformer Substation

a) Single Storey Dwelling

- 4.5 m above grade at the centre of the dwelling; or
- 1.5 m above grade and 30 m horizontally from the façade of the dwelling in the direction of each wind turbine location. If the 30 m radius spans beyond the property line of the dwelling then the receptor location is at the property line.

Either of the two locations is acceptable for assessment[4].

b) Two Storey Dwelling (or Raised Bungalow)

- 4.5 m above grade at the centre of the dwelling.

c) Three Storey or Higher Dwelling

- at the centre of the highest storey of the dwelling.

6.3.2 Wind Farm Includes Transformer Substation

a) Dwellings up to Two Storey High

- 4.5 m above grade at the centre of the dwelling; or
- 1.5 m above grade and 30 m horizontally from the façade of the dwelling in the direction of each wind turbine location. If the 30 m radius spans beyond the property line of the dwelling then the receptor location is at the property line.

The location that results in the higher noise impact must be selected[5].

b) Three Storey or Higher Dwelling

- at the centre of the highest storey of the dwelling; or
- 1.5 m above grade and 30 m horizontally from the façade of the dwelling in the direction of each wind turbine location. If the 30 m radius spans beyond the property line of the dwelling then the receptor location is at the property line.

The location that results in the higher noise impact must be selected[6].

6.3.3 Vacant Lots

Receptors include vacant lots that have been zoned by the local municipality to permit residential or similar noise-sensitive uses, as described in the definition of a Point of Reception in Section 3.

The receptor location, if unknown at the time of the proposal, shall be based on a 1 hectare (10,000 m²) building envelope within the vacant lot property that would reasonably be expected to

[4] Assessment at the centre of the dwelling is simpler. The sound level at 4.5 m above grade at the centre of the dwelling is generally higher.

[5] Assessment at the centre of the dwelling is simpler. The sound level at 4.5 m above grade at the centre of the dwelling is generally higher except where transformer substation noise is a factor.

[6] Assessment at the centre of the dwelling is simpler. The sound level at the highest storey at the centre of the dwelling is generally higher except where transformer substation noise is a factor.

contain the use, and that conforms with the municipal zoning by-laws in effect. The specific receptor location for assessment purposes should be assumed to be 4.5 m above grade and:

- consistent with the typical building pattern in the area, or
- at the centre of the 1 hectare building envelope.

6.3.4 Area Classification of Receptors

Based on the rural nature of the areas surrounding most wind power projects, the Class 3 Area sound level limits shown in Table 1 and Figure 1 apply to all receptors, regardless of their proximity to a roadway, unless it can be shown clearly that less restrictive sound level limits are justified.

Less restrictive sound level limits for receptors within their designated area classification must be justified by analysis of hourly-traffic volumes data or by hourly acoustic monitoring results consistent with Publication NPC-206, Reference [3]. The use of general estimates, such as the Annual Average Daily Traffic data (AADT), is an insufficient method for determining the minimum hourly sound level of the background.

6.3.5 Receptors and Locations

All receptors must be assigned a unique receptor identification and must be tabulated along with their precise coordinates in the report. The table should be provided in electronic form along with the report. A sample table format is shown in Table 5 and Table 6.

The receptor identifications should remain consistent throughout the review process. Any changes to receptor identifications in revised versions of the Noise Assessment Report must be explicitly stated.

6.4 Detailed Noise Impact Assessment

Assessment of the sound levels produced by a Wind Farm, i.e. detailed noise impact assessment, must be made at each Point of Reception and Participating Receptor, within the distance requirements described in Section 6.4.1. In the event that all Points of Reception and Participating Receptors are outside the distance requirements described in Section 6.4.1, a detailed noise impact assessment is not required and the provisions contained in Sections 6.4.2 through to 6.4.10 are not applicable. Note that all proposals for Wind Farm projects must address the requirements described in Sections 6.1, 6.2 and 6.3, and Table 4, Table 5 and Table 6, even if a detailed noise assessment is not required.

The noise assessment must represent the maximum rated output of the Wind Farm, and reflect the principle of “predictable worst case” noise impact, Publications NPC-205 and NPC-232, References [2] and [4].

6.4.1 Distance Requirement

a) Wind Farm Does Not Include Transformer Substation

- A detailed noise impact assessment of the Wind Farm is required if one or more Points of Reception or Participating Receptors are located within 1500 m of a wind turbine generator.

b) Wind Farm Includes Transformer Substation

- A detailed noise impact assessment of the Wind Farm including a Transformer Substation is required if one or more Points of Reception or Participating Receptors are located within 1500 m of a wind turbine generator.
- A detailed noise impact assessment limited to the Transformer Substation is required if no Points of Reception or Participating Receptors are located within 1500 m of a wind turbine generator but a Point of Reception or a Participating Receptor is located within 1000 m of a Transformer Substation.

6.4.2 Whole Wind Farm Assessment

In the event that a detailed noise impact assessment is required, the assessment must not be limited to a 1500 m radius from a receptor, but must consider the impact of the whole Wind Farm subject to the limitations relating to very large distances described in Section 6.4.9.

6.4.3 Transformer Substation Assessment

In general, Transformer Substation noise impact must be assessed in combination with the noise impact from the wind turbine generators. In the unique case where the noise impact is caused only by the Transformer Substation, as described in Section 6.4.1 b), the detailed noise impact assessment is only required to consider the sound levels from the Transformer Substation.

6.4.4 Impact of Adjacent Approved Wind Farms

If a Point of Reception or a Participating Receptor is or can be affected by adjacent, approved[7] Wind Farms, the detailed noise impact assessment must address the combined impact of the proposed and the adjacent Wind Farms. The distance requirements described in Sections 6.4.1 and 6.4.9 apply.

Note that in accordance with Section 6.4.2, where a detailed noise impact assessment is required, it must consider all the wind turbine generators and Transformer Substations in the proposed as well as in the adjacent approved Wind Farms, subject to the limitations relating to very large distances described in Section 6.4.9.

6.4.5 Impact of Adjacent Wind Farms in the Process of Being Planned

If a Point of Reception or a Participating Receptor is or can be affected by adjacent Wind Farms in the process of being planned[8], the detailed noise impact assessment must address, subject to available information[9], the combined impact of the proposed and the adjacent Wind Farms. The distance requirements described in Sections 6.4.1 and 6.4.9 apply.

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[7] For the purposes of this document, a Wind Farm is considered to be "approved" if a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has been issued.

[8] For the purposes of this document, a Wind Farm is considered to be "in the process of being planned" if a Notice of Commencement has been issued for the project in accordance with the Environmental Screening Process prescribed under Ontario Regulation 116/01 under the *Environmental Assessment Act*, but for which a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has not yet been issued.

[9] The combined impact would be expected to be assessed if, for example, the information on turbine locations and models at an adjacent proposed Wind Farm is publicly available (e.g., through a Screening Report or Environmental Review Report under the Environmental Screening Process).

Note that in accordance with Section 6.4.2, where a detailed noise impact assessment is required, it must consider all the wind turbine generators and Transformer Substations in the proposed Wind Farm as well as in the adjacent Wind Farm in the process of being planned, subject to the limitations relating to very large distances described in Section 6.4.9.

6.4.6 Assessment of Participating Receptors

A receptor is a Participating Receptor and not considered as a Point of Reception if the property of the receptor is associated with the Wind Farm, see definition in Section 3. The sound level limits stated in Section 5 do not apply to Participating Receptors.

Despite this exemption, it is prudent to design Wind Farms so as to minimize the noise impact on all receptors, including Participating Receptors.

In some cases, a detailed noise assessment may be required of a receptor that was considered a Participating Receptor for an adjacent approved Wind Farm, or is being considered as a Participating Receptor for an adjacent Wind Farm in the process of being planned. Unless the property owner has also entered into an agreement with the proponent of the proposed Wind Farm, the receptor shall be considered a Point of Reception for the purposes of the detailed noise impact assessment for the proposed Wind Farm.

6.4.7 Prediction Method

Predictions of the total sound level at a Point of Reception or a Participating Receptor must be carried out according to the method described in the standard ISO 9613-2, Reference [6]. The calculations are subject to the specific parameters indicated in Section 6.4.10.

6.4.8 Adjustment for Special Quality of Sound

Should the manufacturer's data indicate that the wind turbine acoustic emissions are tonal, the acoustic emissions must be adjusted by 5 dB for tonality, in accordance with Publication NPC-104, Reference [1]. Otherwise, the prediction should assume that the wind turbine noise requires no adjustments for special quality of sound described in Publication NPC-104, Reference [1].

No special adjustments are necessary to address the variation in wind turbine sound level (swishing sound) due to the blade rotation, see Section 4. This temporal characteristic is not dissimilar to other sounds to which no adjustments are applied. It should be noted that the adjustments for special quality of sound described in Publication NPC-104, Reference [1], were not designed to apply to sounds exhibiting such temporal characteristic.

The calculations of the transformer noise must be consistent with the provisions of Section 6.2.4. Furthermore, since transformer acoustic emissions are tonal, an adjustment of 5 dB must be added to the specified acoustic emissions in accordance with Publication NPC-104, Reference [1].

6.4.9 Sound Level Contributions from Distant Wind Turbine Generators

The standard on which the noise impact prediction method is based, namely standard ISO 9613-2, Reference [6], is designed for source/receiver distances up to about 1000 m. Although the use of the standard may be extended to larger distances, other factors affecting sound level contributions from the distant sources may need to be considered. In practice, sound level contributions from sources such as wind turbines located at very large distances from receptors are affected by additional attenuation effects.

To address the above in a prediction method, contributions from sources located at very large distances from receptors, larger than approximately 5 km, do not need to be included in the calculation.

6.4.10 Specific Parameters

The assessment must use the following parameters that have been designed to provide clarity and consistency as well as reflect the principle of the "predictable worst case" noise impact.

a) All calculations must be performed in terms of octave band sound levels (63 to 8000 Hz) and for each integer wind speed from 6 to 10 m/s.

b) The attenuation due to atmospheric absorption must be based on the atmospheric attenuation coefficients for 10ºC temperature and 70% relative humidity, specifically:

Table 2 Atmospheric Absorption Coefficients

Centre Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Atmospheric Absorption Coefficient (dB/km)	0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0

c) The term for Ground Attenuation must be calculated using the "General" method in the standard ISO 9613-2, Reference [6]. For Class 2 and 3 Areas, the assessment must use ground factor values not exceeding the following:

$G_s = 1.0$
$G_m = 0.8$
$G_r = 0.5$

Where G_s is ground factor for the source region,
G_m is ground factor for the middle region, and
G_r is ground factor for the receiver region.

Alternatively, a global value ground factor not exceeding 0.7 may be used.

Ground factor values for assessments in Class 1 Areas are not specified in this document. The choice of the ground factor values for assessments in Class 1 Areas is site-specific.

6.5 Results and Compliance

6.5.1 Presentation of Results

Results of the noise impact assessment calculations must be presented in accordance with the Noise Impact Assessment Summary Tables, Table 7 and Table 8. In addition, the results should be plotted on drawings of the site plan, showing property boundaries, noise sources and receptor locations with their identifications. A suitable scale for these drawings is 1 cm : 250 m.

A separate drawing must be presented for each of the following wind speeds: 6, 8 and 10 m/s. The sound level scale should be the same on all drawings. If practical, each drawing should show the sound level contours for the 40 dBA level as well as the contour for the applicable sound level limit. The drawings should be included as an Appendix.

6.5.2 Assessment of Compliance

Compliance must be based on the comparison of the combined sound levels from all sources, described in Section 6, at each Point of Reception with the sound level limits stated in Section 5. All calculations and the determination of compliance with the sound level limits must be presented to a precision of one decimal place.

6.6 Summary Tables

6.6.1 Wind Turbine Acoustic Emissions Summary Table

The wind turbine acoustic emissions data used in the calculations must be presented as shown in Table 3. Separate tables should be used if the project involves different models of equipment.

Table 3 Wind Turbine Acoustic Emissions Summary

Make and Model: **Electrical Rating:** **Hub Height (m):** **Wind shear coefficient, as per Section 6.2.3[10]:**										
	Octave Band Sound Power Level (dB)									
	Manufacturer's Emission Levels					**Adjusted Emission Levels**				
Wind Speed[11] (m/s)	**6**	**7**	**8**	**9**	**10**	**6**	**7**	**8**	**9**	**10**
Frequency[12] (Hz)										
63										
125										
250										
500										
1000										
2000										
4000										
8000										
A-weighted										

[10] Adjustment based on the differences in wind shear factors reflecting manufacturer's data and on-site data.

[11] At 10 m reference height.

[12] Centre Octave Band Frequency.

6.6.2 Locations of Wind Turbine Generators, Transformer Substations and Receptors

Location coordinates of all wind turbine generators, Transformer Substations, Points of Reception and Participating Receptors must be given in accordance with Table 4, Table 5 and Table 6.

Table 4 Wind Turbine Locations

Project Name:				
Identifier	**Equipment Make & Model**	**UTM Coordinates**		**Remarks**
		X	**Y**	

Changes in ID or location in revised submissions must be clearly identified under the “Remarks” column.

Table 5 Point of Reception Locations

Project Name:			
Point of Reception ID	**Description**	**UTM Coordinates**	
		X	**Y**

Table 6 Participating Receptor Locations

Project Name:			
Receptor ID	**Description**	**UTM Coordinates**	
		X	**Y**

6.6.3 Noise Impact Assessment Summary Tables

Table 7 Combined Noise Impact Summary – Points of Reception

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6	7	8	9	10	6	7	8	9	10

Values in the table that exceed the applicable limit should be **Underlined and Bolded**.

Table 8 Combined Noise Impact Summary – Participating Receptors

Participating Receptor ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)				
					6	7	8	9	10

Table 9 Wind Turbine Noise Impact Summary – Points of Reception

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6	7	8	9	10	6	7	8	9	10

Values in the table that exceed the applicable limit should be **Underlined and Bolded**.

Table 10 Wind Turbine Noise Impact Summary – Participating Receptors

Participating Receptor ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)				
					6	7	8	9	10

6.7 Appendices

All information necessary to support the conclusions of the report, but not specifically described as required in Section 6, should be referenced and attached as Appendices to the report. Supporting information includes but is not limited to specifications, drawings, letters/agreements, photos, measurements and miscellaneous technical information.

In addition, sample calculation should be included in the Appendices. The sample calculation must include at least one detailed calculation for a source to receiver "pair," preferably addressing the closest wind turbine unit. The sample calculation must represent all other "pairs." If applicable, a sample calculation for the Transformer Substation is also required.

In cases where a Transformer Substation is part of the Wind Farm, Table 11 and Table 12 must be included in the Appendices:

Table 11 Transformer Substation Noise Impact Summary – Points of Reception

Point of Reception ID	Description	Distance to Transformer Substation (m)	Calculated Sound Level (dBA)	Sound Level Limit (dBA)

Values in the table that exceed the applicable limit should be **Underlined and Bolded**.

Table 12 Transformer Substation Noise Impact Summary – Participating Receptors

Point of Reception ID	Description	Distance to Transformer Substation (m)	Calculated Sound Level (dBA)

ATTACHMENT B

GE 2.5-103 TURBINE DATA

JULY, 2011

GE Energy

Commercial Documentation
Wind Turbine Generator Systems
2.5-103 - 60 Hz

Product Acoustic Specifications

Canada Specific
Normal Operation according to IEC 61400-11

imagination at work

GE Energy

Gepower.com

Visit us at
www.gewindenergy.com

All technical data is subject to change in line with ongoing technical development!

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Table of Contents

1 Introduction

This document defines the noise emission characteristics of the wind turbine series 2.5-103, 60 Hz version, equipped with 103 m rotor diameter (GE 50.2 type blade) operating in normal operation (NO).

General Electric continuously verifies specifications with measurements, including those performed by independent institutes.

The calculated apparent sound power level $L_{WA,k}$ as function of v_{10m} (reference wind speed 10 m above ground level) is provided for **normal operation** (**NO**) over cut-in to cut-out wind speed range.

The corresponding wind speeds at hub height v_{HH} are provided assuming different standard hub heights and a logarithmic wind profile**.**

If a wind turbine noise performance test is to be carried out, it needs to be done in accordance with both IEC 61400-11 and GE's "Machine noise performance test" reference guidelines.

Paragraph §2 provides **nominal calculated acoustic performance** for:

- 2.5-103 (60 Hz) calculated apparent sound power level $L_{WA,k}$ as function of v_{10m} and at **95% rated electrical power** per IEC 61400-11.
- 2.5-103 (60 Hz) tonality level $\Delta L_{a,k}$ per IEC 61400-11

Paragraph §3 provides 2.5-103 acoustic performances additional data:

- The wind speeds at reference height v_{10m} extrapolated to v_{HH} (wind speed at hub height)
- Uncertainty information
- IEC 61400-11 and IEC/TS 61400-14 additional information

2 2.5-103 Product Normal Operation Acoustic Performance

2.1 2.5-103 Normal Operation Calculated Apparent Sound Power Level

The Table 1 provides nominal acoustic specifications for 2.5-103 equipped with 103 m rotor diameter (GE 50.2 type blade) and 100 m hub height as function of wind speed v_{10m} (reference wind speed 10 m above ground level), operating at normal operation (NO) per IEC 61400-11 standard and GE's "Machine noise performance test" reference guidelines:

Wind speed at v_{10m} [m/s]	**$L_{WA,k}$* Apparent sound power level [dB]**
≤ 5	≤ 97.1
5.5	99.7
6	≤ 102.0
6.5	≤ 103.4
7	≤ 104.0
8	≤ 104.0
9	≤ 104.0
10-cut-Out	≤ 104.0

Table 1: Normal operations, 2.5-103 wind turbine, 50.2 m blades (103 m rotor), 100 m hub height, apparent sound power level at wind speed v_{10m}.

At wind speeds lower than 5 m/s the sound power levels decreases, and may get so low that the wind turbine noise becomes indistinguishable from the background noise. For a conservative calculation the data at 5 m/s may be used.

At wind speeds above 9 m/s turbine has reached rated power and the increasing pitch angle decreases the noise level. For a conservative calculation the data at 9 m/s may be used.

The nominal acoustic performances for **2.5-103**, 60 Hz version, equipped with 103 m rotor diameter (GE 50.2 type blade) operating in **normal operation** (NO), specified at **95 % rated electrical power**:

- The calculated apparent sound power level is $L_{WA,k}$ ≤ 104.0dBA.

* $L_{WA,k}$ indicates apparent sound power level per IEC-61400-11 standard measured in dB, A-weighted 10 base logarithmic value of apparent sound power relative to reference sound power of 10^{-12} W.

2.2 2.5-103 Normal Operation Calculated Tonality

The nominal acoustic performance for **2.5-103**, 60 Hz version, equipped with 103 m rotor diameter (GE 50.2 type blade) operating in **normal operation** (NO), specified at reference ground measuring distance $\mathbf{R_o}$ measurement position #1 per both IEC 61400-11 and GE's "Machine noise performance test" reference guidelines:

- Tonal audibility $\mathbf{\Delta L_{a,k} < 2\ dB}$.

3 2.5-103 Product Additional Information

3.1 2.5-103 Wind Speeds at Reference Height extrapolated to Hub Height

The wind speeds v_{10m} at reference height (10 m above ground) can be extrapolated from v_{10m} to v_{HH} (wind speed at hub height), per IEC 61400-01, assuming surface roughness of $z_{0, ref}$ = 0.05 m typical average condition and using:

$$V_{10m\ height} = V_{hub} \frac{\ln\left(10m / z_{0ref}\right)}{\ln\left(hub\ height / z_{0ref}\right)}$$

Meaning wind speeds from Table 1 can be extrapolated to 100 m hub height using $\mathbf{v_{HH} = v_{10m}}$ * 1.43 and to 85 m hub height using $\mathbf{v_{HH} = v_{10m}}$ * 1.40 per Table 2.

Wind speed at 10 m reference height v_{10m} [m/s]	Wind speed at 85 m hub height $V_{HH=85}$ [m/s]	Wind speed at 100 m hub height $v_{HH=100}$ [m/s]
≤ 5	≤ 7.0	≤ 7.2
5.5	7.7	7.9
6	8.4	8.6
6.5	9.1	9.3
7	9.8	10.0
8	11.2	11.5
9	12.6	12.9
10-cut-out	13.7-cut-out	14-cut-out

Table 2: Relation between wind speed at reference height v_{10m} and wind speeds at different hub heights v_{HH} for $z_{0, ref}$ = 0.05 m

3.2 2.5-103 Testing Uncertainty and Product Variation per IEC/TS 61400-14

Per IEC/TS 61400-14, $\mathbf{L_{WAd}}$ is the maximum apparent sound power level resulting from ***n*** measurements performed according to IEC 61400-11 standard for 95 % confidence level: $L_{WAd} = \overline{L_{WA}} + K$, where $\overline{L_{WA}}$ is the mean apparent sound power level from ***n*** IEC 61400-11 testing reports and $\mathbf{K = 1{,}645 \cdot \sigma_T}$.

The testing standard deviation values σ_T, σ_R and σ_P for measured apparent sound power level are described by IEC/TS 61400-14, where σ_T is the total standard deviation, σ_P is the standard deviation for product variation and σ_R is the standard deviation for test reproducibility.

Assuming σ_R **< 0.8 dB** and σ_P **< 0.8 dB** typical values, leads to calculated **K < 2 dB** for 95 % confidence level.

3.3 IEC 61400-11 and IEC/TS 61400-14 Terminology

- $L_{WA,K}$ is wind turbine apparent sound power level (referenced to 10^{-12}W) measured with A-weighting as function of reference wind speed v_{10m}. Derived from multiple measurement reports per IEC 61400-11, it is considered as a mean value
- σ_P is the product variation i.e. the 2.5-103 unit-to-unit product variation; typically < 0.8 dB
- σ_R is the overall measurement testing reproducibility as defined per IEC 61400-11; typically < 0.8 dB with adequate measurement conditions and sufficient amount of data samples
- σ_T is the total standard deviation combining both σ_P and σ_R
- $K = 1{,}645 \cdot \sigma_T$ is defined per IEC/TS 61400-14 for 95 % confidence level
- R_o is the ground measuring distance from the wind turbine tower axis per IEC 61400-11
- $\Delta_{La,k}$ is the audibility according to IEC 61400-11, described as potentially audible narrow band sound

References:

- IEC 61400-1, Wind turbines – part 1: Design requirements, ed. 3, 2005-08
- IEC 61400-11, wind turbine generator systems part 11: Acoustic noise measurement techniques, ed. 2.1, 2006-11
- IEC/TS 61400-14, Wind turbines – part 14: Declaration of apparent sound power level and tonality values, ed. 1, 2005-03
- MNPT – Machine Noise Performance Test, Technical documentation, GE 2007

Technical Documentation

Wind Turbine Generator Systems

2.5-103 – 60 Hz

Detailed Acoustic Data Addendum

Normal Operation according to IEC 61400-11

Canada Specific

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1 Introduction

This document is intended to meet country specific regulations which require more specific octave band power spectra from wind turbines, in order to support detailed acoustic data input for the purpose of wind park detailed acoustic assessment.

In addition to the 2.5-103 wind turbine product acoustic specifications the following detailed data are provided:

Calculated octave band apparent sound power level LWA**,k**

2 2.5-103 Calculated Octave Band Spectra – Canada Specific

The table below provides simulated, A-weighted octave band spectra as a function of standardized wind speed at 10 m height, and expressed as apparent sound power levels.

The uncertainties for octave sound power levels are generally higher than for total sound power levels.

Guidance is given in IEC 61400-11, Annex D.

2.5-103 – A-Weighted Octave Spectra (dB)

Standard WS at 10m [m/s]	**5**	**5.5**	**6**	**6.5**	**7**	**8**	**9**	**10-Cutout**
Hub Height WS @ 100m [m/s]	7.2	7.9	8.6	9.3	10.0	11.5	12.9	14-Cutout
Frequency [Hz]								
32	72.9	75.7	78.4	80.6	80.8	80.9	81.1	81.1
63	82.6	85.4	88.1	90.2	90.5	90.5	90.7	90.8
125	86.9	89.7	92.3	94.5	94.6	94.7	94.9	94.9
250	89.7	92.3	94.7	96.6	96.4	95.7	95.9	95.9
500	90.7	93.3	95.7	97.5	97.3	96.2	95.4	95.2
1000	91.0	94.2	96.6	98.4	98.4	98.7	98.6	98.4
2000	88.2	90.7	93.2	95.3	95.7	96.9	97.3	97.6
4000	82.2	84.3	86.2	87.7	87.5	88.1	89.0	89.4
8000	65.8	68.2	70.3	71.9	71.6	71.4	71.4	71.0
Lwa [dBA]	96.9	99.6	102.1	104.0	104.0	104.0	104.0	104.0

Table 1: Octave Spectra for 2.5-103 - hub height wind speeds were calculated based on equation (7) from IEC standard 61400-11:2002, using a representative roughness height of 0.05 m

ATTACHMENT C

SAMPLE CALCULATION FOR NIGHT TIME NOISE IMPACT ON R288

SEPTEMBER, 2011

ISO 9613-2 Sample Calculation

Receiver: R288

Project: McLean's Mountain Wind Farm

Project Number: 8020

Time Period	Total (dBA)
Day	39.9
Night	39.9

Receiver Name	Receiver ID	X	Y	Z	Ground
R288	R288	425189	5087124	293.5	289.02

Source Name	Source ID	X	Y	Z	Ground	ReflOrd	LxT	LxN	L/A	Dist.	hm	Freq	Adiv	KOb	Agr	Abar	z	Aatm	Afol	Ahous	Cmet	CmetN	Dc	RL	LtotT	LtotN
T20	T20	425263	5086379	392.2	293.85	0	104.0	104.0	1.0	755	51.7	0	68.6	0	-0.6	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	33.6	33.6
T13	T13	425578	5087836	384.8	286.47	0	104.0	104.0	1.0	817	51.2	0	69.2	0	-0.5	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	32.8	32.8
T12	T12	424685	5087875	412.9	314.62	0	104.0	104.0	1.0	912	50.3	0	70.2	0	-0.5	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	31.6	31.6
T19	T19	426002	5086354	368.4	270.11	0	104.0	104.0	1.0	1123	52.2	0	72.0	0	-0.5	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	29.4	29.4
T14	T14	424005	5087874	417.0	318.69	0	104.0	104.0	1.0	1407	44.3	0	74.0	0	-0.5	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	26.9	26.9
T15	T15	426514	5087605	373.6	275.27	0	104.0	104.0	1.0	1412	53.5	0	74.0	0	-0.5	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	26.9	26.9
T06	T06	425374	5088648	389.7	291.39	0	104.0	104.0	1.0	1538	49.0	0	74.7	0	-0.5	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	25.9	25.9
T10	T10	426243	5088273	381.9	283.64	0	104.0	104.0	1.0	1562	54.1	0	74.9	0	-0.5	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	25.7	25.7
T05	T05	425967	5088867	388.3	290	0	104.0	104.0	1.0	1911	51.8	0	76.6	0	-0.5	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	23.5	23.5
T11	T11	423155	5087692	418.3	320	0	104.0	104.0	1.0	2115	43.4	0	77.5	0	-0.5	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	22.3	22.3
T09	T09	426960	5088349	377.5	279.21	0	104.0	104.0	1.0	2155	54.1	0	77.7	0	-0.5	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	0.0	22.1	22.1
T16	T16	423976	5085277	395.1	296.76	0	104.0	104.0	1.0	2212	46.8	0	77.9	0	-0.5	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	21.8	21.8
T28	T28	424742	5084943	381.3	283	0	104.0	104.0	1.0	2228	44.8	0	78.0	0	-0.5	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	21.7	21.7
T18	T18	423020	5086314	408.6	310.31	0	104.0	104.0	1.0	2318	47.5	0	78.3	0	-0.4	0.0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	21.3	21.3
T23	T23	423091	5085958	401.3	303.04	0	104.0	104.0	1.0	2402	47.3	0	78.6	0	-0.4	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	20.9
T29	T29	423719	5084978	391.2	292.92	0	104.0	104.0	1.0	2603	45.3	0	79.3	0	-0.4	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	19.9	19.9
T30	T30	424258	5084654	384.0	285.68	0	104.0	104.0	1.0	2641	45.2	0	79.4	0	-0.4	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	19.8	19.8
T34	T34	423970	5084235	376.0	277.67	0	104.0	104.0	1.0	3137	42.0	0	80.9	0	-0.5	0.0	-1.3	5.8	0.0	0.0	0.0	0.0	0.0	0.0	17.8	17.8
T17	T17	421160	5086508	414.3	316.03	0	104.0	104.0	1.0	4077	44.0	0	83.2	0	-0.9	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	15.1	15.1
T21	T21	420869	5086170	411.3	313	0	104.0	104.0	1.0	4425	43.6	0	83.9	0	-1.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3
Xfrmr	Xfrmr	423616	5087363	323.0	320	0	94.4	94.4	1.0	1591	2.1	0	75.0	0	0.6	4.2	0.1	3.7	0.0	0.0	0.0	0.0	0.0	0.0	10.9	10.9