BOW LAKE WIND FARM
DESIGN AND OPERATIONS REPORT

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Prepared for:

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Executive Summary

Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, by their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan GP Corp., respectively (the "Proponent") are proposing to develop Phase 1 and Phase 2 of the Bow Lake Wind Farm predominantly on Provincial Crown Land within the unorganized Townships of Smilsky and Peever, in the District of Algoma, Ontario (the "Project"). The Project is located approximately 80 km north of Sault Ste. Marie and roughly six kilometers east of Montreal River Harbour. The Project has three Feed-in Tariff Contracts with the Ontario Power Authority for the sale of electricity generated by the Project.

As part of the Project's design, construction, and operational activities, and understanding the Project falls within the territory of the Batchewana First Nation of Ojibways ("BFN"), the Proponent has engaged directly with the BFN. As a result of these efforts, the BFN:

- Has entered the Project as partner;
- Has entered into various business and relationship agreements with the Proponent to guide Project activities; and
- Has issued a Development and Power Generation Permit, which provides the BFN's approval to construct, operate, repower, and decommission the Project.

The English name of the Project is the *Bow Lake Wind Farm*, however, the BFN know and refer to the Project as *Chinodin Chigumi Nodin Kitagan*.

As proposed, the Project will include 36 wind turbines for a total maximum installed nameplate capacity of up to 58.32 MW. In addition, the operation of the Project will require 34.5 kV above and below ground electrical collector and communication lines, pad-mounted transformers, crane pads, two permanent meteorological towers, access roads, operations and maintenance building, welfare buildings, a transformer station, construction compounds and laydown yards, and other ancillary facilities. The Project will connect to the provincial power grid via existing 115 kV transmission lines located adjacent to the Project's transformer station location.

The Proponent has retained Stantec Consulting Ltd. to prepare a Renewable Energy Approval ("REA") Application, as required under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the *Environmental Protection Act* ("O. Reg. 359/09"). Based upon the criteria set out in subsection 6.(3) of O.Reg.359/09, the Project is classified as a Class 4 Wind Facility and will follow the requirements identified in O. Reg. 359/09 for such a facility.

This Design and Operations Report is one component of the Renewable Energy Approval REA application for the Project and has been prepared in accordance with O. Reg. 359/09, the Ontario Ministry of Natural Resources' *Approval and Permitting Requirements Document for Renewable Energy Projects* (September 2009), and the Ontario Ministry of the Environment's *Technical Guide to Renewable Energy Approvals*.

The following Table summarizes the requirements of this Report as specified under O. Reg. 359/09.

Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	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, rights of way and easements required in respect of the renewable energy generation facility and situated within 300 m of the facility,	✓	Appendix A
B. any ground water and surface water supplies used at the facility,	✓	Appendix A
C. any things from which contaminants are discharged into the air,	N/A	N/A
D. any works for the collection, transmission, treatment and disposal of sewage,	✓	Appendix A
E. any areas where waste, biomass, source separated organics and farm material are stored, handled, processed or disposed of,	N/A	N/A
F. the project location in relation to any of the following within 125 m: 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	✓	Appendix A
G. any noise receptors or odour receptors that may be negatively affected by the use or operation of the facility,	✓	Appendix B
ii. a description of each item diagrammed under subparagraph i,	✓	3.0
iii. one or more maps or 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,	✓	Appendix A
iv. a description, map or diagram of the distance between the base of any wind turbines and any public road rights of way or railway rights of way that are within a distance equivalent to the length of any blades of the wind turbine, plus 10 metres,	✓	2.2
v. a description, map or diagram of the distance between the base of any wind turbines and all boundaries of the parcel of land on which the wind turbine is constructed, installed or expanded within a distance equivalent to the height of the wind turbine, excluding the length of any blades, and	N/A	N/A
vi. a description, map or diagram of the distance between the base of each wind turbine and the nearest noise receptor.	✓	Appendix B
2. Set out conceptual plans, specifications and descriptions related to the design of the renewable energy generation facility, including a description of,		
i. any works for the collection, transmission, treatment and disposal of sewage, including details of any sediment control features	✓	3.8, 3.10, Appendix A

Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	Section Reference
and storm water management facilities,		
ii. any things from which contaminants are discharged into the air, and	N/A	N/A
iii. any systems, facilities and equipment for receiving, handling, storing and processing any waste, biomass, source separated organics, farm material and biogas, and	N/A	N/A
iv. if the facility includes a transformer substation, the works, facilities and equipment for secondary spill containment.	✓	3.4
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,	✓	3.7
A. a description of the time period and duration of water takings expected to be associated with the operation of the facility,	✓	3.7
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	✓	3.7
C. an assessment of and documentation showing the potential for the facility to interfere with existing uses of the water expected to be taken,	✓	3.7
ii. a description of the expected quantity of sewage produced and the expected quality of that sewage at the project location and the manner in which it will be disposed of, including details of any sediment control features and storm water management facilities,	✓	3.8, 3.10, 4.6
iii. a description of any expected concentration of air contaminants discharged from the facility,	N/A	N/A
iv. in respect of any biomass, source separated organics and farm material at the facility,	N/A	N/A
A. the maximum daily quantity that will be accepted,	N/A	N/A
B. the estimated annual average quantity that will be accepted,	N/A	N/A
C. the estimated average time that it will remain at the facility, and	N/A	N/A
D. the estimated average rate at which it will be used	N/A	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,	N/A	N/A
B. the estimated annual average quantity that will be accepted,	N/A	N/A
C. the estimated average time that it will remain at the facility, and	N/A	N/A
D. the estimated average rate at which it will be used,	N/A	N/A
vi. if the facility includes a transformer substation, A. a description of the processes in place to prevent spills,	✓	4.4

Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	Section Reference
B. a description of the processes to prevent, eliminate or ameliorate any adverse effects in the event of a spill, and	✓	4.4
C. a description of the processes to restore the natural environment in the event of a spill.	✓	4.4
4. Include an environmental effects monitoring plan in respect of any negative environmental effects that may result from engaging in the renewable energy project, setting out,		
i. performance objectives in respect of the negative environmental effects,	✓	5.0
ii. mitigation measures to assist in achieving the performance objectives mentioned in subparagraph i, and	✓	5.0
iii. a program for monitoring negative 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.	✓	5.0
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,	✓	6.0
ii. means by which persons responsible for engaging in the project may be contacted, and	✓	6.0
iii. means by which correspondence directed to the persons responsible for engaging in the project will be recorded and addressed.	✓	6.0
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 of 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	N/A
ii. how the project will be engaged in to,	N/A	N/A
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	N/A
B. use a vegetative riparian area, unless the project location is used for agricultural purposes and will continue to be used for such purposes.	N/A	N/A
7. If it is determined that the project location is not on a property described in Column 1 of the Table to section 19, provide a summary of the matters addressed in making the determination.	✓	2.0
8. If section 20 applies in respect of the project and it is determined that the project location does not meet one of the descriptions set out in subsection 20 (2) or that the project location is not in an area described in subsection 20 (3), provide a summary of the matter addressed in making the determination.	✓	2.0
9. If subsection 21 (3) or 23 (2) applies, provide a summary of the matters addressed in making the determination,	✓	2.0
i. under subsection 21 (3) or clause 23 (2) (a), as the case may be, including a copy of the document completed under the applicable provision, and	✓	2.0

Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	Section Reference
ii. under clause 23 (3) (b), if applicable.	✓	2.0

Provided the identified protective and mitigation measures are properly applied to the environmental features, in conjunction with the monitoring plans and contingency measures discussed herein, the operation phase of the Project is not predicted to cause significant net negative environmental effects.

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1.0 Overview

Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, by their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp., respectively (the "Proponent"), are proposing to develop Phase 1 and Phase 2 of the Bow Lake Wind Farm predominantly on Provincial Crown Land within the unorganized Townships of Smilsky and Peever, in the District of Algoma, Ontario (the "Project"). The Project is located approximately 80 km north of Sault Ste. Marie and roughly six kilometres east of Montreal River Harbour. The Project has three Feed-in Tariff ("FiT") Contracts with the Ontario Power Authority ("OPA") for the sale of electricity generated by the Project.

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As proposed, the Project will include 36 wind turbines for a total maximum installed nameplate capacity of up to 58.32 MW. In addition, the Project will require 34.5 kV above and below ground electrical collector and communication lines, pad-mounted transformers, crane pads, two permanent meteorological towers, access roads, operations and maintenance building, welfare buildings, a transformer station (TS), construction compounds and laydown yards, and other ancillary facilities. The Project will connect to the provincial power grid via existing 115 kV transmission lines located adjacent to the Project's transformer station location. A full description of Project infrastructure is provided in the **Project Description Report**. The Project site plan is provided in **Appendix A**.

The Project Location is defined in O. Reg. 359/09 to include all land and buildings/structures in, on or over which the Proponent proposes to engage in the Project and any air space in which the Proponent proposes to engage in the Project. This includes structures such as wind turbines, access roads, operations and maintenance building, welfare buildings, and collector lines that will be utilized during the operation of the Project.

A "Zone of Investigation" has been identified based upon the requirements of Ontario Regulation 359/09 ("O. Reg. 359/09") and the Ontario Ministry of Natural Resources' ("MNR") *Approval and Permitting Requirements Document for Renewable Energy Projects*, September

2009 (“APRD”). In general, the Zone of Investigation encompasses the Project Location plus an additional 120 m surrounding the outer edges of the Project Location. This Report identifies natural features that are within the Zone of Investigation and assesses potential negative environmental effects that may result from construction activities. To the extent practical, identified natural features are avoided, however where appropriate mitigation measures are also identified to alleviate potential negative environmental effects.

According to subsection 6.(3) of O. Reg. 359/09, the Project is classified as a Class 4 Wind Facility. This Design and Operations Report is one component of the Renewable Energy Approval (“REA”) application for the Project, and has been prepared in accordance with O. Reg. 359/09, the MNR’s *APRD*, and the Ontario Ministry of the Environment’s (“MOE”) *Technical Guide to Renewable Energy Approvals*.

2.0 Project Site Plan

The Site Plan includes the following information (**Appendix A**):

- Facility component locations, including: wind turbines, crane pads, Met towers, access roads, collector and communication lines, operations and maintenance building, welfare buildings, and transformer station.
- Project Location: the outer edges of all components of the Project. The Project Location is used for defining setback and site investigation distances.
- Existing and proposed public multi-use, forestry, and Project-specific access roads.
- Significant natural features and water bodies.
- Visual representation of setback distances from the Project Location to water bodies and significant natural features.
- Adjacent land uses.

Noise receptors are illustrated within the Noise Assessment Report (**Appendix B**). Additionally, setbacks to noise receptors and associated noise calculation tables are provided within **Appendix B**.

The locations of archaeological study areas and heritage resources are shown within the Archaeological and Heritage Reports, which are included as part of the Project's REA application documents. This includes a discussion of archaeological and heritage resources described in sections 19 thru 23 of O. Reg. 359/09 and an assessment of the potential effects and mitigation measures to these resources.

2.1 PROJECT COMPONENTS

The Project components that will be used during the operation of the Project include wind turbines, access roads, two Met towers, crane pads, an operation and maintenance building, welfare buildings, collector and communication lines, TS which would connect the Project with the provincial high voltage transmission system, and other ancillary facilities. A detailed description of Project components is included in the **Project Description Report**.

2.2 SETBACK DISTANCES

O. Reg. 359/09 specifies, with some exceptions, setback distances between the Project Location and:

- significant natural features – 120 m setback;
- Provincial parks and conservation reserves – 120 m setback; and
- water bodies – 120 m setback.

O. Reg. 359/09 also specifies, with some exceptions, setback distances between a wind turbine (base) and:

- public road rights-of-way – blade length plus 10 m;
- railway rights-of-way (none within the area) – blade length plus 10 m; and
- noise receptors – 550 m minimum.

Visual representation of the setback distances are shown on the Site Plan (**Appendix A**) and within the Noise Assessment Report (**Appendix B**). All wind turbines exceed the minimum distance of 550 m from the nearest noise receptor and meet the MOE's noise level requirements at all receptors. In addition, all wind turbines exceed the setback of blade length plus 10 m from public road rights-of-way.

Where the Project Location is within the setback distances to significant natural features, additional evaluation and assessment is provided within the **Natural Heritage Assessment/Environmental Impact Study** ("**NHA/EIS**") and **Water Body and Water Assessment Report**, which are included with the Project's REA application documents.

3.0 Project Design Plan

This section provides a description of the key Project components identified on the Project Site Plan (**Appendix A**). None of the components or equipment in the Project's operational design are proposed for surface water supply or control, management of air discharges, and/or water and biomass management.

3.1 WIND TURBINES

The selected model of wind turbine for the Project is the General Electric ("GE") 1.6-100; details of this wind turbine are summarized in **Table 3.1** and are used in the assessment of potential effects detailed below. Further information on the technical characteristics of the wind turbine is provided in the **Wind Turbine Specifications Report**.

Table 3.1: Wind Turbine Specifications

Operating Data	Specification
General	
Make	General Electric
Model	GE 1.6-100
Name plate capacity (MW)	1.62
Maximum Sound Power Level (dBA)	105
Rotor	
Rotor diameter (m)	100
Blade length (m)	48.7
Blade swept area (m^2)	7,854
Rotation Speed (RPM)	9.75-15.33
Tower	
Hub height above grade (m)	96
Tip height (m)	146

The **Project Description Report** identifies turbine locations and associated Project components.

Select wind turbines will require aviation safety lighting in accordance with Transport Canada requirements. It is anticipated that based on Transport Canada requirements, approximately 23 of the 36 proposed wind turbines and two Met towers will require aviation safety lighting. In addition, all lighting will confirm with current Canadian Aviation Regulations which specifies requirements such as the type of light, intensity and timing of use.

3.2 TURBINE FOUNDATIONS

The wind turbine foundations are made of poured in place reinforced concrete. Foundation design will vary based upon a site specific geotechnical assessment and could be either a gravity spread type foundation or pile-type foundation with or without rock anchors. Rock anchors may be required at some locations should geotechnical conditions require Gravity

spread type footings are octagonal in shape with an approximate diameter of 18 - 25 m and range from 3 - 6 m deep. The foundation will also include conduits for electrical power cables along with a grounding grid consisting of copper wire and ground rods.

3.3 TURBINE TRANSFORMERS AND COLLECTOR LINES

A pad-mount transformer, located at the base of each wind turbine, is required to increase the voltage of the electricity generated in the nacelle of each wind turbine to the collection system line voltage (i.e., 690 V to 34.5 kV). Each pad-mount transformer is mounted on a precast or poured in place concrete pad adjacent to the wind turbine tower. All power cables entering/leaving the pad-mount transformer are located underground along with a grounding grid consisting of copper wire and ground rods.

From each pad-mount transformer, 34.5 kV collector lines carry the electricity from the wind turbines to the Project's TS and are accompanied by the installation of a fibre optic communications line. The collector lines will include both underground and overhead sections depending upon the ground conditions, depth of bedrock, the amount of natural overburden, and environmental conditions. The underground cables may be direct buried or installed in high density polyethylene conduit approximately 1.0 m below finished grade. Some sections of the collector system will be installed overhead where burying cables is impractical or technically not preferred. In these cases, the overhead lines will be constructed on single pole structures.

The collector lines will follow the route of the access roads where practical to reduce the area required for construction and minimize potential construction effects. The cables will be installed either to one side of the access road, just off the graveled surface, or within the road itself.

Where water crossings will be required for collector lines, the crossings will be either overhead or underground, depending on local terrain and geotechnical conditions. All crossings will be conducted according to MNR and the Department of Fisheries and Oceans ("DFO") requirements.

3.4 TRANSFORMER STATION

The TS is required to step up the 34.5 kV power of the collector lines to the 115 kV potential required by the transmitter, Great Lakes Power Transmission LP ("GLPT"). The TS consists primarily of two 50 MVA power transformers, grounding transformers, 34.5 kV and 115 kV circuit breakers and disconnect switches, surge arrestors, instrument transformers, metering, a protection and control building, along with associated foundations to mount the afore mentioned equipment. The TS will likely have four 34.5 kV collector circuits entering the low voltage section and two 115 kV circuits leaving the high voltage section. GLPT is responsible for the high voltage infrastructure between the TS fenceline and the GLPT transmission lines.

The TS will occupy a graded area of approximately 95 m by 155 m which will be fenced and secured to prevent unauthorized entry and maintain public safety. All non-current conducting metal components within the fenced area of the TS will be connected to a grounding grid installed below finished grade.

The two power transformers will be mounted on foundations that have a secondary liquid containment storage area designed to capture the insulating fluid in the unlikely event of a leak. The liquid containment system is designed to hold all of the liquid from the transformers as well as any precipitation that may accumulate.

The TS will be operated in accordance with all applicable codes and standards including the Canadian Electrical Code and the Ontario Electrical Safety Code.

3.5 ACCESS ROADS

Public multi-use roads approved under the Forest Management Planning process ("FMP roads") will be used to access Project infrastructure and where necessary, will be upgraded to support construction and operational activities. The FMP roads include existing FMP roads which have been constructed to support forestry operations within the Project Location, as well as approved FMP roads that have not yet been constructed, but are approved and included in the Annual Work Schedule of the Forest Management Plan applicable to the Project Location. Construction and upgrading of both existing and approved FMP roads have been evaluated under an existing FMP regulatory process for the area, will be constructed in accordance with FMP requirements.

The construction of new public multi-use and Project-specific roads will also be necessary to access some Project infrastructure, and will be designed to minimize the effects on natural features. Where gates are present on the existing roads, they will remain in place. Project-specific roads such as spur roads connecting public multi-use roads to wind turbine sites will likely be equipped with locked access gates for public safety and security reasons. Existing public roads and new/upgraded FMP roads will not be gated and will remain open for public use. One section of Project-specific roads extending between turbine 2 and turbine 4 is located on Patent lands and may be gated.

The driveable surface of access roads will be approximately 8 - 12 m wide. Access roads will be constructed of gravel, native materials, and/or engineered fill. In some instances a woven geotextile may also be utilized with a reduced granular material depth or a cement/soil stabilizing agent.

3.6 CRANE PADS

Crane pads will be adjacent to wind turbine locations (within the wind turbine staging areas). Crane pads are anticipated to be approximately 20 x 30 m in size; however final crane pad design will be based upon the specific requirements of the cranes utilized for turbine assembly and erection purposes. Following the construction of the Project, the crane pads will remain in

place to support any crane activities during the operations, repowering, and/or decommissioning phases of the Project.

3.7 OPERATIONS AND MAINTENANCE BUILDING AND WELFARE BUILDINGS

An Operations and Maintenance ("O&M") building will be used to monitor the day-to-day operations of the Project and provide an area for storage of spare parts and maintenance equipment. It is envisioned the O&M building will be constructed on the site of the construction compound adjacent to the TS. The building will house offices, workshop, parts and vehicle storage, septic system, water well, storage yard, and other ancillary facilities.

Two welfare buildings will be constructed as part of the Project; one in the central portion of the Project and the second in the southern portion of the Project **(Appendix A).** The welfare buildings will be used to store tools and small equipment, as well as provide shelter for Project maintenance staff. Each of the welfare buildings will be approximately 100 square metres in size, of modular or conventional framed construction, with a concrete floor. Fencing will be installed surrounding the building for security purposes. Water wells are not anticipated to be required for the welfare buildings. Portable generators will be used to supply power to the buildings and a propane forced air furnace used for heating.

3.8 MET TOWERS

Two permanent Met towers will be erected for use during the operation phase of the Project. These towers will be installed as per the requirements of the Independent Electrical System Operator ("IESO") and the Canadian Standards Association ("CSA") protocol for power performance measurements. The Met towers will be used to validate the performance of the wind turbines during operations and to provide meteorological data to the IESO to support their wind forecasting activities and operations of the provincial electrical system. The Met towers will remain and be maintained for the duration of the Project's operating life. In addition to the two permanent Met towers, temporary hub height Met towers may be erected at selected wind turbine locations during the construction phase to collect baseline data to support power performance testing.

The Met towers will consist of a steel lattice or monopole type structure approximately 100 m high. The tower foundations, depending on ground conditions, are typically a steel reinforced concrete-filled tubular pile. The Met towers will be equipped with guy wires for lateral support. Guy wires will be mounted on steel anchors embedded into concrete pads or anchored directly to bedrock.

4.0 Facility Operations Plan

The following section identifies the key daily activities related to the operation and maintenance of the facility.

4.1 SITE SUPERVISION

During the operations phase of the Project, the Proponent may hire specialized personnel or an Operation and Maintenance Contractor for specific maintenance tasks. The Proponent and/or the Operation and Maintenance Contractor would carry out the various on-going activities, including daily operation associated with the facility.

It is expected that approximately four to five full time operation and maintenance staff would be employed by the Project during the operation phase. During larger maintenance events temporary personnel may be brought in to support full time staff.

4.2 MAINTENANCE PROGRAM

Prior to operation, the Proponent and/or the Operation and Maintenance Contractor would develop an operation and maintenance program. The program would be designed to ensure compliance with any applicable local, provincial and/or federal requirements as well as address manufacturer recommended maintenance. As appropriate, the program would cover staff training, predictive/preventive maintenance, routine maintenance, unscheduled maintenance (including appropriate environmental mitigation measures), inspection of equipment and components, and procurement of spare parts. It would also include a schedule for regular inspections of the Project's facilities, including roads used for Project access.

Maintenance staff would be able to monitor the performance of all wind turbines from the O&M building, as well as remotely off-site, on a real time basis through the Projects' Supervisory Control and Data Acquisition ("SCADA") system. The SCADA system would identify potential operational issues so that pro-active inspection and maintenance can be undertaken. For example, if an imbalance in the blades occurs (due to, for example, ice accumulation) that is outside of design specifications, the wind turbines will detect the issue, shut down, and provide the operator with an alarm and diagnostic information. Upon receiving an alarm the operator would perform a visual inspection to identify cause of shut down.

Regular maintenance of Project equipment is the most effective means of preventing potential equipment failures. Scheduled maintenance will include the following:

- Visual inspection of major components such as blades, towers, and pad-mounted transformers;
- Inspection and maintenance of electrical and high voltage components
- Mechanical inspections and maintenance such as greasing, fluid level and quality checks, bolt torque checks, and filter changes
- Inspection and maintenance of access roads and water crossings.

Fluid changes will be completed as required and as a minimum to the turbine manufacturer's specifications. Used fluids would collected and temporarily stored in a designated storage area and picked up and transported by a licensed waste hauler with the appropriate manifests in place and disposed of at an appropriate MOE licensed facility.

If oil/grease is detected in the power transformer containment area, the liquid would be removed from site via a licensed waste hauler and the source of the oil/grease would be determined and rectified.

The Proponent and/or the Operation and Maintenance Contractor will provide unscheduled maintenance of the Project when required and other activities such as security and snow removal.

4.3 MONITORING METEOROLOGICAL DATA

Each wind turbine will have sensors to measure wind speed and direction. This data is then utilized by the wind turbine control system to determine when the wind speeds are within the operational range of the wind turbines as well as to control the pitch of the blades and the orientation of the nacelle.

Meteorological data will also be collected from the two permanent Met towers. All meteorological data would be used to monitor the operational performance of the wind turbines and comply with the IESO reporting requirements.

4.4 ACCIDENTAL SPILLS

Appropriate containment facilities will be installed for fuel storage and emergency response materials (e.g., spill kits) will be maintained on-site as required. Vehicle refuelling, equipment maintenance, and other potentially contaminating activities will occur only in designated areas.

In the event of an accidental discharge of fluids associated with Project operation, the Operation and Maintenance personnel will immediately stop work, identify the source of discharge and rectify the accidental spill. Once the discharge is stopped and contained, any contaminated soil will be assessed, removed and disposed of in accordance with the current appropriate provincial

legislation, such as Ontario Regulation 347. Areas affected by accidental spills will be restored to a safe and clean condition using native materials and vegetation in accordance with MNR requirements.

In the event of a spill reaching a waterbody, containment booms will be deployed and the contained fluids will be removed from the water surface by vacuum truck or other appropriate method. Any contaminated shoreline soils or sediments will be removed and disposed of in accordance with applicable provincial legislation and as determined in consultation with the MNR and DFO as required.

The Emergency Response Plan (see Section 6 for additional details) will contain procedures for spill contingency and response plans, spill response training, notification procedures, and necessary clean-up materials and equipment. As per s.13, 15 and 92 of the *Environmental Protection Act*, all releases that could potentially have an adverse environmental effect, or are in excess of prescribed regulatory levels will be reported to the MOE's Spills Action Centre.

4.5 WASTE MATERIAL DISPOSAL

During operation, users of the O&M Building will produce waste materials typical of an office setting, including recyclables and domestic waste. In all instances, waste materials will be recycled or sent for re-use/re-conditioning whenever possible and for disposal in a landfill where not practicable. Domestic waste produced at the O&M Building biweekly is estimated as follows:

- 1 - 4 yd garbage container
- 1 - 4 yd cardboard recycle container
- 4 - 95 gal recycle containers.

Outdoor waste storage containers located at the O&M building will be emptied approximately every other week. It is anticipated that non-recyclable domestic waste will be disposed of at the MNR's landfill, while recycling would occur at other licensed receiving facilities in the region.

Waste lubricating and hydraulic oils will be generated during standard operation and maintenance activities. Waste fluids may be stored temporarily within a designated area designed and maintained in accordance with applicable legislation. These waste materials will be picked up and hauled by a licenced contractor and disposed of at an appropriate approved off-site facility. There will be no on-site disposal of waste during the operation of the facility.

4.6 SEWAGE

A septic system will be utilized to service the O&M building during the Project's operational phase. The septic system will be designed in accordance with MOE and Ontario Building Code requirements and the site characteristics (e.g., topographic conditions and soil properties). During operation, on-going maintenance of the septic system will include periodic cleaning, inspections, and as necessary repairs, as recommended by the equipment manufacturers.

The septic system will have effluent flow rates less than 10,000 L/day and is anticipated to consist of a septic tank, distribution box (or drop box), and absorption field. In the event that a high water table renders a septic system unsuitable, a holding tank will be utilized and pumped out as required by a licensed, third party sewage hauler.

4.7 ACCIDENTS AND MALFUNCTIONS

Although highly unlikely, the potential exists for full or partial blade failure from a wind turbine, resulting in potential damage to the area where the detached blade material lands. In order to determine the potential for effects associated with blade failure, Garrad Hassan Canada undertook a review of publicly-available literature on wind turbine rotor failures resulting in full or partial blade failure (Garrad Hassan Canada, 2007). Such events were found to be very rare; therefore data describing these events are scarce.

Root causes of blade failure have been continuously addressed through developments in best practice in design, testing, manufacture, and operation; much of these developments have been captured in the International Electrotechnical Commission ("IEC") standards, to which all current large wind turbines comply (Garrad Hassan Canada, 2007), including those of the Project.

Wind turbine control systems are subjected to rigorous specification in the design standards for wind turbines (IEC 61400-1) and exhaustive analysis in the certification process. Wind turbines with industry certification must have a safety system completely independent of the control system. In the event of a failure of one system, the other is designed to control the rotor speed.

Lightning protection systems for wind turbines have developed significantly over the past decade and best practices have been incorporated into the industry standards to which all modern turbines must comply. This has lead to a significant reduction in events where lightning causes structural damage.

Even in the rare event of a blade failure in modern wind turbines, it is much more likely that the damaged structure would remain attached to the turbine rather than separating (Garrad Hassan Canada, 2007). Reviews of available information did not find any recorded evidence of injury to the public as a result of turbine blade or structural failure (Garrad Hassan Canada, 2007; Chatham-Kent Public Health Unit, 2008).

Given that accidents or malfunctions of wind turbines are considered to be infrequent events, that current design standards greatly assist in minimizing such potential, and that the wind turbines are proposed to be located a minimum of approximately 840 m from the closest receptor (a seasonal camp/cabin site), the event of structural failure would not fall beyond the setback distance and therefore not affect public health and safety.

The remote possibility also exists for accidents related to third party damage of the wind turbines. However, given the location of the wind turbines (e.g., in remote forested areas), coupled with the structural integrity of the wind turbines, impacts affecting the structural integrity of the wind turbines are highly unlikely.

4.8 WATER-TAKING ACTIVITIES

The O&M building will include the installation of a water well for washing and human consumption. If necessary, a water treatment system such as a simple filter system with carbon (i.e., for the removal of organic compounds) and fibre (i.e., for the removal of suspended sediment/turbidity) filters combined with an ultraviolet system for disinfection will be utilized. The well will be installed by a licensed well driller and water withdrawals will not exceed the 50,000 L/day.

In the event that the well water is not suitable for drinking with treatment, drinking water will be delivered to the site.

5.0 Potential Environmental Effects and Monitoring Plans

The following operation-specific potential effects, mitigation measures, monitoring plans, and contingency plans have been identified and developed to address potential negative environmental effects that may result from the operation of the Project within the Zone of Investigation (**Table 5.1**).

Descriptions of the existing natural heritage, water, archaeological, and heritage environments in the Project Location and/or the Zone of Investigation can be found within the **Natural Heritage Assessment & Environmental Impact Study** ("NHA/EIS"), **Water Body and Water Assessment Report**, and **Archaeological and Heritage Report**. These reports form part of the REA application and are provided under separate cover.

Where a significant natural feature is located within the Zone of Investigation, a detailed analysis of the potential effects is provided in the **NHA/EIS** and/or **Water Assessment and Water Body Report**. The Project Site Plan (**Appendix A**) clearly identifies all natural features within the Zone of Investigation and the Project Location in relation to the natural feature.

The environmental effects monitoring plans for the Project have been designed to monitor implementation of the proposed protection and mitigation measures and to verify compliance of the Project with O. Reg. 359/09. The Proponent and/or the Operation and Maintenance Contractor would be the primary party responsible for the implementation of operational effects monitoring. Implementation of these measures would be undertaken in compliance with applicable provincial and federal standards and guidelines as well as the requirements of the BFN.

Potential effects associated with accidental spills will be mitigated and responded to in accordance with the information contained above in Section 4.4 and thus are not referenced within the table below.

Table 5.1: Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operation

Environmental Feature	Potential Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures	Net Effects
Heritage and Archaeological Resources					
Protected Properties and Heritage Resources	• No direct or indirect potential effects are anticipated. • No heritage resources are known to occur in the Project Location, including those associated with the Group of Seven. Therefore no negative effects are anticipated to occur related to operation of the Project.	• Minimize potential effects to protected properties and heritage resources.	• Cluster wind turbines and locate wind turbines away from immediate Lake Superior coastline area. • The Project Location is not on, or adjacent to any designated heritage properties.	• No additional measures are warranted in addition to the identified mitigation measures.	• No direct or indirect net effects are anticipated.
Archaeological Resources	• It is anticipated that all excavations associated with operation of the Project will occur within previously disturbed areas, and therefore there is limited potential for potential effects on Archaeological Resources.	• Minimize potential effects to Archaeological Resources	• In the event that archaeological resources are encountered during operations, all work within the vicinity of an archaeological find will be temporarily suspended. • The BFN and the Ministry of Tourism, Culture and Sport archaeologist would be contacted.	• In the event that human remains are encountered during operations, all work would stop immediately. Notification would then be made to the Ontario Provincial Police or local police and the BFN.	• No net effects to archaeological resources during operations are anticipated.
Natural Heritage Resources					
Provincially Significant Wetlands	• Degradation of wetland through changes in water flow or surface water contamination. • Degradation of wetland through sedimentation during maintenance activities.	• Minimize potential effects to provincially significant wetlands.	• No Project infrastructure within Provincially Significant Wetland boundaries. • All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from wetlands. • Implement Sediment and Erosion control measures during major maintenance activities (described in the NHA/EIS). • During major maintenance activities, stockpile materials >30m from wetland edge. Where this is not possible, stockpiles will be covered when not in use, especially during rain events or high wind events.	• Maintain emergency spill kits on site. • Implement MOE spill action plan if necessary. • Dispose of waste material by authorized and approved off-site vendors. • Locations with erosion and sediment control measures will be checked when inclement weather events anticipated (i.e., high winds/rain events). • Sediment will be removed if it is found to accumulate. • Regularly monitor culvert installations to ensure flow conveyance, with no restrictions or ponding. • If covers over stockpile material are found not to be effectively preventing sediment transport, additional erosion control measures will be employed as necessary.	• No significant net effects are anticipated.
Areas of Natural and Scientific Interest	• As no Areas of Natural and Scientific Interest were identified, there are no anticipated effects.	• N/A	• Not required	• Not required	• None
Significant Valleylands	• Significant Valleylands have development prohibitions only on lands that are located south and east of the Canadian Shield. The Project location is situated on the Canadian Shield, therefore this environmental feature is not applicable to the Project.	• N/A	• Not required	• Not required	• None
Significant Woodlands	• Significant Woodlands have development prohibitions only on lands that are located south and east of the Canadian Shield. The Project location is situated on the Canadian Shield, therefore this environmental feature is not applicable to the Project.	• N/A	• Not required	• Not required	• None
Provincial Parks and Conservation Reserves	• Lake Superior Provincial Park is located north of the Project Location (on the north side of the Montreal River). The Project will be visible from select vantage points within the Park. • An addition (P292) to Lake Superior Provincial Park (LSPP) is located within 120 m of the Project Location. P292 is located west of Highway 17, and across the	• No Project infrastructure within a Provincial Park or Conservation Reserve.	• The Project Location is not within any Provincial Park or Conservation Reserve. • An addition to Lake Superior Provincial Park is located outside the Project Location, but within the ZOI. Site Investigation and consultation with the Park Superintendent confirmed that there are no potential indirect impacts.	• Not required	• None

Table 5.1: Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operation

Environmental Feature	Potential Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures	Net Effects
	highway from the entrance to Dump Road.				
Significant Wildlife Habitat (includes seasonal concentration areas, specialized habitat for wildlife, and habitat for species of special concern)	• Disturbance and/or mortality through collisions with turbines. • Habitat avoidance/disturbance caused by maintenance activities.	• Minimize the likelihood of direct mortality and disturbance	• Avoidance of natural features such as migratory corridors, migratory stopover areas, and late winter moose habitat. • Turbine lighting to conform to Transport Canada standards. • Restrict maintenance vehicle traffic to daytime hours, and limit speeds to 30 km or less on roads near sensitive habitat such as amphibian breeding ponds (including signage).	• Post-construction mortality monitoring at 10 turbines. Twice weekly from May 1-Oct. 31, for a period of three years. • In the event of mortality to birds/bats above MNR established thresholds, contingency measures will be implemented which may include operational controls, such as periodic shut-down and/or blade feathering (see EEMP for additional details). • Post-construction disturbance monitoring in waterfowl nesting areas. Once a year during the breeding season, for a period of three years. • Post-construction disturbance monitoring in forested ecosites that were surveyed during pre-construction surveys. Once a year during the breeding season, for a period of three years.	• No significant net effects are anticipated given the required implementation of contingency measures associated with the EEMP.
Water Bodies and Aquatic Resources					
Groundwater	• Minimal amounts of groundwater will be required via the O&M building water well and thus no potential effects are anticipated.	• Minimize groundwater withdrawal requirements	• Water withdrawal amounts for the O&M building will be minimal and well below 50,000 L/day. Therefore no water taking permit is required under the Water Resources Act from MOE.	• None required	• None
Surface Water, Fish, and Fish Habitat	• No potential impacts are anticipated as a result of operational activities with the exception of impacts associated with accidental spills and/or leaks.	• Minimize potential effects to surface water, fish, and fish habitat by minimizing likelihood of spills and leaks.	• No wind turbines have been located within 30 m of the average annual high water mark of a lake or a permanent or intermittent watercourse. • Spills and leaks can be minimized through proper storage of materials (e.g. maintenance fluids) at off-site storage containers or in facilities located more than 30 m from a water body. • Spill containment kit will be stored on-site so that any minor spills or leaks can be stopped and cleaned up efficiently.	• DFO Authorizations (if required) would likely include conditions of approval such as monitoring activities. However, it expected that DFO Authorization will not be required; therefore no post-construction monitoring is anticipated. In the event that agencies mandate post-construction monitoring, it may include monitoring to ensure that sites are re-vegetating as expected, and that there is no sedimentation or erosion occurring as a result of Project maintenance activities.	• None
Air Quality and Environmental Noise					
Air Quality	• Emissions from equipment and vehicles during maintenance activities.	• Minimize duration and magnitude of emissions.	• Operate vehicles in a manner that reduces air emissions to the extent practical, including: o Using multi-passenger vehicles wherever possible; and, o Avoid idling vehicles. o Equipment and vehicles will be maintained in a manner that reduces air emissions. • Monitor road conditions and apply dust suppressant (e.g. water or calcium) to access roads as required.	• All vehicles used in the operations phase of the Project will be properly maintained and undergo regular emissions testing as required by provincial legislation. Operations vehicles will be repaired immediately if required.	• Any net effects are expected to be short-term in duration and highly localized.
Environmental Noise	• Noise emitted from a turbine and/or transformers.	• Noise at all non-participating receptors to meet MOE Noise Guidelines.	• The wind farm was designed to be compliant with the applicable MOE environmental noise guidelines. • A regular maintenance program would largely mitigate potential effects related to noise. • The closest wind turbine to a receptor is about	• Noise monitoring (if required) would be conducted in accordance with the REA for the Project • In cases where there is a malfunction of the unit, the wind turbine would be shut down until such time as the malfunction is corrected.	• No significant net effects are anticipated due to the Project being designed in compliance with the MOE noise guidelines and REA setbacks, as well as

Table 5.1: Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operation

Environmental Feature	Potential Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures	Net Effects
			840 m, well beyond the MOE requirement of 550 m.	• Turbine maintenance to ensure turbines are running properly and efficiently.	due to the distance from receptors.
Land Use and Socio-Economic Resources					
Agricultural Lands	• None – No agricultural lands occur within the Project Location.	• N/A	• Not required	• Not required	• None
Mineral, Aggregate, and Petroleum Resources	• Aggregate extraction from Project pits used to help maintain the roads • As there are no known petroleum resources within the Project Location, there are no anticipated potential effects.	• N/A	• Not required	• Not required	• None
Game And Fishery Resources	• Disturbance to game species from operations activities. • No effects identified to fishery resources.	• Minimize disturbance to game resources. • Minimize effects of access improvements or restrictions.	• Routine maintenance to ensure equipment is operating properly and efficiently, thus limiting potential noise disturbance to game resources. • Game species occurring in the Project Location currently experience human activity associated with logging, recreational, and hunting activities, so it is anticipated that game will adapt to the limited number of operations staff. As identified by Arnett et. Al., (2007) the game species located in the Project Location are anticipated to adapt to the presence of operational turbines [1] Hunting will continue to be permitted in the area during operation. • Access to previously inaccessible areas has been minimized to the extent practical through the use of existing roads and trails for Project access (e.g., Dump Road). Project specific roads may be gated for public safety concerns; however public multi-use roads will remain un-gated as per the request of the MNR.	• During the operations phase of the Project any monitoring requirements specified in MNR or DFO watercrossing permits will be undertaken. • The Project will also undertake reporting and monitoring activities as required by the BFN.	• No significant net effects are anticipated to game or fishery resources.
Provincial Plans, Policies, and Recreation Areas	• None	• N/A	• Not required	• Not required	• None
Local Traffic	• Short-term disruption to local traffic as a result of excess loads during maintenance events.	• Minimize disturbance to local traffic.	• There may be instances where maintenance activities require excess loads (e.g., cranes) and will require special traffic planning. • The Proponent and/or the Operations and Maintenance Contractor will implement a Traffic Management Plan (or similar) during instances of large scale equipment transport that have the potential to significantly affect local traffic patterns or transportation infrastructure.	• As necessary, permits will be obtained from the MTO and/or MNR.	• A limited, short term effect on local traffic during large scale maintenance activities, but will be managed through the implementation of a Traffic Management Plan.
Local Economy	• Increase in direct employment. • Local economic benefits from local expenditures, including but not limited to parts and materials, contracting services (e.g., road maintenance, tree trimming and collector line vegetation control), equipment, lodging, meals and other services.	• Create positive effects on local economy.	• The FiT contracts held by the Project require that the Project meet minimum requirements for investment in Ontario goods and services providers. • To the extent possible, the Proponent will source required goods and services from qualified local suppliers provided they are competitively priced,	• None required.	• A positive net effect is anticipated on the local economy during operation of the Project. • On average, it is estimated that 4 to 6 persons may be directly

[1] Arnett, E. B., D. B. Inkley, D. H. Johnson, R. P. Larkin, S. Manes, A. M. Manville, R. Mason, M. Morrison, M. D. Strickland and R. Thresher. 2007. Impacts of Wind Energy Facilities on Wildlife and Wildlife Habitat. Wildlife Society Technical Review 07-2. The Wildlife Society, Bethesda, Maryland, USA

Table 5.1: Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operation

Environmental Feature	Potential Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures	Net Effects
			available in the appropriate quality and quantity, and with the necessary experience.		employed during operation.
Viewscape	• Viewscape from areas surrounding the Project Location will be altered due to the presence of wind turbines.	• Minimize potential for visual disturbance.	• Wind turbines are set back from the Lake Superior shoreline, reducing their visibility from local vantage points along Highway 17 and Lake Superior Provincial Park. • The forested nature of the local landscape assists in screening the Project from many potential vantage points.	• None.	• There will be a net effect (positive or negative - based on individual perceptions) due to the change in viewscape of the surrounding area.
Existing Infrastructure					
Provincial and Municipal Infrastructure	• No potential impacts are anticipated as the Project will not require the use of provincial and/or municipal infrastructure such as municipal servicing.	• N/A	• None required.	• None required.	• None
Navigable Waters	• Project infrastructure may be located across potentially navigable waterways (via electrical collector lines).	• Minimize effects on navigable waterways	• Implement any design mitigation measures that may be required to address conditions of any permits obtained from TC or the MNR related to navigable waters including adherence to applicable Operational Policy Statements.	• Will be identified as part of any required permits.	• None
Telecommunication and Radar Systems	• Potential to interfere with telecommunication and radar systems.	• Minimize interference with telecommunication and radar systems.	• The Proponent has been and will continue to consult with relevant agencies and licensed providers to identify any likely effects to telecommunication and radar systems including Environment Canada with respect to the Montreal River Weather Radar Station. • In the event that signal disruption is experienced, mitigation measures will be discussed with the relevant agencies and licensed providers.	• Adherence to Complaint Response Protocol. • The Proponent would review potential incidents of telecommunications interference on a case by case basis.	• No anticipated significant effects to telecommunication/ radar systems.
Aeronautical Systems	• Aeronautical obstruction.	• Minimize potential hazard to low flying aircraft.	• It is anticipated that approximately 23 turbines will be equipped with aviation warning lights to reduce the night time lighting effect. • Nav Canada will be responsible for updating all aeronautical charts with the turbine locations. • Low-level aircraft are to be familiar with the area they are flying over.	• None	• No anticipated significant effects to aeronautical systems.
Public Health and Safety					
Public Health and Safety	• Potential traffic safety hazards. • Safety hazards due to accidents and malfunctions. • Safety hazards due to ice throw.	• Operational performance target of zero (0) reportable instances on an annual basis.	• As appropriate, all non-conventional loads would have front and rear escort or “pilot” vehicles accompany the truck movement on public roads. May provide notification to MTO of non-conventional load movements. • Implementation of a Traffic Management Plan and a Health and Safety/Emergency Response Plan. • The wind turbines will be maintained and operated according to applicable industry standards/certifications. • Project components have been designed to withstand the effects of extreme weather	• Adherence to Complaint Response Protocol (Section 6.3) • On-going dialogue with local emergency services personnel to address any concerns, confirm alignment between local agency protocols and Project operational protocols (e.g., emergency response, 911 notifications). If required, the Proponent would participate in a training session/orientation for local emergency services managers regarding the Project. • Failsafe devices integrated into the wind turbine design are capable of shutting down the turbine operation in the event of excessive wind conditions, rotor imbalance, or malfunction of other turbine components.	• With adherence to safety policies and procedures identified herein, and the mitigation measures proposed, there is minimal increased or new risk to public health and safety

Table 5.1: Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operation

Environmental Feature	Potential Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures	Net Effects
			events. • All turbines have been located more than the required setback distance from all non-participating dwellings as per O. Reg. 359/09. As proposed the wind turbines are at least 840 m from nearby receptors. • All personnel operating the wind farm will be provided with all necessary training and personal protective equipment to work safely and in accordance with applicable provincial and federal health and safety regulations.	• Wind turbines will be monitored electronically twenty-four hours a day, seven-days a week, to ensure wind turbine operational are adhered to and any mechanical concerns are addressed quickly. • Inspections of turbines will occur after extreme weather events which may have resulted in mechanical loads beyond turbine design specifications. • Annual safety reporting will be undertaken in accordance with applicable regulations.	

6.0 Emergency Response, Environmental, and Communication Plans

As part of the environmental monitoring measures outlined above, several programs, plans, and procedures will be developed by the Proponent and/or the Operation and Maintenance Contractor. The Project would be operated in accordance with these plans to ensure industry-standard practices are followed and the Project operates in a safe and environmentally responsible manner.

6.1 EMERGENCY RESPONSE PLAN

The Proponent and/or the Operation and Maintenance Contractor will develop a detailed Emergency Response Plan ("ERP") which may include collaboration with the MNR and local Emergency Services Departments. As appropriate, the ERP may cover response actions to extreme weather events including severe winds, fire preparedness (including forest fires), evacuation procedures, and medical emergencies. Developing the ERP in conjunction with the MNR and local emergency services personnel would allow the Proponent to determine the extent and nature of the local emergency response resources and coordinate Project plans and protocols with the response actions of the local emergency services agencies.

The ERP would also include key contact information for emergency service providers, and a description of the chain of communications and how information would be disseminated to the relevant responders. The ERP would also indicate how the Proponent and/or the Operation and Maintenance Contractor would contact local residents, businesses or Crown land users who may be directly impacted by an emergency at the Project Location so that the appropriate actions can be taken to protect public safety.

6.1.1 Environmental and Safety Plans, Programs, and Procedures

As appropriate, the Proponent and/or the Operation and Maintenance Contractor would implement the programs, plans, and procedures to prevent environmental and safety incidents during the operations phase of the Project. The Proponent and/or the Operation and Maintenance Contractor will ensure that they have appropriately skilled personnel to carry out the responsibilities as defined in this document. All organizations involved in Project operational activities would develop responsive reporting systems that clearly assign responsibility and accountability.

During the operation of the facility, changes to operational plans may be required from time to time to address changes in conditions. The Proponent and/or the Operation and Maintenance Contractor would be responsible for ensuring environmental and safety issues associated with such changes are identified and addressed.

The following environmental and safety procedures may be employed during operations:

- *Spill prevention and spill response:* to identify the specific procedures for the prevention, response, and notification of spills. In addition, it will establish the general procedures for spill kits, spill clean-up, personnel training, and material handling and storage;
- *Hazardous waste management:* to outline the procedures for proper identification, temporary storage, handling, transport, and disposal of hazardous waste;
- *Non-hazardous waste management*: to establish procedures for reducing, managing, recycling or disposing of non-hazardous waste.
- *Personnel training and orientation*: to ensure personnel receive appropriate training in relation to operation and maintenance programs, environmental, health, and safety procedures, and the ERP.
- *Project health and safety plan:* to ensure that safety risks are addressed to the extent reasonably practicable and applicable health and safety regulations are met or exceeded. The Project's health and safety plan will also contain the health and safety policies and procedures to address risks specific to Project maintenance activities (e.g., electrical equipment, working at heights). The Project health and safety plan will also identify measures to be implemented (e.g., such as appropriate signage near electrical equipment) to ensure the public is protected from personal injury during operations and maintenance activities.
- *Forest Fire Prevention and Preparedness Plan*: to address fire risks through all phases of the Project including land clearing and disposal of debris. Plan will follow MNR's standards for forest fire prevention and preparedness. The Project will not involve the burning of debris and/or other materials.

6.2 PROJECT UPDATES AND ACTIVITIES

The Proponent will continue communications with Project stakeholders (public, aboriginal communities, and agencies) during the operation of the Project through direct correspondence, as well as through the Project website, and public notice where appropriate, for so long as this remains an effective two-communications tool. As a long-term presence in the area, the Proponent will continue to develop and foster constructive local relationships and channels of communication.

6.3 COMMUNICATIONS AND COMPLAINT RESPONSE PROTOCOL

Contact information for the Proponent and/or the Operation and Maintenance Contractor will be posted on the Project website as well as on signage in a prominent location(s) within the Project Location and will be provided directly to the MNR and MOE. The telephone number provided for the reporting of concerns and/or complaints would be equipped with a voice message system used to record the name, address, telephone number of the complainant, time and date

of the complaint along with details of the complaint. All messages would be recorded in a Complaint Response Document to maintain a record of all communications.

The Proponent and/or the Operation and Maintenance Contractor would endeavour to respond to messages within two business days. Where a complaint has been verified by the Proponent, reasonable commercial efforts would be made to investigate the cause of the complaint, implement reasonable corrective action if possible, and report back to the interested party on any corrective actions taken or results of the investigation.

The corrective actions taken to address the cause of the complaint and the proposed actions to be taken to prevent reoccurrences of the same complaint would also be recorded within the Complaint Response Document. If appropriate, and subject to confidentiality and right to privacy obligations, correspondence would be shared with other stakeholders or authorities, such as the MOE, as required and/or as deemed appropriate.

7.0 Closure

This Design and Operations Report for the Project has been prepared by Stantec for the Proponent in accordance with O. Reg. 359/09, the MOE's REA Technical Guide, and the MNR's APRD.

This Report has been prepared by Stantec for the sole benefit of the Proponent, and it may not be used by any third party without the express written consent of the Proponent. The data presented in this Report are in accordance with Stantec's understanding of the Project as it was presented at the time of reporting.

STANTEC CONSULTING LTD.

Mark Kozak
Project Manager

Rob Nadolny
Project Director

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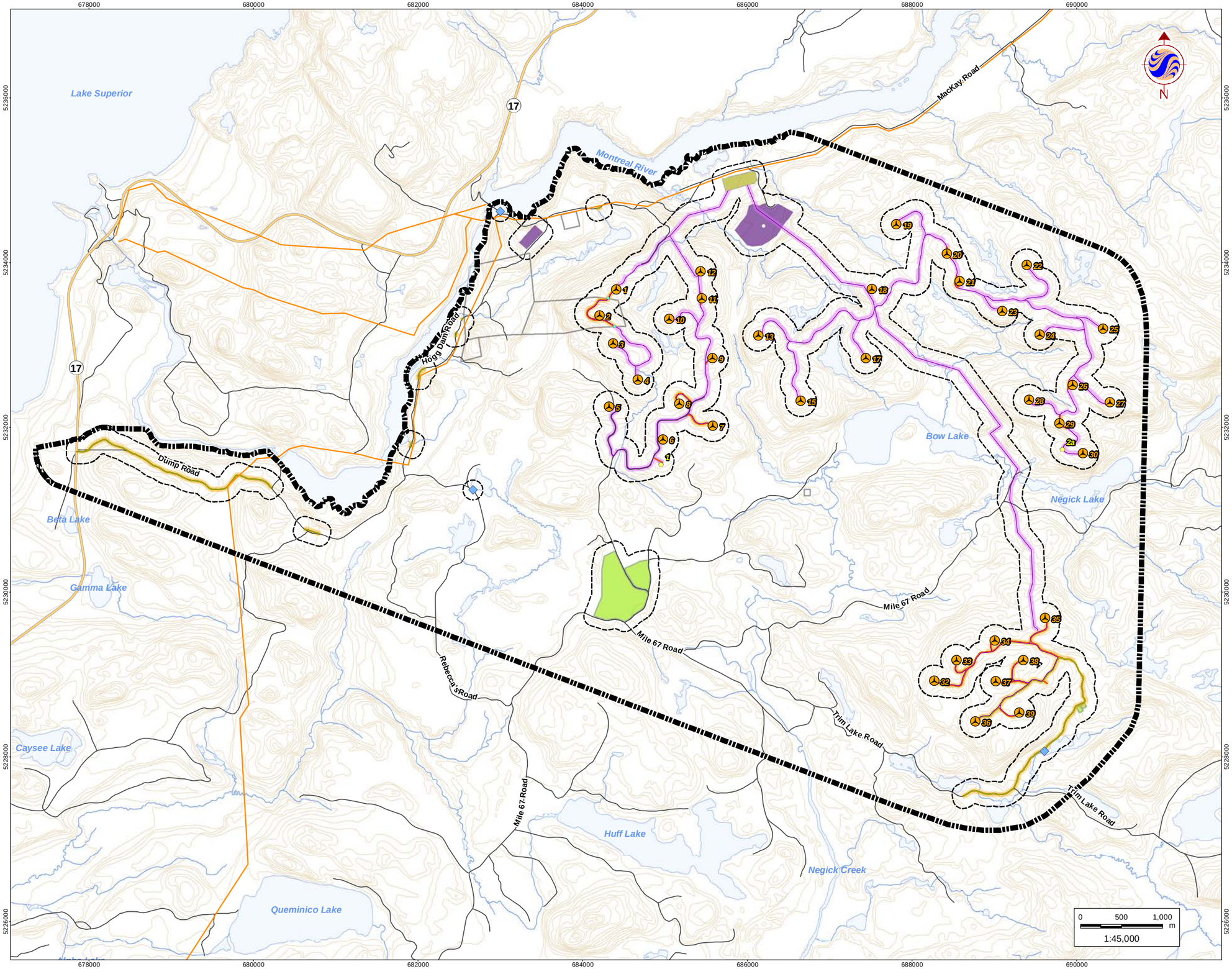
O. Reg. 359/09. 2012. Ontario Regulation 359/09 made under the Environmental Protection Act Renewable Energy Approvals Under Part V.0.1 of the Act.

Appendix A

Site Plans



Legend

- Study Area
- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

Stantec

January 2013
160960771

Client/Project
Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.
1.0

Title
Project Location & Study Area - Overview

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Revised: 2013-01-23 By: pworsell

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5236000 5234000 5232000 5230000 5228000 5226000

Lake Superior
Montreal River
MacKay Road
Hogg Dam Road
Dump Road
Bow Lake
Negick Lake
Beta Lake
Gamma Lake
Mile 67 Road
Rebecca's Road
Trim Lake Road
Caysee Lake
Huff Lake
Negick Creek
Queminico Lake
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Legend

- Study Area
- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)
- Boreal Bedstraw Habitat (BBH)
- Braun's Holly Fern Habitat (BHFH)
- Oval-leaved Bilberry Habitat (OBH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

* Breeding ponds in woodland habitats assumed throughout Zone of Investigation (not illustrated).

** Forested breeding habitats throughout Zone of Investigation (not illustrated)

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January 2013
160960771

Client/Project
Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.
2.0

Title
Significant Natural Heritage Features and Attributes - Overview

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Revised: 2013-01-23 By: pworsell

677500 678000 678500 679000 679500 680000

5232500 5232000 5231500 5231000 5230500

17

G135S
SWET-11
Dump Road
SWET-40
OBH-82
G129Tt
CWH-1
ABHW-11
CWH-3
SWET-60
G129Tt
OBH-94
ABHW-9

0 100 200 m
1:10,000

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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)

ABHW-1 Black text, white halo = Confirmed Significant Feature

CWH-1 White text, grey halo = Assumed Significant Feature

Notes

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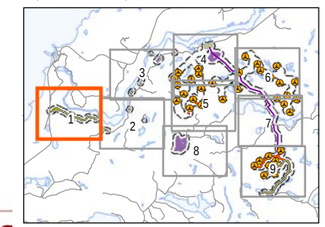
** Forested breeding habitats throughout Zone of Investigation (not illustrated)



Stantec

January 2013
160960771

Client/Project

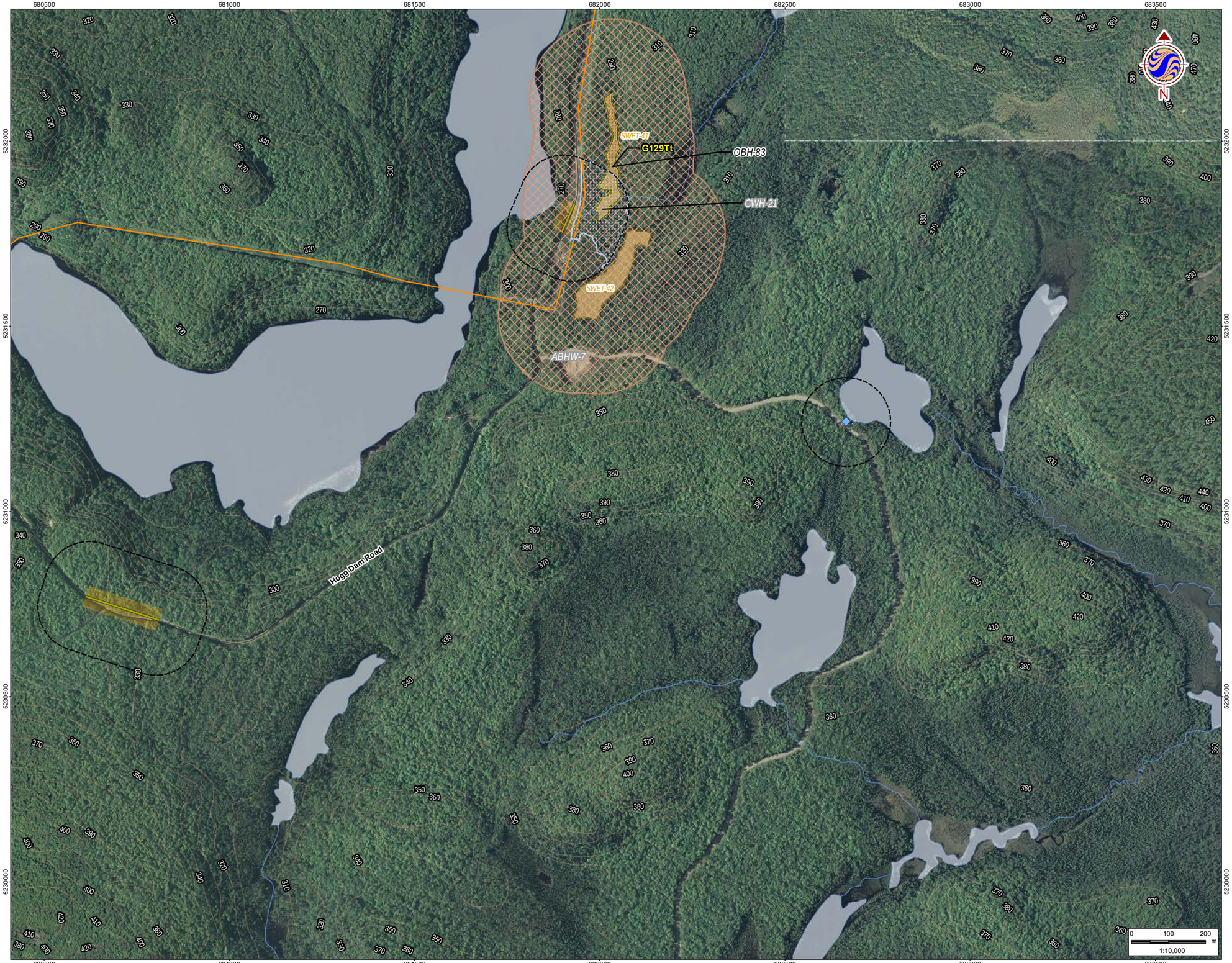
Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.1

Title

Significant Natural Heritage Features and Attributes



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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)
- *ABHW-1* Black text, white halo = Confirmed Significant Feature
- *CWH-1* White text, grey halo = Assumed Significant Feature

Notes

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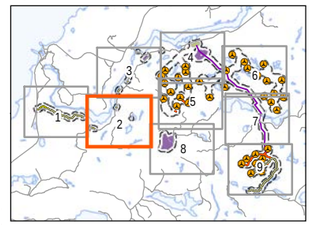

Stantec

January 2013
160960771

Client/Project

Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.2

Title

Significant Natural Heritage Features and Attributes

681000 681500 682000 682500 683000 683500 684000

5234500 5234000 5233500 5233000 5232500

OFH-5
SEEP-11
CWH-22
ABHW-4
SWET-12
G148N
WNA-5
Hogg Dam Road

0 100 200 m
1:10,000

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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)

ABHW-1 Black text, white halo = Confirmed Significant Feature

CWH-1 White text, grey halo = Assumed Significant Feature

Notes

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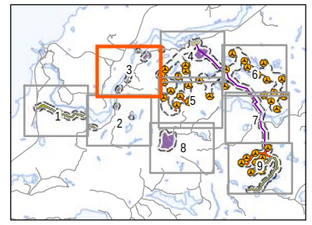

Stantec

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160960771

Client/Project

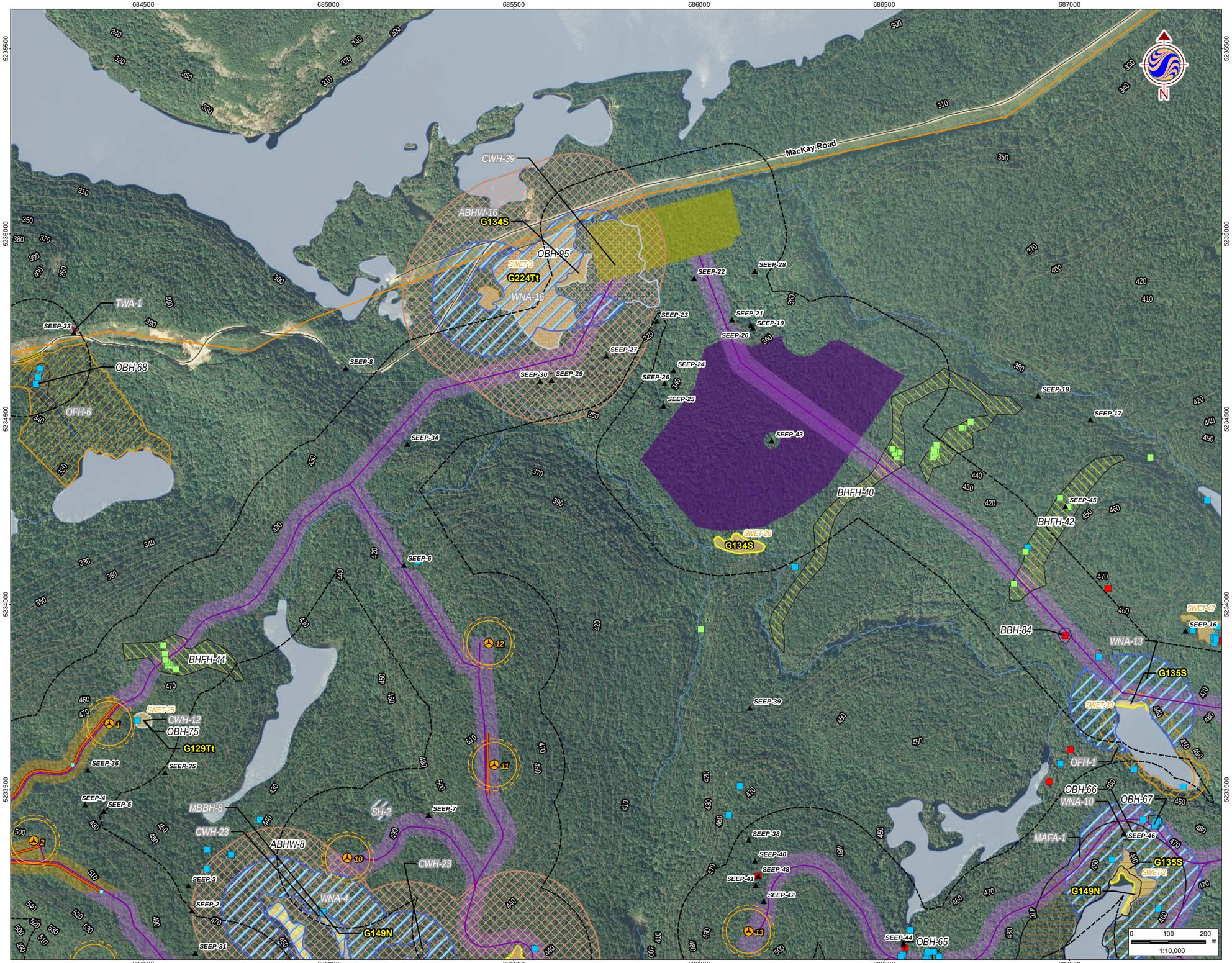
Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.3

Title

Significant Natural Heritage Features and Attributes



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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)

ABHW-1 Black text, white halo = Confirmed Significant Feature

CWH-1 White text, grey halo = Assumed Significant Feature

Notes

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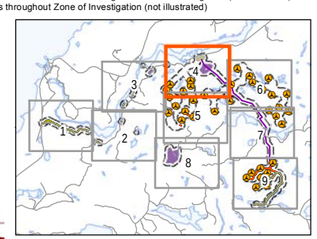

Stantec

January 2013
160960771

Client/Project

Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.4

Title

Significant Natural Heritage Features and Attributes

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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)

ABHW-1 Black text, white halo = Confirmed Significant Feature

CWH-1 White text, grey halo = Assumed Significant Feature

Notes

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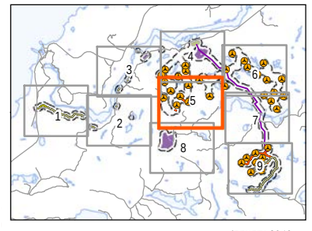
** Forested breeding habitats throughout Zone of Investigation (not illustrated)



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Client/Project

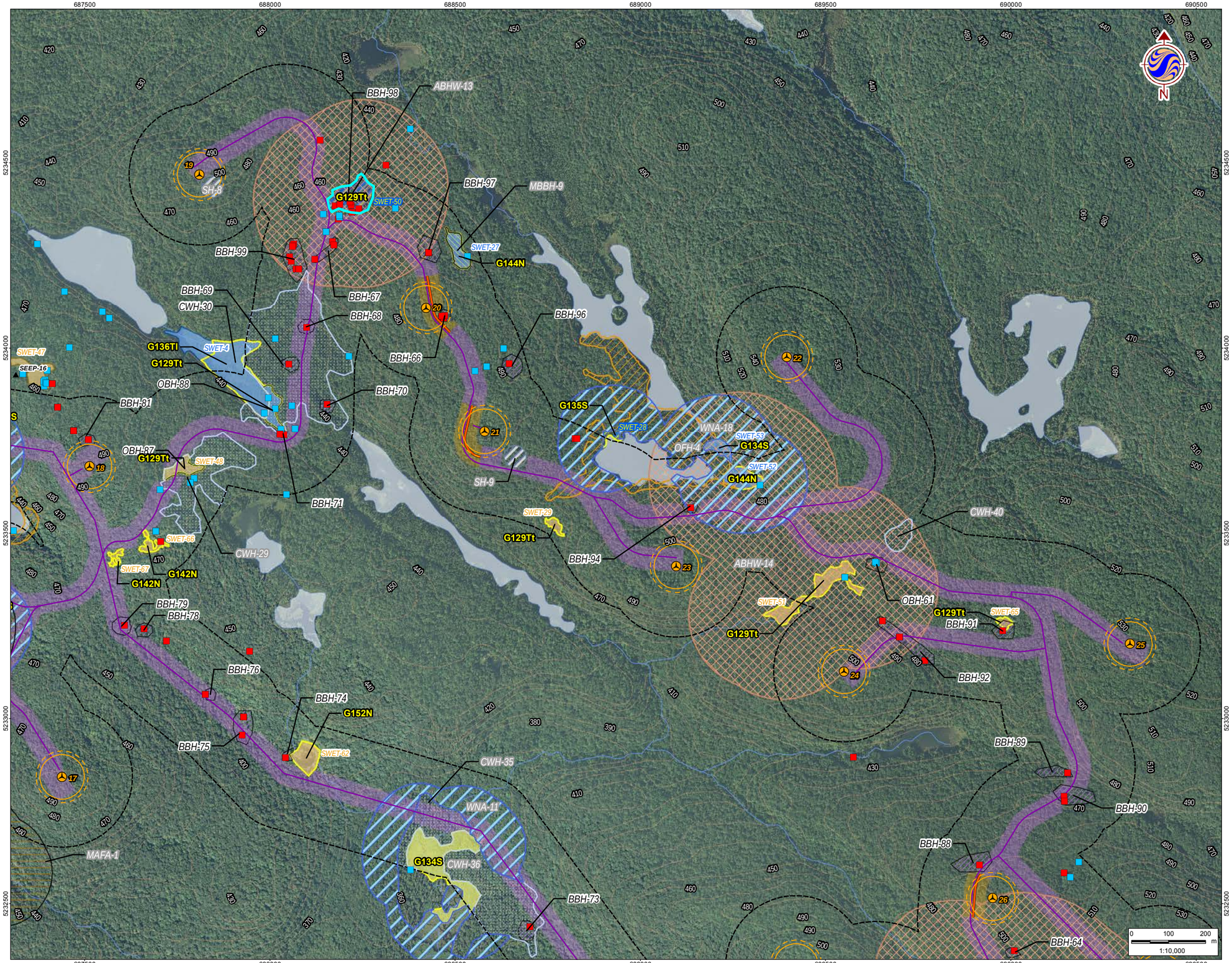
Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.5

Title

Significant Natural Heritage Features and Attributes



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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)
- ABHW-1 Black text, white halo = Confirmed Significant Feature
- CWH-1 White text, grey halo = Assumed Significant Feature

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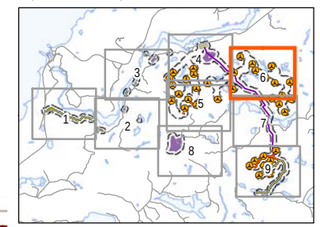

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January 2013
160960771

Client/Project

Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.6

Title

Significant Natural Heritage Features and Attributes

687500 688000 688500 689000 689500 690000 690500

5232000 5231500 5231000 5230500 5230000

BBH-64
OBH-59
G129Tt
ABHW-15
SWET-59
SWET-58
BBH-86
OBH-96
BBH-63
G129Tt
G146N
BBH-87
G135S
G135S
G135S
G135S
G135S
G134S
SWET-33
OFH-13
G142N
SWET-64
G129Tt
CWH-15
SWET-57
G129Tt
Mile 67 Road
28
27
29
2a
30

0 100 200 m
1:10,000

N

Legend

120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
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- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)

ABHW-1 Black text, white halo = Confirmed Significant Feature

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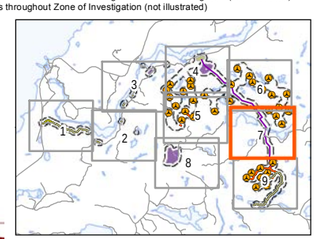

Stantec

January 2013
160960771

Client/Project

Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.7

Title

Significant Natural Heritage Features and Attributes

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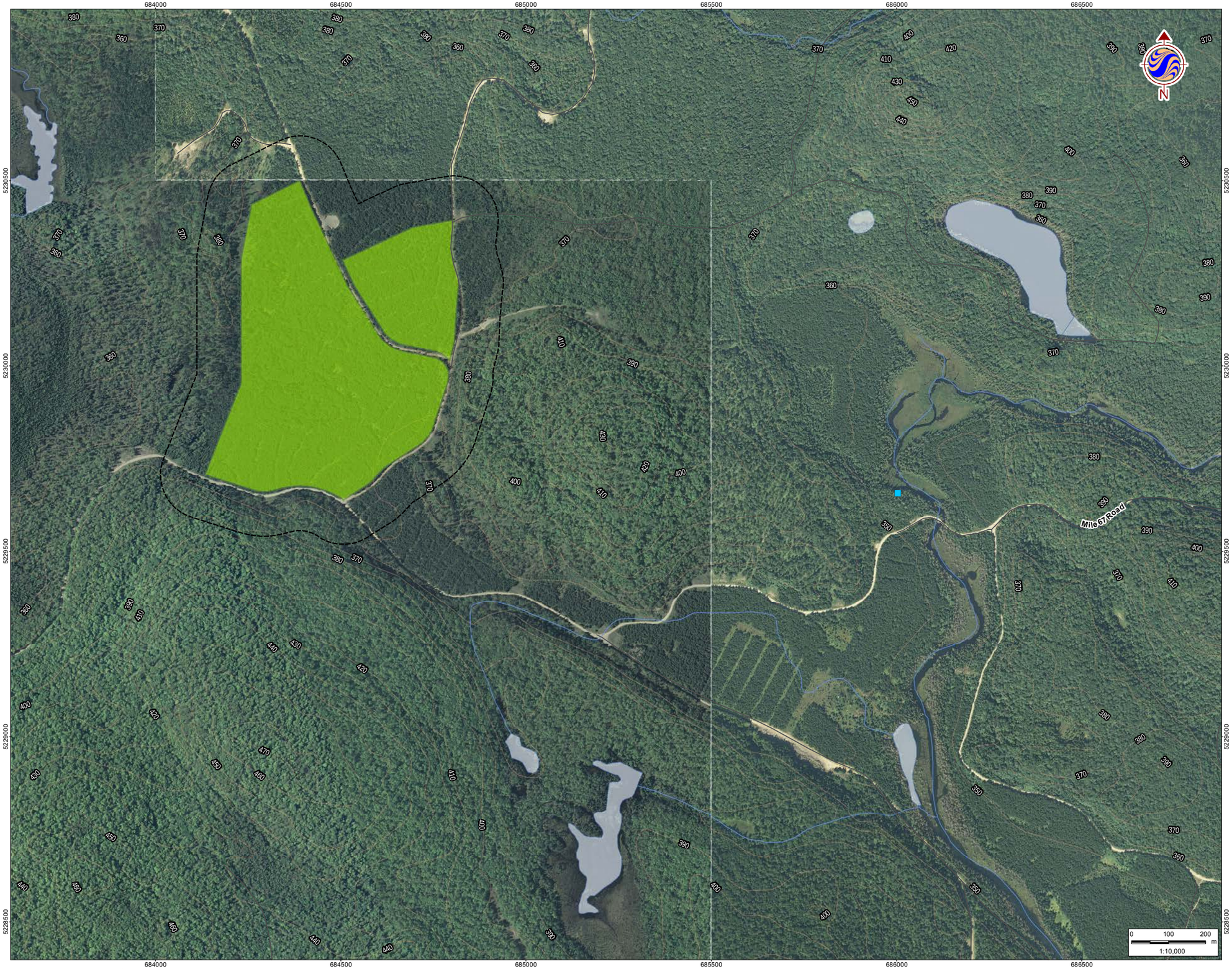

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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

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- Previously Evaluated Wetland - Non-PSW
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Wildlife Habitat – Seasonal Concentration Areas

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- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

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- Waterfowl Nesting Area (WNA)
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- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)
- *ABHW-1* Black text, white halo = Confirmed Significant Feature
- *CWH-1* White text, grey halo = Assumed Significant Feature

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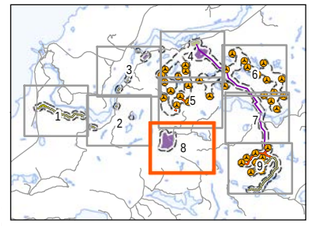


Stantec

January 2013
160960771

Client/Project

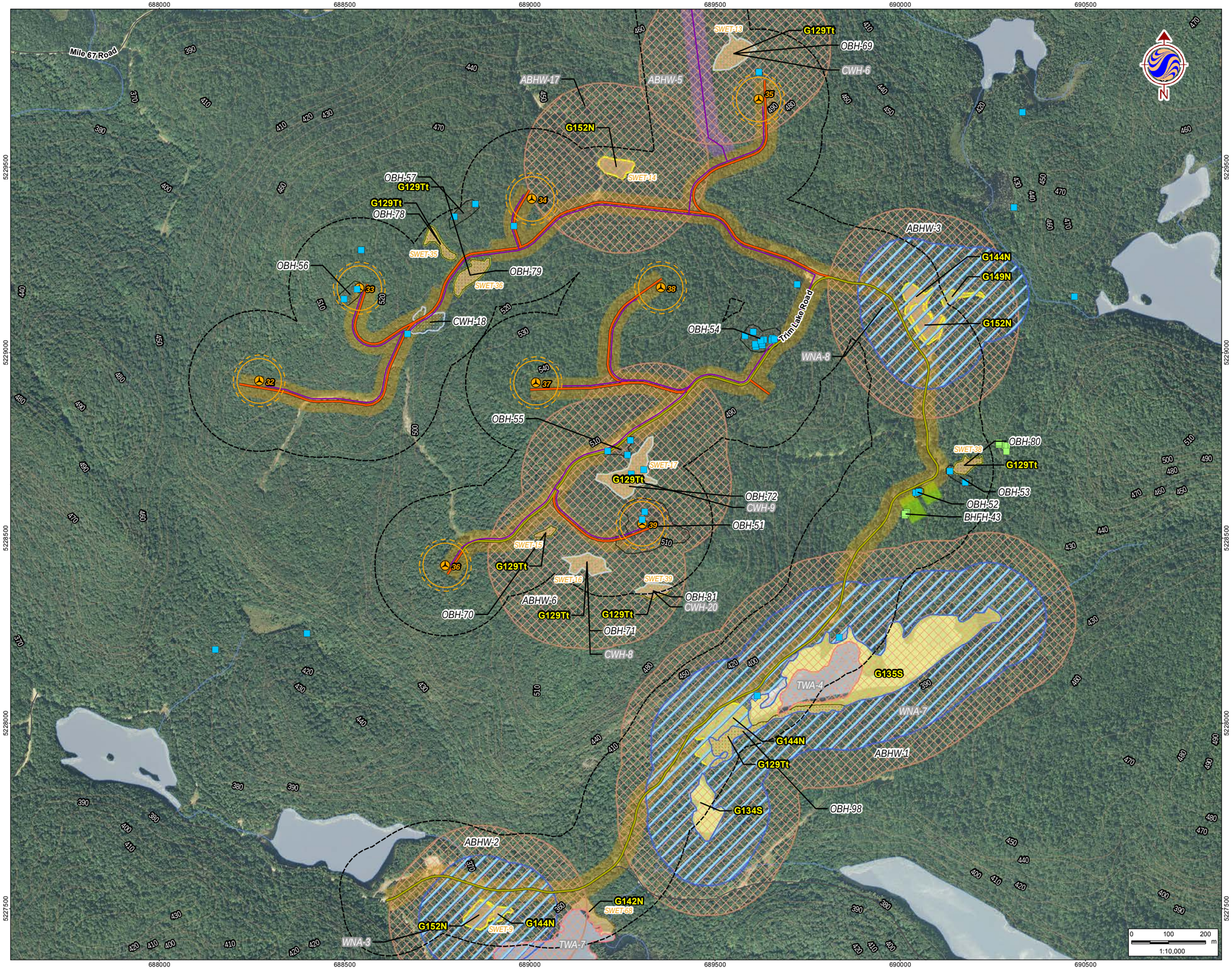
Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.8

Title

Significant Natural Heritage Features and Attributes



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Revised: 2013-01-23 By: pworsell

Legend

- 120m Zone of Investigation

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Access Road (New)
- Access Road (Upgrade)
- Overhead/Underground Collector Line
- Access Road Corridor
- Collector Line Corridor
- Turbine Sweep Area
- Turbine Laydown Area
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land
- Vegetation Community Boundary

Wetlands (delineated by Stantec - SWET)

- Previously Significant Wetland - PSW
- Previously Evaluated Wetland - Non-PSW
- Previously Unidentified Wetland
- Previously Unidentified Wetland Recommended for Inclusion in PSW

Wildlife Habitat – Seasonal Concentration Areas

- Snake Hibernaculum (SH)
- Turtle Overwintering Area (TWA)

Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife

- Moose Aquatic Feeding Area (MAFA)
- Waterfowl Nesting Area (WNA)
- Canada Warbler Habitat (CWH)
- Olive-sided Flycatcher Habitat (OFH)

Attributes Supporting Significant Wildlife Habitat

- Seep
- Boreal Bedstraw
- Braun's Holly Fern
- Oval-leaved Bilberry
- Amphibian Breeding Habitat – Woodlands (ABHW)

Species of Conservation Concern or Rare Birds

- Marsh Bird Breeding Habitat (MBBH)

ABHW-1 Black text, white halo = Confirmed Significant Feature

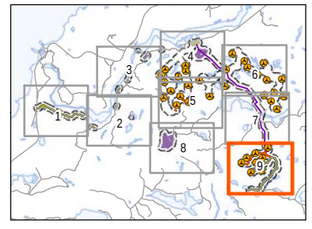
CWH-1 White text, grey halo = Assumed Significant Feature

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthographic imagery provided by © USGS, 2013. Imagery taken in 2008.

* Breeding ponds in woodland habitats assumed throughout Zone of Investigation (not illustrated).

** Forested breeding habitats throughout Zone of Investigation (not illustrated)



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January 2013
160960771

Client/Project

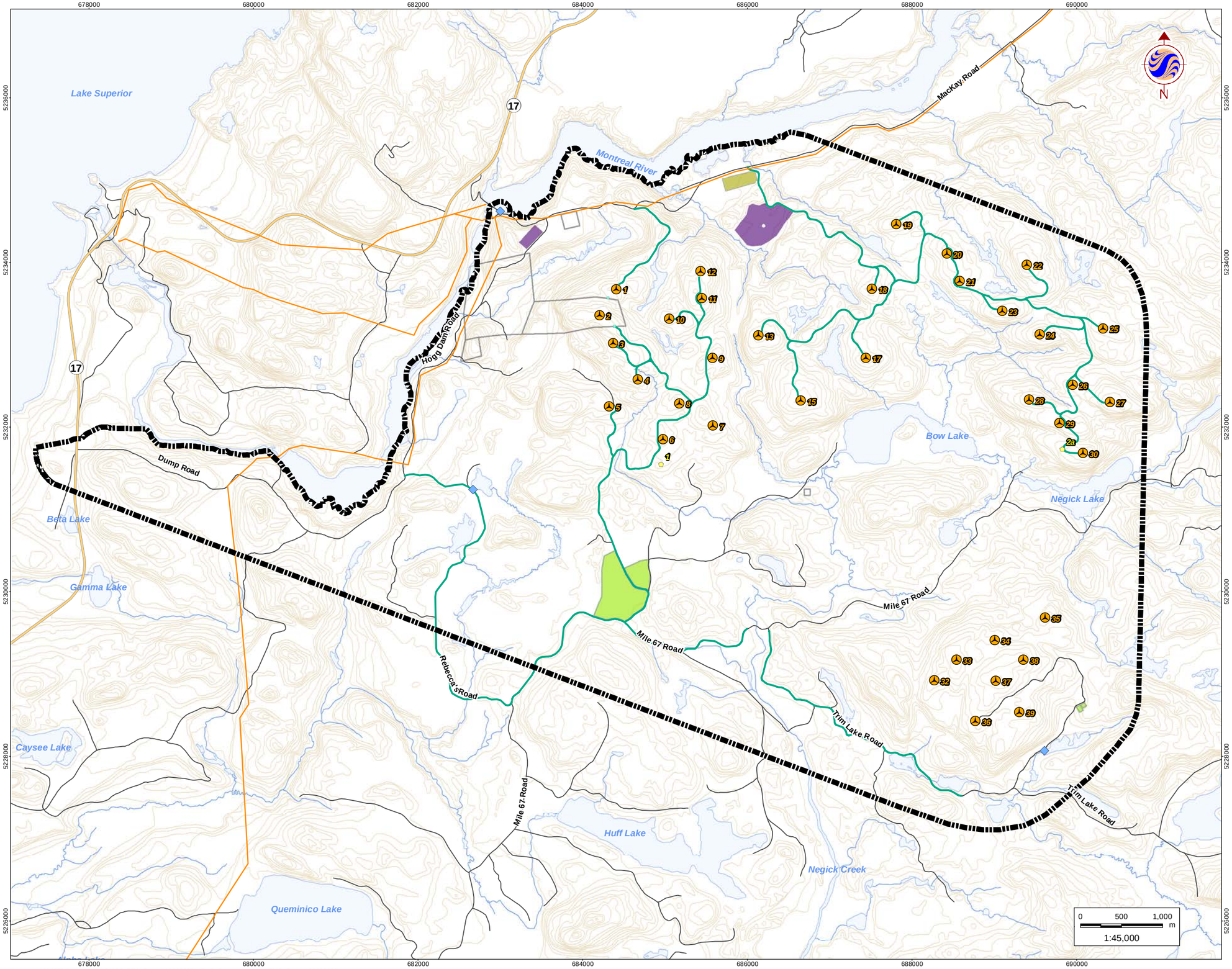
Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

2.9

Title

Significant Natural Heritage Features and Attributes



W:\active\60960734\drawing\MXD\APC\REA_Report\160960771_Fig3_ExistingApprovedFMP_Roads_20130123.mxd
Revised: 2013-01-23 By: pworsell

Legend

- Study Area

Project Components

- Turbine Location
- Gate Location
- Meteorological Tower
- Proposed Water Extraction Location
- Construction Compound
- Construction Compound & Welfare Building
- Construction Compound & Transformer Station/Operations & Maintenance Building

Existing Features

- Expressway / Highway
- Road
- Existing & Approved FMP Road
- Elevation Contour
- Existing Transmission Line
- Watercourse
- Waterbody
- Patent Land

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

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January 2013
160960771

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Bow Lake Wind Farm
Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, through their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp.

Figure No.

3.0

Title

Existing & Approved FMP Roads

Appendix B

Noise Assessment Report

Howe Gastmeier Chapnik Limited
2000 Argentia Road, Plaza One, Suite 203
Mississauga, Ontario, Canada L5N 1P7
t: 905.826.4044

NOISE ASSESSMENT REPORT

Bow Lake Wind Project

District of Algoma, Ontario

Prepared for:

Nodin Kitagan Limited Partnership and
Nodian Kitagan 2 Limited Partnership
c/o Shongwish Nodin Kitagan GP Corp.
200, 4723 – 1 Street SW
Calgary, Alberta, T2G 4Y8

Prepared by

Ian R. Bonsma, PEng

and

Brian Howe, MEng, MBA, PEng

October 4, 2013

VERSION CONTROL

Bow Lake Wind Project / Chinodin Chigumi Nodin Kitagan,
District of Algoma, Ontario

Ver.	Date	Version Description	Prepared By
1	5-Oct-12	Original DRAFT Acoustic Assessment Report supporting a Renewable Energy Application.	M. Brenner
2	25-Jan-13	Finalized Acoustic Assessment Report supporting a Renewable Energy Application.	I. Bonsma
3	7-Mar-13	Updated Acoustic Assessment Report to reflect comments from the MOE (adjusted ground absorption).	I. Bonsma
4	4-Oct-13	Updated Noise Assessment Report – revised coordinates for receptor R31.	I. Bonsma

EXECUTIVE SUMMARY

Howe Gastmeier Chapnik Limited ("HGC Engineering") was retained by Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, by their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp., respectively, to assess the acoustic impact of the proposed Bow Lake Wind Project also known as the Chinodin Chigumi Nodin Kitagan. The proposed wind project site is located in the unorganized Townships of Smilsky and Peever, in the District of Algoma Ontario. The project is within the territory of the Batchewana First Nation of Ojibways.

This project consists of thirty-six GE 1.6-100 wind turbine generators. Each turbine is rated at 1.62 MW for a total nameplate capacity of 58.32 MW. HGC Engineering has assessed the acoustic impact against the acoustic criteria of the Ontario Ministry of the Environment ("MOE") and in accordance with the requirements of Ontario Regulation 359/09. This report comprises a summary of our assessment and is intended as supporting documentation for an application for a Renewable Energy Approval.

There are a number of potential receptors, hunting camps and seasonal dwellings located on Crown Land that have been issued authorization from the Ontario Ministry of Natural Resources. From an acoustic perspective, the area is a rural environment, with relatively low ambient sound levels. The criteria of MOE publication NPC-232 *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)* are thus relevant. Supplementary guidance is also provided by MOE publication *Interpretation for Applying MOE NPC Technical Publications to Wind Power Generation Facilities*.

The sound power data for the GE wind turbine generators has been obtained and used in a computer model to predict the sound level impact at the closest receptors. The results of the modelling demonstrate compliance with the MOE guidelines when all thirty-six turbines are operating over their entire wind speed range.

Details of our assessment are provided in the main body of this report. The report is structured around the report format suggested by the MOE for Renewable Energy Approval applications for wind energy projects, with the required summary tables included as Appendix A.

TABLE OF CONTENTS

Ministry of the Environment | Ministère de l'Environnement

Ontario

NOISE ASSESSMENT REPORT CHECK-LIST

Company Name: Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership

Company Address: c/o Shongwish Nodin Kitagan GP Corp.

200. 4723-1st Street SW, Calgary, Alberta, T2G 4Y8

Location of Facility: Township of Smilsky and Peever, District of Algoma, Ontario

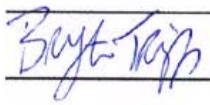
The attached Noise Assessment Report was prepared in accordance with the methods prescribed in the ministry guidance document "Noise Guidelines for Wind Farms Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities", October 2008.

Company Contact:

Name: Bryan Tripp

Title: Lead Regulatory East

Phone Number: 519-821-7319

Signature: 

Date: Oct 04, 2013

Technical Contact:

Name: Ian Bonsma

Representing: HGC Engineering

Phone Number: 905-826-4044

Signature: 

Date: October 4, 2013

1 INTRODUCTION

Howe Gastmeier Chapnik Limited ("HGC Engineering") was retained by Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership to assess the acoustic impact of the proposed Bow Lake Wind Project. The purpose of this report is to determine the acceptability of the predicted sound levels at the nearby receptors resulting from the operation of thirty-six 96 meter hub height, General Electric ("GE") 1.6-100 wind turbine generators rated at 1.62 MW in relation to the guidelines of the Ontario Ministry of the Environment ("MOE"). Based on Ontario Regulation 359/09, the Project is considered a Class 4 wind facility. This report is intended as supporting documentation for a Renewable Energy Approval application for the facility.

UPDATES ADDRESSED IN THIS ASSESSMENT REPORT

This report has been updated to address minor comments from the MOE, and includes updated UTM coordinates for receptor location R31, shown in Table 1.

Table 1: Receptor R31 Coordinate Changes

Point of Reception ID	Original UTM Coordinates		Revised UTM Coordinates		Difference between Coordinates (m)
	Easting	Northing	Easting	Northing	
R31	690013	5230846	690036	5230677	171

2 GENERAL DESCRIPTION OF WIND TURBINE INSTALLATION SITE AND SURROUNDING ENVIRONMENT

The wind project consists of thirty-six wind turbine generators to be located within the unorganized Townships of Smilsky and Peever in the District of Algoma, Ontario. The project is within the territory of the Batchewana First Nation of Ojibways. It is located 80 kilometers north of Sault Ste Marie and 8 kilometers east of the Montreal River Harbour, as shown in Figure 1.

The area is rural in nature, both acoustically and in general character, with wood lots surrounding the site. The zoning maps in Appendix B indicate that the area is zoned rural. Thirty-six receptors, shown in Figure 2, have been identified based on small lease parcels provided by Ontario Ministry of Natural Resources ("MNR"). The wind turbines will all be sited on Crown Land or Patent Land, the

transformers will be on Patent Land, and there are no participating receptors associated with this project.

3 DESCRIPTION OF SOUND SOURCES

Thirty-six GE 1.6-100 series wind turbine generators are proposed for the site, as shown in Figure 2. The wind turbines of this series have a maximum rated output of 1.62 MW with a corresponding maximum sound power level of 105 dBA. They are three bladed, upwind, horizontal axis wind turbines with a rotor diameter of 100 meters. The turbine rotor and nacelle are mounted on top of a 96 meter high tubular tower. This report assumes a turbine height of 96 meters. The turbines are anticipated to operate continuously whenever wind conditions allow. Additional details are contained in Appendix C, with acoustic information contained in Appendix D. Electronic topography mapping for the area suggests that the turbines will generally be based at an elevation of between 450 and 550 metres.

Table 2 provides the proposed UTM coordinates (Zone 16) of the thirty-six wind turbine generators and the two transformers. Two transformers will be installed as part of the project with additional details in Section 5 below.

Table 2: Locations of Wind Turbine Generators (WTG)

Source ID	Easting [m]	Northing [m]	Source ID	Easting [m]	Northing [m]
WTG 1	684408	5233679	WTG 11	685448	5233567
WTG 2	684204	5233361	WTG 12	685433	5233896
WTG 3	684368	5233022	WTG 13	686134	5233118
WTG 4	684670	5232579	WTG 15	686649	5232323
WTG 5	684321	5232252	WTG 17	687439	5232842
WTG 6	684974	5231855	WTG 18	687513	5233680
WTG 7	685581	5232019	WTG 19	687810	5234468
WTG 8	685174	5232291	WTG 20	688422	5234108
WTG 9	685577	5232844	WTG 21	688580	5233775
WTG 10	685052	5233316	WTG 22	689396	5233976

Table 2 cont'd: Locations of Wind Turbine Generators (WTG)

Source ID	Easting [m]	Northing [m]	Source ID	Easting [m]	Northing [m]
WTG 23	689097	5233410	WTG 32	688270	5228924
WTG 24	689550	5233127	WTG 33	688540	5229174
WTG 25	690322	5233201	WTG 34	689006	5229415
WTG 26	689951	5232514	WTG 35	689618	5229683
WTG 27	690404	5232305	WTG 36	688772	5228426
WTG 28	689420	5232332	WTG 37	689017	5228919
WTG 29	689790	5232049	WTG 38	689354	5229175
WTG 30	690077	5231685	WTG 39	689304	5228538
Transformer 1 (West)	685854	5235017	Transformer 2 (East)	5235025	685877

Smaller transformers will be installed at each of the wind turbine generator locations however these are acoustically insignificant in comparison to the wind turbine generator sound power levels. One large step-up transformer will be installed as part of the project. Additional details regarding the larger step-up transformers are provided below.

4 WIND TURBINE NOISE EMISSION RATINGS

Overall sound power data for the GE wind turbines as determined in accordance with CAN/CSA-C61400-11:07 [1], are provided by GE in the document *REA Specifications Report, BluEarth Renewables – Bow Lake* [2], included in Appendix D. Additionally, an excerpt from an IEC test report completed by KEMA, *Acoustic Noise Measurement Summary GE 1.6-100 Turbine 88 at the Bishop Hill Wind Project near Galva, Illinois* [3] was also reviewed. The overall A-weighted sound power levels as a function of 10 meter height wind speed are shown in Table 3.

Table 3: 10 Meter Height Wind Speed vs. Turbine Sound Power Level, Based on IEC Sound Power Determination Methodology and Wind Shear of 0.2

Wind Speed [ms] at 10 m Height	6	7	8	9	10
1.6-100 Wind Turbine Sound Power Level [dBA]	102.9	105.0	105.0	105.0	105.0

Sound power level data determined under CAN/CSA-C61400-11:07 is normalized to a standard "roughness length" value of 0.05 m. The roughness length concept is used to take into account the effect of friction at the ground, which results in lower wind speeds near the ground than at higher elevations. The wind shear exponent quantifies the same concept by describing the rate of change of wind speed with elevation. A roughness length of 0.05 meters is generally held to be equivalent to a wind shear value of about 0.2. Meteorological data near the proposed wind project provided by the proponent indicates that the average summer night-time wind shear coefficient is approximately 0.27. This means that a 10 meter height wind speed of 5.4 m/s can occur simultaneously with a 10 m/s wind speed at the hub height of 96 meters, indicating that maximum sound power output may occur during relatively low 10 meter level wind speeds. Consequently the maximum sound power level for the General Electric wind turbine (corresponding to a hub height wind speed of 10 m/s) has been used in this analysis.

The wind turbine generators will operate with an overall sound power level of 105.0 dBA. Table 4 presents the typical octave band spectrum for various 10 meter height wind speeds received from General Electric, also included in Appendix D. The spectral shape shown for the 10 meter height 10 m/s wind speed has been used in the analysis.

Table 4: Wind Turbine Acoustic Emissions Summary

Make and Model:	General Electric GE-1.6-100
Electrical Rating:	1.62 MW
Hub Height (m):	96 m
Wind Shear Coefficient:	Maximum sound power utilized to account for average summer nighttime wind shear value of 0.27

	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					**Adjusted Emission Level**				
Wind Speed [m/s]	**6**	**7**	**8**	**9**	**10**	**6**	**7**	**8**	**9**	**10**
Frequency [Hz]										
63	112.2	115.3	115.4	115.4	115.3	115.3	115.3	115.3	115.3	115.3
125	107.4	109.9	110.1	110.1	109.9	109.9	109.9	109.9	109.9	109.9
250	104.3	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2
500	101.4	101.9	101.7	101.8	102.0	102.0	102.0	102.0	102.0	102.0
1000	96.2	100.6	100.8	100.9	101.0	101.0	101.0	101.0	101.0	101.0
2000	93.2	95.9	95.8	95.5	95.0	95.0	95.0	95.0	95.0	95.0
4000	87.2	87.2	86.3	85.7	85.1	85.1	85.1	85.1	85.1	85.1
8000	70.3	70.3	68.9	68.3	68.3	68.3	68.3	68.3	68.3	68.3
Overall A-Weighted	102.9	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0

In the REA Specification Report [2], General Electric indicates that the GE 1.6 -100 at 96m hub height does not produce tonal audibility above 2 dB. A tonal penalty has not been applied in this assessment. General Electric has also indicated that the sound power levels provided have an uncertainty of less than +/- 2 dBA. The sound level predictions herein are thus subject to the degree of uncertainty related to the sound power of the turbine, in addition to the uncertainty related to the fluctuations of atmospheric conditions and the accuracy and limitations inherent in the modelling methodology.

5 TRANSFORMER SOUND POWER ESTIMATION

The project proposes to utilize two transformers. The transformers (TS1 and TS2) will be located to the north of the wind turbine generators. At the time of the report the transformer make and model had not been selected, however the proponent has indicated the transformers will have a maximum National Electrical Manufacturers Association ("NEMA") sound level of 78 dB measured in accordance with IEEE Standard C57.12.90, "IEEE Standard Test Code for Liquid-Immersed

Distribution, Power and Regulating Transformers" [4]. Using sample drawings provided in Appendix E, an enclosing surface area estimate of about 280 m^2 was determined. The NEMA sound rating and the approximate measurement surface area were used to compute the overall sound power level of 103 dBA [5]. Under MOE guidelines, tonal noises such as the hum typically produced by electrical transformers, are penalized 5 dB to account for the increased potential for annoyance that such sounds tend to have [6]. Thus, the 103 dBA sound power level becomes 108 dBA.

6 POINT OF RECEPTION SUMMARY

As shown in Figure 2, there are a number of noise sensitive receptors in the vicinity of the project, generally sited along the roadways. Receptor locations were identified by the proponent and their consultants through aerial imagery, Ministry of Natural Resources record searches, land parcel mapping, field reconnaissance, and discussions with local landowners. A table of UTM co-ordinates for 36 non-participating receptors located near the proposed wind turbine generators was received from the proponent. The identified noise-sensitive receptors include permanent residences, seasonal cottages, hunting and trapping cabins, and camps. Some of the identified noise sensitive receptor locations may not meet the MOE definition of a Dwelling or Point of Reception however, these locations have been included as a conservative measure to ensure a comprehensive analysis. Based on information received from the proponent and their consultants, 8 non-participating receptors are located within 1500 meters of a proposed wind turbine and sound level predictions are provided for these locations herein.

The existing receptors, together with their coordinates are listed in Table A3. For the purposes of this report, each of the 36 receptors was represented by a discrete sound prediction location at the dwelling coordinate, with an assumed height of 4.5 metres above the local grade to represent potential second-story windows. There are no participating receptors included in this project.

7 ASSESSMENT CRITERIA

The MOE publication NPC-232 *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)* [7] indicates that the applicable sound level limit for a stationary source of sound is the background sound level. However, where background sound levels are low, exclusionary minimum criteria

apply, with an exclusionary limit of 40 dBA specified for quiet night time periods, and 45 dBA specified for quiet daytime periods.

Because wind turbines generate more sound as the wind speeds increase, and because increasing wind speeds tend to cause greater background sound levels, wind turbine generators have been identified by the MOE as a unique case, and the MOE has provided supplementary guidance for the assessment of wind turbine noise in MOE publication *Noise Guidelines for Wind Farms Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities* ("*Interpretation*") [8]. This publication provides criteria for the combined impact of all turbines in an area as a function of 10 meter height wind speed. The criteria are presented in A-weighted decibels, as follows.

Table 5: Wind Turbine Noise Criteria [dBA]

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

It should be noted that the MOE guidelines, including NPC-232 and *Interpretation* do not require or imply that a noise source should be inaudible at a point of reception, and inaudibility should not be expected. In fact, even when the sound levels from a source are less than the numeric guideline limits, spectral and temporal characteristics of a sound regularly result in audibility at points of reception. To be clear, wind turbines will be audible at many residences even when sound levels are below MOE noise criteria guidelines.

In the case of this assessment, the sound power output of the General Electric wind turbines is assumed to be constant at the maximum value of 105.0 dBA over the full range of 10 meter height wind speeds due to the average summer nighttime wind shear exponent, which means that strong hub height winds and the maximum sound power level can occur at the same time as low 10 meter height winds and low background sound. Thus, the assessment of the GE wind turbines is based on the minimum criteria of 40 dBA and the maximum wind turbine sound power level.

8 IMPACT ASSESSMENT

An acoustic model of the site was created on a computer using Cadna/A (version 4.3.143), a commercial acoustic modelling system. Cadna/A uses the computational procedures of ISO 9613-2, *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* [9], which accounts for the reduction in sound level with distance due to geometrical spreading, air absorption, ground attenuation and acoustical shielding by intervening structures (or by topography and foliage where applicable). This is the standard that is specified by *Interpretation* to be used in the assessment of wind project noise.

Topographical data for the site and surrounding area was provided by the proponent. The topography in the study area varies from 179 m along the shore of Lake Superior and up to 590 m above sea level at the peaks of a number of hills. Given the significant elevation changes between several receptors and the wind turbine locations, the ground attenuation was assumed to be spectral for all sources, with the ground factor (G) conservatively assumed to be 0.0 globally.

The temperature and relative humidity were assumed to be 10° C and 70%, respectively. Stands of foliage were not modelled. For each receptor the predictions include the sound emissions of known wind turbines within a 5 km radius as stipulated in the 2008 MOE *Interpretation*. There are no other known wind projects within 5 km of the proposed project.

All the GE wind turbine generators were modeled as point sources at a height of 96 meters above grade. Figure 2 presents the acoustic model, with the receptor and source locations shown. Figure 3 shows the noise contours of the area surrounding the facility, as produced by Cadna/A, based on the octave band sound power levels of each wind turbine and a 10 m height wind speed of 10 m/s. The required summary tables are contained in Appendix A of this report.

In accordance with the 2008 MOE *Interpretation*, sound level predictions for receptors within 1500 meters of the sound sources are presented in Table A4. Sound levels are predicted to be at or below the 40.0 dBA minimum criterion at all receptor locations. Details of the calculations are provided in Appendix E.

When conducting an acoustic audit of a conventional stationary industrial sound source, the MOE guidelines direct that periods of high wind be excluded. Typically, the noise output of industrial sound sources is independent of wind speed. However, this is not the case for wind plants and there is an intrinsic relationship between wind speed (and therefore ambient noise) and increased sound power levels associated with the wind turbine generators. Complicating matters, there is a large degree of variability related to environmental factors within the wind plant area including, among others, local ground level wind speeds, wind speeds affecting the wind turbine generator blades, the associated wind shear, and the sound power of the wind turbine generators, all of which affect the measured sound levels. Thus, it is not realistic to expect that in practice a single repeatable sound level can or will be measured for a given wind speed at a given setback distance; a simple comparison of single numbers is not sufficient or possible.

9 CONCLUSIONS

The analysis, performed in accordance with the methods prescribed by the Ontario Ministry of the Environment in publication *Interpretation for Applying MOE NPC Technical Publications to Wind Power Generation Facilities*, October 2008, indicates that the operation of the proposed wind project will comply with the requirements of the MOE publication NPC-232 *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)* for all identified receptor locations.

REFERENCES

1. CAN/CSA-C61400-11-07, *Wind Turbine Generator Systems – Part 11: Acoustic noise measurement techniques*, Edition 2.1, 2006-11.
2. GE Energy, *REA Specifications Report.* February, 2012.
3. KEMA, *Acoustic Noise Measurement Summary GE 1.6-100 Turbine 88 at the Bishop Hill Wind Project near Galva, Illinois*, January 24, 2013.
4. Institute of Electrical and Electronics Engineers (IEEE), Standard C57-12-90-2006, *IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulation Transformers.*
5. Crocker, Malcolm, J., Sound *Power Level Predictions for Industrial Machinery*, In Encyclopedia of Acoustics (Vol. 2, pp. 1049 - 105), John Wiley & Sons, Inc., 1997.
6. Ontario Ministry of the Environment Publication NPC-104, *Sound Level Adjustments,* August, 1978.
7. Ontario Ministry of the Environment Publication NPC-232, *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural),* October, 1995.
8. Ontario Ministry of the Environment Publication, *Noise Guidelines for Wind Farms, Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities*, October 2008.
9. International Organization for Standardization, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*, ISO-9613-2, Switzerland, 1996.
10. Google Maps Aerial Imagery, Internet Application: *maps.google.com*
11. NEMA Standards Publication No. TR 1-1993 (R2000), *Transformers, Regulators and Reactors*, National Electrical Manufacturers Association, 2000.

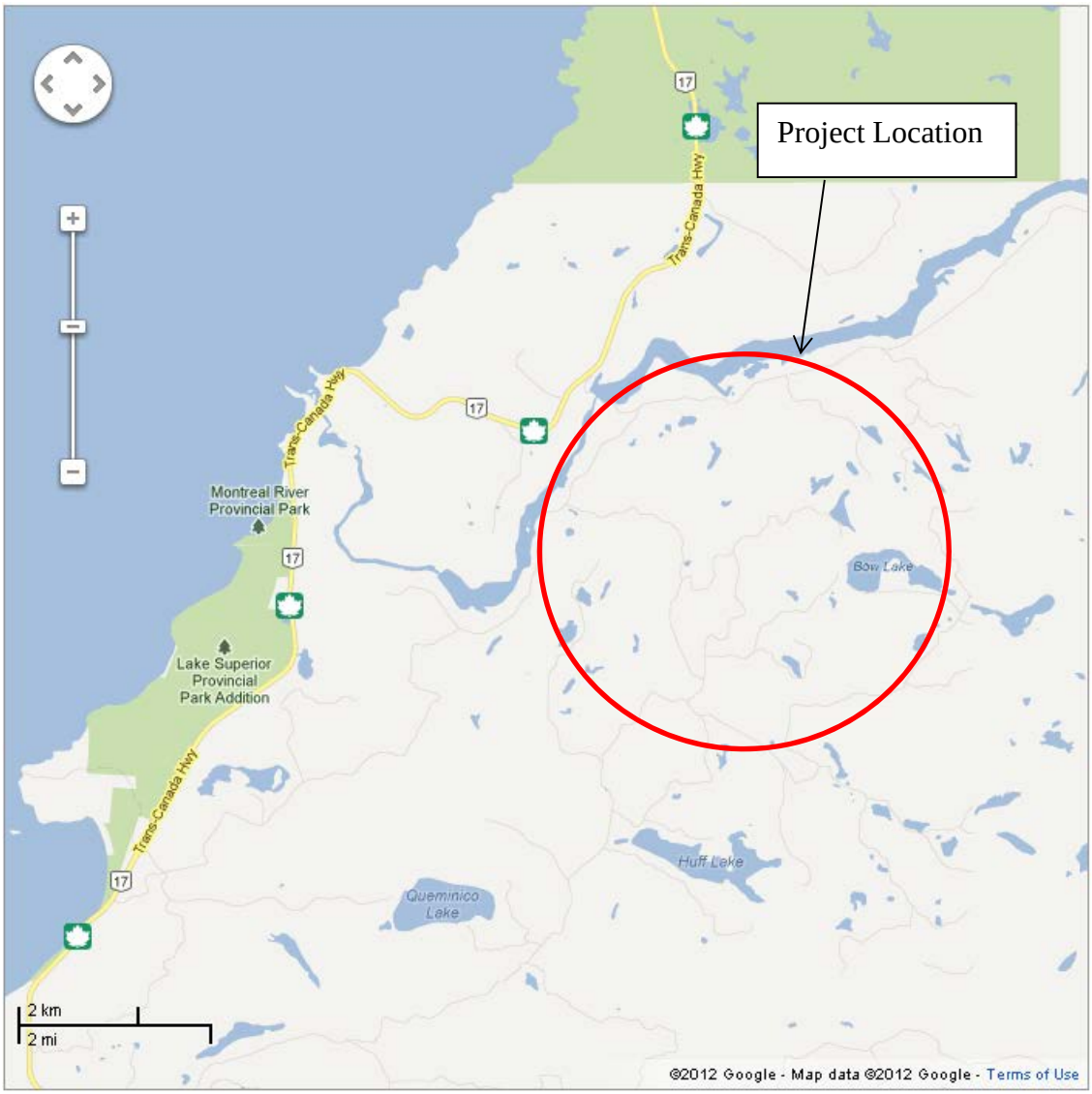
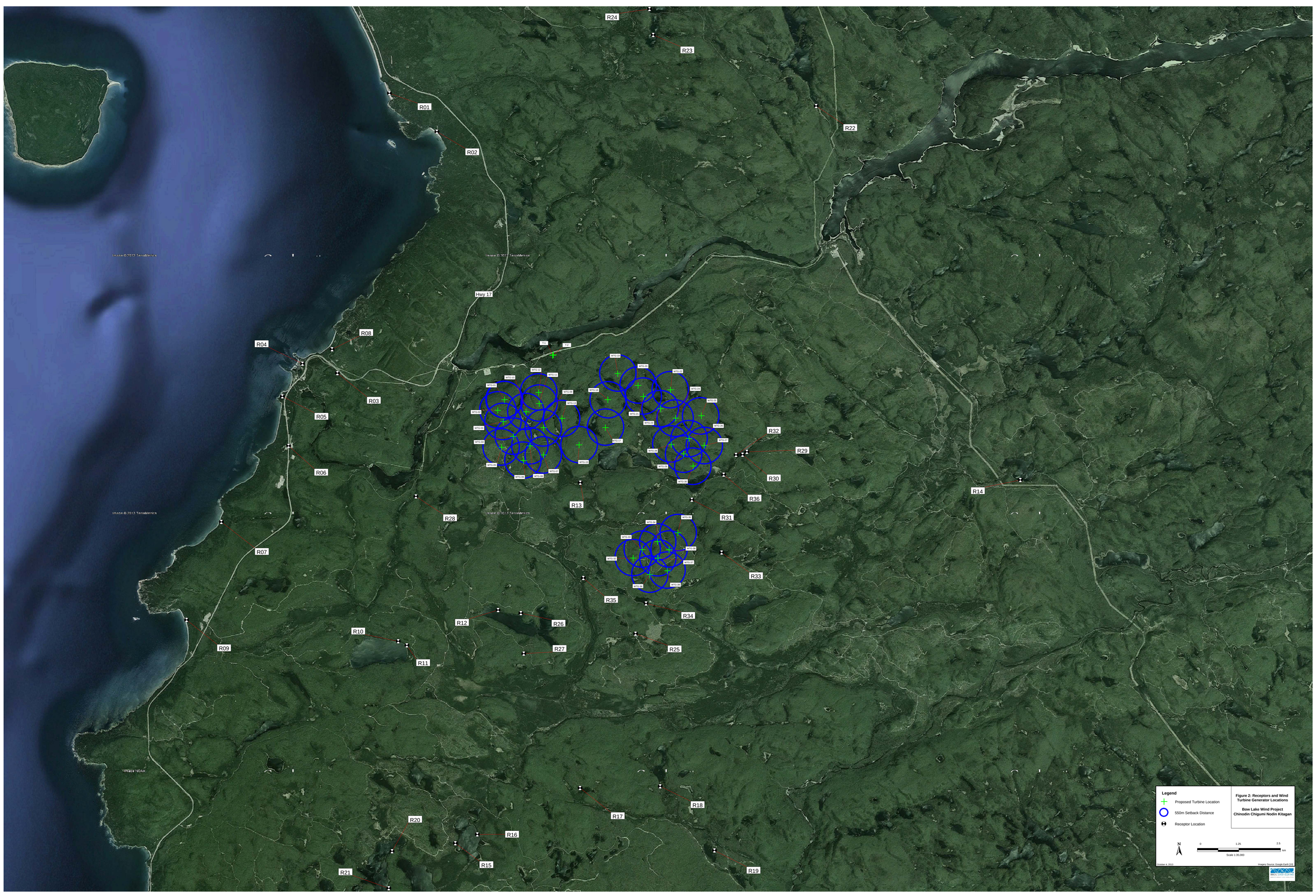


Figure 1: Bow Lake Wind Project



FRAME COORDINATES ARE UTM IN METRES

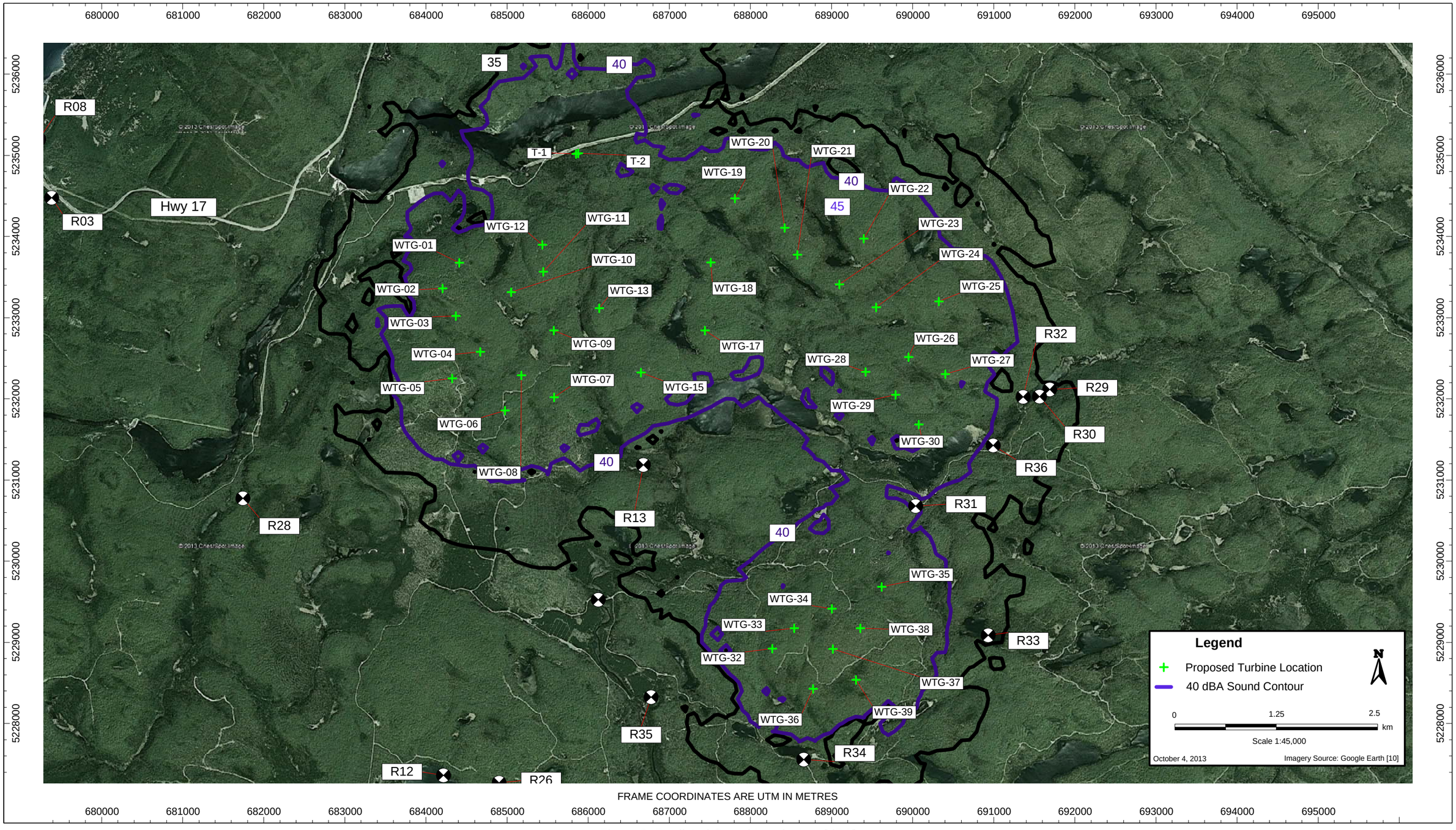


Figure 3: Predicted Sound Levels, Leq [dBA]
Bow Lake Wind Project / Chinodin Chigumi Nodin Kitagan
Sound Level Grid Calculated at 4.5m

APPENDIX A:
ASSESSMENT SUMMARY TABLES

NOISE ASSESSMENT SUMMARY TABLES

VERSION CONTROL

Bow Lake Wind Project/Chinodin Chigumi Nodin Kitagan, Algoma District, Ontario

Tables Ver.	Date	Issued as Part of NAR?	Version Description	Prepared By
1	5-Oct-12	Y	Original DRAFT Acoustic Assessment Report supporting a Renewable Energy Application	M. Brenner
2	15-Jan-13	Y	Finalized Original Acoustic Assessment Report supporting a Renewable Energy Application	I. Bonsma
3	7-Mar-13	Y	Revised version of tables as part of Ver. 3 of the Acoustic Assessment Report	I. Bonsma
4	4-Oct-13	Y	Revised version of tables as part of Ver. 4 of the Noise Assessment Report	I. Bonsma

Table A1: General Electric GE1.6-100 Wind Turbine Acoustic Emissions Summary
Bow Lake Wind Project / Chinodin Chigumi Nodin Kitagan

Make and Model:	General Electric, GE 1.6-100
Electrical Rating:	1620 kW
Hub Height (m):	96 m
Wind Shear Coefficient:	Maximum sound power level utilized to account for average summer nighttime wind shear value of 0.27.

	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					**Adjusted Emission Level**				
Wind Speed [m/s]	**6**	**7**	**8**	**9**	**10**	**6**	**7**	**8**	**9**	**10**
Frequency [Hz]										
63	112.2	115.3	115.4	115.4	115.3	115.3	115.3	115.3	115.3	115.3
125	107.4	109.9	110.1	110.1	109.9	109.9	109.9	109.9	109.9	109.9
250	104.3	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2
500	101.4	101.9	101.7	101.8	102.0	102.0	102.0	102.0	102.0	102.0
1000	96.2	100.6	100.8	100.9	101.0	101.0	101.0	101.0	101.0	101.0
2000	93.2	95.9	95.8	95.5	95.0	95.0	95.0	95.0	95.0	95.0
4000	87.2	87.2	86.3	85.7	85.1	85.1	85.1	85.1	85.1	85.1
8000	70.3	70.3	68.9	68.3	68.3	68.3	68.3	68.3	68.3	68.3
Overall A-Weighted	102.9	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0

Table A2: Wind Turbine Generator Locations
Bow Lake Wind Project / Chinodin Chigumi Nodin Kitagan

Source ID	Wind Turbine Generator Make and Model	UTM Coordinates	
		Easting	Northing
WTG-01	General Electric, GE1.6-100, 96m hub height, 1.62 MW	684408	5233679
WTG-02	General Electric, GE1.6-100, 96m hub height, 1.62 MW	684204	5233361
WTG-03	General Electric, GE1.6-100, 96m hub height, 1.62 MW	684368	5233023
WTG-04	General Electric, GE1.6-100, 96m hub height, 1.62 MW	684670	5232579
WTG-05	General Electric, GE1.6-100, 96m hub height, 1.62 MW	684321	5232252
WTG-06	General Electric, GE1.6-100, 96m hub height, 1.62 MW	684974	5231855
WTG-07	General Electric, GE1.6-100, 96m hub height, 1.62 MW	685581	5232019
WTG-08	General Electric, GE1.6-100, 96m hub height, 1.62 MW	685174	5232291
WTG-09	General Electric, GE1.6-100, 96m hub height, 1.62 MW	685577	5232844
WTG-10	General Electric, GE1.6-100, 96m hub height, 1.62 MW	685052	5233316
WTG-11	General Electric, GE1.6-100, 96m hub height, 1.62 MW	685448	5233567
WTG-12	General Electric, GE1.6-100, 96m hub height, 1.62 MW	685433	5233896
WTG-13	General Electric, GE1.6-100, 96m hub height, 1.62 MW	686134	5233118
WTG-15	General Electric, GE1.6-100, 96m hub height, 1.62 MW	686649	5232323
WTG-17	General Electric, GE1.6-100, 96m hub height, 1.62 MW	687439	5232842
WTG-18	General Electric, GE1.6-100, 96m hub height, 1.62 MW	687513	5233680
WTG-19	General Electric, GE1.6-100, 96m hub height, 1.62 MW	687810	5234468
WTG-20	General Electric, GE1.6-100, 96m hub height, 1.62 MW	688422	5234108
WTG-21	General Electric, GE1.6-100, 96m hub height, 1.62 MW	688580	5233775
WTG-22	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689396	5233976
WTG-23	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689097	5233410
WTG-24	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689550	5233127
WTG-25	General Electric, GE1.6-100, 96m hub height, 1.62 MW	690322	5233201
WTG-26	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689951	5232514
WTG-27	General Electric, GE1.6-100, 96m hub height, 1.62 MW	690404	5232305
WTG-28	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689420	5232332
WTG-29	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689790	5232049
WTG-30	General Electric, GE1.6-100, 96m hub height, 1.62 MW	690077	5231685
WTG-32	General Electric, GE1.6-100, 96m hub height, 1.62 MW	688270	5228924
WTG-33	General Electric, GE1.6-100, 96m hub height, 1.62 MW	688540	5229174
WTG-34	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689006	5229415
WTG-35	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689618	5229683
WTG-36	General Electric, GE1.6-100, 96m hub height, 1.62 MW	688772	5228426
WTG-37	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689017	5228919
WTG-38	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689354	5229175
WTG-39	General Electric, GE1.6-100, 96m hub height, 1.62 MW	689304	5228538
T-1	Transformer	685851	5235017
T-2	Transformer	685877	5235025

Table A3: Non-Participating Receptor Locations
Bow Lake Wind Project / Chinodin Chigumi Nodin Kitagan

Point of Reception ID	Description	UTM Coordinates	
		Easting	Northing
R01	Non-Participating Receptor	680950	5242889
R02	Non-Participating Receptor	682378	5241734
R03	Non-Participating Receptor	679386	5234477
R04	Non-Participating Receptor	678338	5234759
R05	Non-Participating Receptor	677734	5233780
R06	Non-Participating Receptor	677917	5232292
R07	Non-Participating Receptor	675896	5230007
R08	Non-Participating Receptor	679224	5235197
R09	Non-Participating Receptor	674856	5227064
R10	Non-Participating Receptor	681214	5226420
R11	Non-Participating Receptor	681475	5226300
R12	Non-Participating Receptor	684217	5227359
R13	Non-Participating Receptor	686682	5231187
R14	Non-Participating Receptor	699905	5231268
R15	Non-Participating Receptor	682931	5220354
R16	Non-Participating Receptor	683592	5220618
R17	Non-Participating Receptor	686681	5222015
R18	Non-Participating Receptor	689087	5222064
R19	Non-Participating Receptor	690713	5220139
R20	Non-Participating Receptor	681031	5220112
R21	Non-Participating Receptor	680928	5218998
R22	Non-Participating Receptor	693771	5242502
R23	Non-Participating Receptor	688874	5244639
R24	Non-Participating Receptor	688762	5245419
R25	Non-Participating Receptor	688345	5226647
R26	Non-Participating Receptor	684903	5227268
R27	Non-Participating Receptor	684988	5226048
R28	Non-Participating Receptor	681743	5230774
R29	Non-Participating Receptor	691690	5232115
R30	Non-Participating Receptor	691564	5232026
R31	Non-Participating Receptor	690036	5230677
R32	Non-Participating Receptor	691364	5232023
R33	Non-Participating Receptor	690933	5229086
R34	Non-Participating Receptor	688657	5227556
R35	Non-Participating Receptor	686777	5228323
R36	Non-Participating Receptor	690993	5231427

Table A4: Wind Turbine Noise Impact Summary - Non-Participating Receptor Locations
Bow Lake Wind Project / Chinodin Chigumi Nodin Kitagan

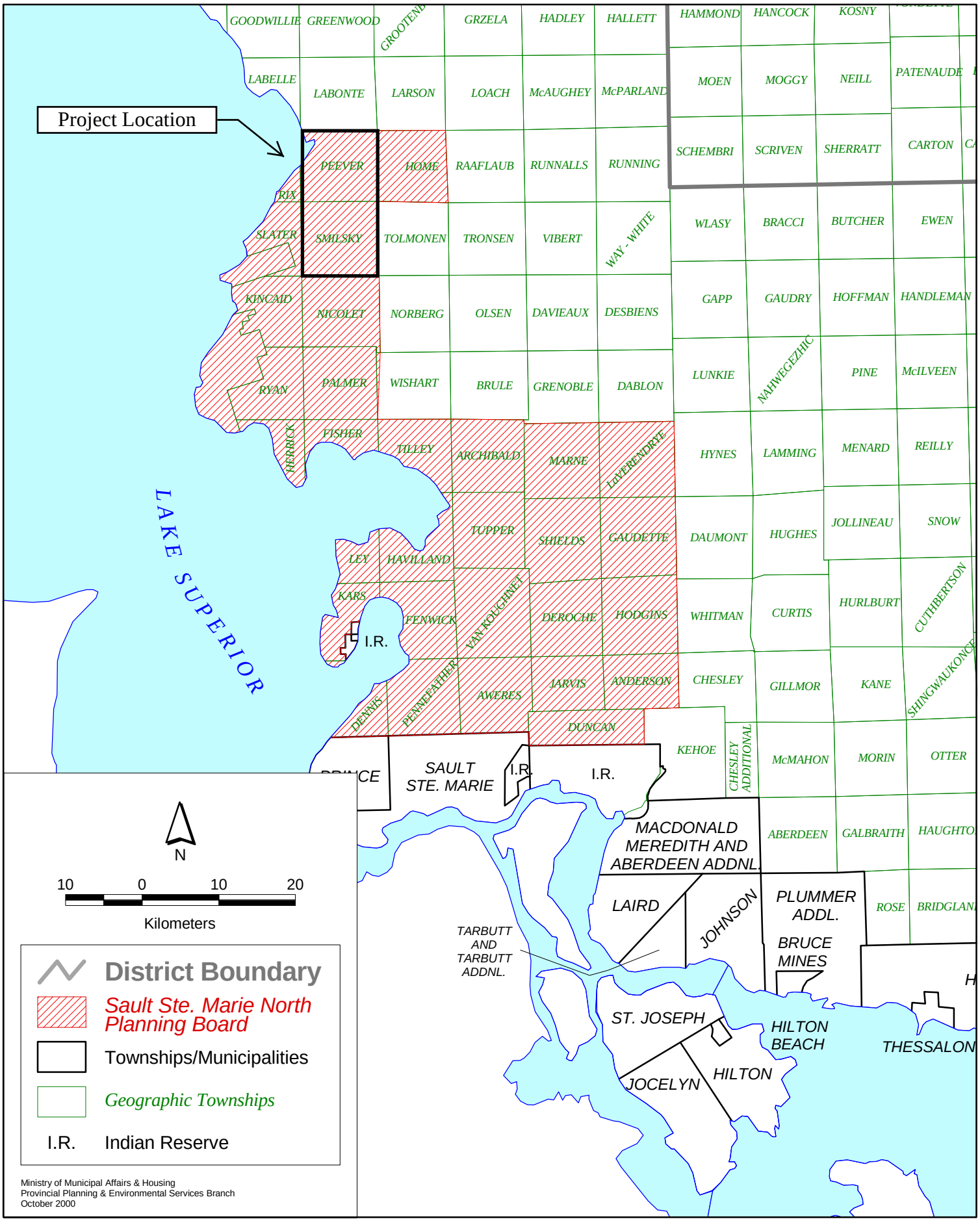
Point of Reception ID	Description	Height [m]	Distance to Nearest Source [m]	Nearest Turbine ID	Calculated Sound Level [dBA] at Selected Wind Speeds (m/s)					Sound Level Limit [dBA]
					6	7	8	9	10	
R01	Non-Participating Receptor	4.5	9838	WTG-01	-	-	-	-	-	40.0
R02	Non-Participating Receptor	4.5	8307	WTG-01	-	-	-	-	-	40.0
R03	Non-Participating Receptor	4.5	4946	WTG-02	-	-	-	-	-	40.0
R04	Non-Participating Receptor	4.5	6031	WTG-02	-	-	-	-	-	40.0
R05	Non-Participating Receptor	4.5	6484	WTG-02	-	-	-	-	-	40.0
R06	Non-Participating Receptor	4.5	6378	WTG-02	-	-	-	-	-	40.0
R07	Non-Participating Receptor	4.5	8719	WTG-05	-	-	-	-	-	40.0
R08	Non-Participating Receptor	4.5	5308	WTG-02	-	-	-	-	-	40.0
R09	Non-Participating Receptor	4.5	10793	WTG-05	-	-	-	-	-	40.0
R10	Non-Participating Receptor	4.5	6608	WTG-05	-	-	-	-	-	40.0
R11	Non-Participating Receptor	4.5	6565	WTG-06	-	-	-	-	-	40.0
R12	Non-Participating Receptor	4.5	4344	WTG-32	-	-	-	-	-	40.0
R13	Non-Participating Receptor	4.5	1137	WTG-15	39.1	39.1	39.1	39.1	39.1	40.0
R14	Non-Participating Receptor	4.5	9557	WTG-27	-	-	-	-	-	40.0
R15	Non-Participating Receptor	4.5	9964	WTG-36	-	-	-	-	-	40.0
R16	Non-Participating Receptor	4.5	9370	WTG-36	-	-	-	-	-	40.0
R17	Non-Participating Receptor	4.5	6744	WTG-36	-	-	-	-	-	40.0
R18	Non-Participating Receptor	4.5	6370	WTG-36	-	-	-	-	-	40.0
R19	Non-Participating Receptor	4.5	8511	WTG-36	-	-	-	-	-	40.0
R20	Non-Participating Receptor	4.5	11360	WTG-36	-	-	-	-	-	40.0
R21	Non-Participating Receptor	4.5	12265	WTG-36	-	-	-	-	-	40.0
R22	Non-Participating Receptor	4.5	9583	WTG-22	-	-	-	-	-	40.0
R23	Non-Participating Receptor	4.5	10227	WTG-19	-	-	-	-	-	40.0
R24	Non-Participating Receptor	4.5	10992	WTG-19	-	-	-	-	-	40.0
R25	Non-Participating Receptor	4.5	1830	WTG-36	-	-	-	-	-	40.0
R26	Non-Participating Receptor	4.5	3752	WTG-32	-	-	-	-	-	40.0
R27	Non-Participating Receptor	4.5	4364	WTG-32	-	-	-	-	-	40.0
R28	Non-Participating Receptor	4.5	2971	WTG-05	-	-	-	-	-	40.0
R29	Non-Participating Receptor	4.5	1300	WTG-27	35.4	35.4	35.4	35.4	35.4	40.0
R30	Non-Participating Receptor	4.5	1193	WTG-27	36.8	36.8	36.8	36.8	36.8	40.0
R31	Non-Participating Receptor	4.5	1008	WTG-30	39.9	39.9	39.9	39.9	39.9	40.0
R32	Non-Participating Receptor	4.5	1001	WTG-27	37.6	37.6	37.6	37.6	37.6	40.0
R33	Non-Participating Receptor	4.5	1445	WTG-35	36.2	36.2	36.2	36.2	36.2	40.0
R34	Non-Participating Receptor	4.5	878	WTG-36	38.3	38.3	38.3	38.3	38.3	40.0
R35	Non-Participating Receptor	4.5	1609	WTG-32	-	-	-	-	-	40.0
R36	Non-Participating Receptor	4.5	952	WTG-30	39.0	39.0	39.0	39.0	39.0	40.0

"-" Distance to wind turbine generator greater than 1500m

APPENDIX B:

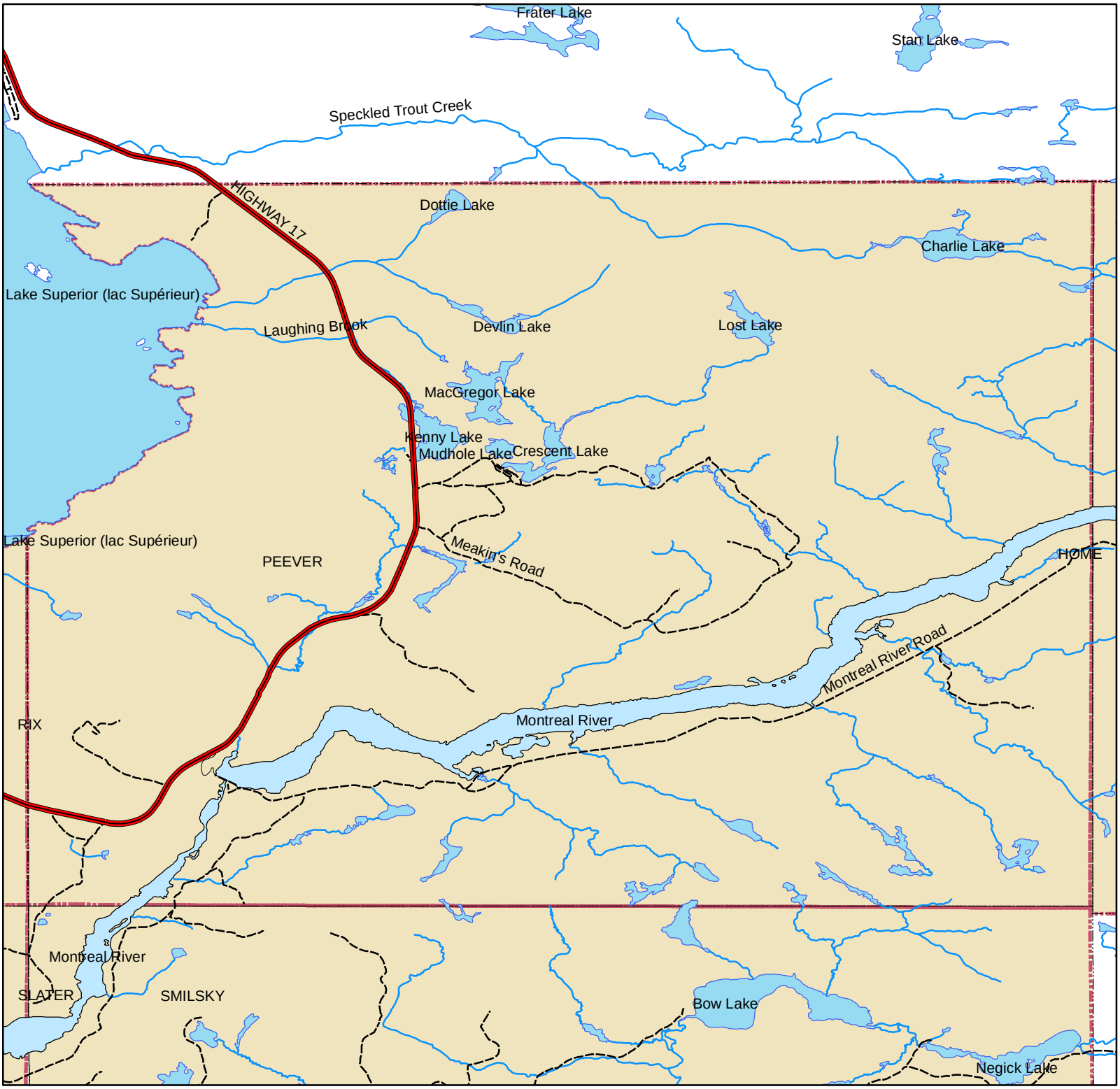
Zoning Maps

Sault Ste. Marie North Planning Board



Ministry of Municipal Affairs & Housing
Provincial Planning & Environmental Services Branch
October 2000

Zoning for Peever Township



Legend

* Mobile Homes permitted

1982 Zoning

ZONE

- Urban Residential
- Rural Residential*
- Seasonal Residential
- Mobile Home Park*
- General Commercial
- Resort Commercial
- General Industrial
- Institutional
- Open Space
- Waste Disposal
- Rural*
- Environmental Protection

- Lot Fabric
- Townships

Water

- Lake
- River

Stream

- Permanent
- Intermittent

All Roads

- Arterial
- Collector
- Expressway / Highway
- Local Street
- Ramp
- Resource / Recreation

N W E S

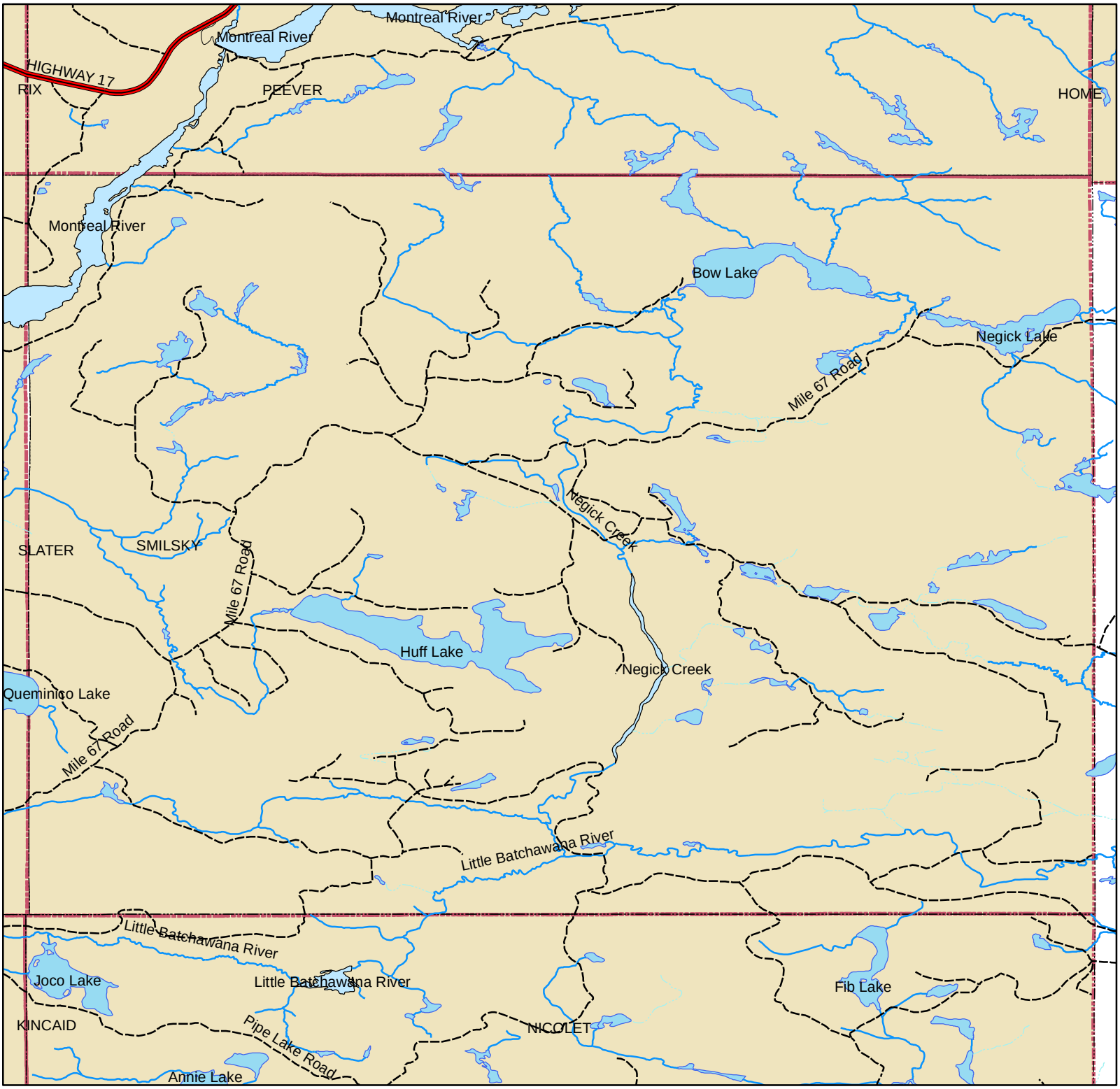
1:70,000

2,200 1,100 0 2,200 Meters

Created by:
Sault Ste. Marie North Planning Board

Date: 13/06/2012

Zoning for Smilsky Township



Legend

* Mobile Homes permitted

1982 Zoning

ZONE

- Urban Residential
- Rural Residential*
- Seasonal Residential
- Mobile Home Park*
- General Commercial
- Resort Commercial
- General Industrial
- Institutional
- Open Space
- Waste Disposal
- Rural*
- Environmental Protection

- Lot Fabric
- Townships

Water

- Lake
- River

Stream

- Permanent
- Intermittent

All Roads

- Arterial
- Collector
- Expressway / Highway
- Local Street
- Ramp
- Resource / Recreation

N
W E
S

1:70,000

2,200 1,100 0 2,200 Meters

Created by:
Sault Ste. Marie North Planning Board

Date: 13/06/2012

APPENDIX C:

General Electric GE 1.6-100

Wind Turbine Generator Information

GE Power & Water
Renewable Energy

Introducing GE's **1.6-100**

Best-in-class capacity factor

a product of
ecomagination

imagination at work

Introducing GE's **1.6-100**

Product evolution. It's one of the things GE does best. Especially when it comes to the next generation of wind turbines. Building on a strong power generation heritage spanning more than a century, our onshore wind turbines deliver proven performance, availability and reliability—creating more value for our customers.

As one of the world's leading wind turbine suppliers, GE Energy's current product portfolio includes wind turbines with rated capacities ranging from 1.5 MW–4.1 MW and support services extending from development assistance to operation and maintenance.

GE's 1.6-100 Wind Turbine

GE's 1.6-100 wind turbine offers a 47% increase in swept area when compared to the 1.6-82.5 turbine, resulting in 19% increase in Annual Energy Production (AEP) at 7.5 m/s. This increase in blade swept area allows greater energy capture and improved project economics for wind developers. GE's 1.6-100 turbine has a 53% gross capacity factor, at 7.5 m/s; a class leading performance. GE's proprietary 48.7 meter blade uses the same proven aerodynamic shape as the blades found on the 2.5-100 turbine, but with the use of carbon fiber the weight is significantly reduced from the original blade predecessor.

GE's stringent design procedures result in a turbine designed for high performance, reliability and availability. The use of the rotor from the proven GE 2.5-100 turbine and selected component modifications provide increased annual production with the same reliable performance as the 1.5 MW series turbine.

Available in 80 meter and 100 meter tower heights, these sizes provide flexible options for Class III wind sites, allowing for higher energy capture in lower wind speed environments.

Building Upon the Proven 1.5 MW and 2.5 MW Platforms

The evolution of GE's 1.5 MW turbine design began with the 1.5i turbine introduced in 1996. The 65 meter rotor was increased to 70.5 meters in the 1.5s then to 77 meters in the 1.5sle turbine which was introduced in 2004. Building on the exceptional performance and reliability of the 1.5sle, GE introduced the 1.5xle with its 82.5 meter diameter in 2005. Subsequent improvements in design led to the 1.6-82.5 turbine, introduced in 2008. Ongoing investment in the industry workhorse resulted in the introduction of GE's 1.6-100 wind turbine with a 100 meter rotor. This product evolution ensures increased capacity factor while increasing AEP by 19%.

Incremental changes to the 1.6-100 resulted in a significant performance increase. These enhancements include greater blade length, use of carbon fiber, Low Noise Trailing Edge (LNTE) and gearbox improvements resulting in an increase in AEP, high capacity factor, and controlled sound performance.

GE's new, Low Noise Trailing Edge serrations are employed on this turbine to enable tailored sound as a function of wind speed for a smaller sound footprint and optimized park layout to increase AEP. Testing has shown this design for the blade enables improved turbine acoustic performance. Designed with high reliability to ensure continued operation in the field, GE's 1.6-100 can provide excellent availability comparable with the 1.5 MW series units operating in the field today.

Technical Description

GE's 1.6-100 wind turbine is a three-blade, upwind, horizontal axis wind turbine with a rotor diameter of 100 meters. The turbine rotor and nacelle are mounted on top of a tubular steel tower providing hub heights of 80 meters and 100 meters. The machine uses active yaw control to keep the blades pointed into the wind. The turbine is designed to operate at a variable speed and uses a doubly fed asynchronous generator with a partial power converter system.

Specifications:

1.6-100 Wind Turbine:

- Designed to IEC 61400-1
  — TC III: 7.5 m/s average wind speed; B turbulence intensity
- Standard and cold weather extreme options
- Standard tower corrosion protection; C2 internal and C3 external with optional C4 internal and C5 external available
- Rotational direction: Clockwise viewed from an upwind location
- Speed regulation: Electric drive pitch control with battery backup
- Aerodynamic brake: Full feathering of blade pitch

Features and Benefits

- Higher AEP than its 1.6 predecessors
- Highest capacity factor in its class
- Designed to meet or exceed the 1.5 MW platform's historic high availability
- Grid friendly options are available
  — Enhanced Reactive Power, Voltage Ride Thru, Power Factor Control
- Wind Farm Control System; WindSCADA*
- Sharing of components with family products
- GE proprietary 48.7 meter blade
- Ultra-quiet power production Low Noise Trailing Edge serrations as an acoustic enhancement for the 1.6-100
- Available in both 50 Hz and 60 Hz versions for global suitability

Construction

Towers: tubular steel sections provide variable hub heights from 80 meters to 100 meters

Blades: GE 48.7 meter blades with Low Noise Trailing Edge serrations

- Providing high energy capture with low sound emission
- Carbon spar caps within blades reduce weight, which reduces turbine loads

Drivetrain components: GE's 1.6-100 uses proven design gearboxes, mainshaft and generators with appropriate improvements to enable the larger rotor diameter on the 1.6 MW machine

Enhanced Controls Technology

The 1.6-100 wind turbine employs two enhanced control features:

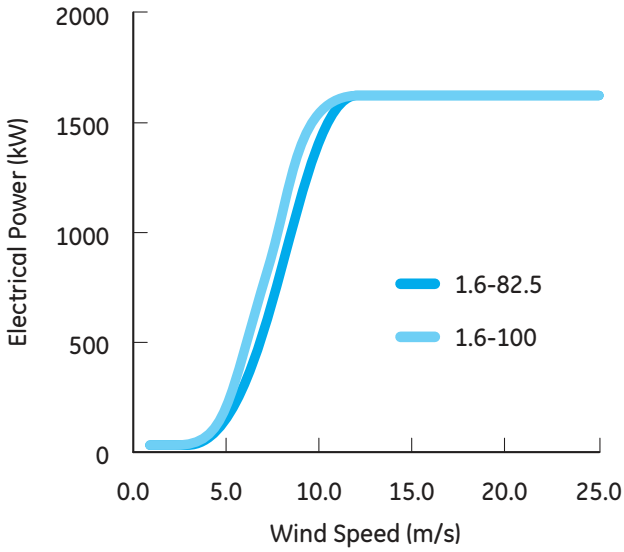
- GE's patented Advanced Loads Control reduces loads on turbine components by measuring stresses and individually adjusting blade pitch
- Controls developed by GE Global Research minimize loads including at near rated wind speeds to improve Annual Energy Production (AEP)

Condition Based Monitoring

GE's Condition Based Monitoring (CBM) and SCADA Anomaly Detection Services, a complementary suite of advanced condition monitoring solutions, proactively detect impending drive train and whole-turbine issues enabling increased availability and decreased maintenance expenses. Built upon half a century of power generation drivetrain and data anomaly monitoring experience, this service solution is available as an option on new GE Units and as an upgrade.

1.6-100 Specifications

Power Curve Improvement



Highest capacity factor in its class

- **Value.** Best in Class Capacity Factor, 53% @ 7.5 m/s
- **Reliability.** GE fleet at 98%+ availability
- **Experience.** 16,500+ fleet, most 100 meter+ rotors, 2.1 million operating hours
- **Finance-ability.** Evolutionary design using "proven technology" from GE 1.5 MW and 2.5 MW platforms

1.6 MW wind turbine, Tahachapi, California, U.S.A.

Powering the world...responsibly.

For more information please visit www.ge-energy.com/wind.

GEA18628 (04/2011)

APPENDIX D:
GE 1.6-100 Wind Turbine Generator
Sound Power Data

GE
Energy

REA Specifications Report

BluEarth Renewables – Bow Lake

1.6-100

February, 2012

Basic Turbine Information

Make and Model: GE 1.6-100

Nameplate Capacity: 1.62 MW

Hub Height Above Grade: 96m

Rotational Speed Range: 9.75 to 15.33 RPM

Acoustic Emissions Data*

*In Accord with CAN/CSA-C61400-11:07 – which adopted without modification IEC 61400-11, ed. 2.1:2006.

Overall and Octave-Band Sound Power Values

Wind speed at hub height (m/s)	Overall 1.6-100 96 m hub height LWA (dBA)	63 Hz Octave band level (dBA)	125 Hz Octave band level (dBA)	250 Hz Octave band level (dBA)	500 Hz Octave band level (dBA)	1000 Hz Octave band level (dBA)	2000 Hz Octave band level (dBA)	4000 Hz Octave band level (dBA)	8000 Hz Octave band level (dBA)	16000 Hz Octave band level (dBA)
7.2	98.4	81.9	87.1	91.2	93.0	91.7	90.5	83.6	63.4	18.5
7.9	100.8	84.1	89.3	93.7	95.8	94.0	92.5	86.1	66.5	21.3
8.6	102.9	86.0	91.3	95.7	98.2	96.2	94.4	88.2	69.2	23.7
9.3	104.2	88.0	92.8	95.5	98.7	99.1	96.0	87.9	67.8	24.6
10.0	105.0	89.1	93.8	95.6	98.7	100.6	97.1	88.2	69.2	25.4
11.5	105.0	89.2	94.0	95.6	98.5	100.8	97.0	87.3	67.8	24.5
12.9	105.0	89.2	94.0	95.6	98.6	100.9	96.7	86.7	67.2	25.8
14 - cutout	105.0	89.1	93.8	95.6	98.8	101.0	96.2	86.1	67.2	27.3

Measurement Uncertainty Value: <2 dBa for 95% confidence interval per IEC/TS 61400-14

Tonality and Tonal Audibility: <2dB at a ground distance from the turbine base equal to hub height plus half the rotor diameter.

APPENDIX E:
CALCULATION DETAILS

Summary of Calculations - Overall dBA Format

R13	P1 NSA, camp	686682	5231187	364.4												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
WTG-01	General Electric, GE1.6-100	684408	5233679	571.0	105	81.6	0	0.0	-3.3	0.0	6.9	0.0	0.0	0.0	0.0	20
WTG-02	General Electric, GE1.6-100	684204	5233361	605.0	105	81.4	0	0.0	-3.3	0.0	6.8	0.0	0.0	0.0	0.0	20
WTG-03	General Electric, GE1.6-100	684368	5233023	621.0	105	80.4	0	0.0	-3.0	0.0	6.3	0.0	0.0	0.0	0.0	21
WTG-04	General Electric, GE1.6-100	684670	5232580	601.0	105	78.8	0	0.0	-3.0	0.0	5.5	0.0	0.0	0.0	0.0	24
WTG-05	General Electric, GE1.6-100	684321	5232252	555.8	105	79.3	0	0.0	-3.0	0.0	5.8	0.0	0.0	0.0	0.0	23
WTG-06	General Electric, GE1.6-100	684974	5231856	553.7	105	76.3	0	0.0	-3.0	0.0	4.5	0.0	0.0	0.0	0.0	27
WTG-07	General Electric, GE1.6-100	685581	5232019	561.0	105	73.9	0	0.0	-3.0	0.0	3.7	0.0	0.0	0.0	0.0	30
WTG-08	General Electric, GE1.6-100	685174	5232292	581.0	105	76.5	0	0.0	-3.0	0.0	4.6	0.0	0.0	0.0	0.0	27
WTG-09	General Electric, GE1.6-100	685577	5232844	561.0	105	77.0	0	0.0	-3.0	0.0	4.8	0.0	0.0	0.0	0.0	26
WTG-10	General Electric, GE1.6-100	685052	5233316	586.0	105	79.6	0	0.0	-3.0	0.0	5.9	0.0	0.0	0.0	0.0	23
WTG-11	General Electric, GE1.6-100	685448	5233568	601.0	105	79.6	0	0.0	-3.0	4.8	5.9	0.0	0.0	0.0	0.0	18
WTG-12	General Electric, GE1.6-100	685433	5233896	591.0	105	80.5	0	0.0	-3.0	4.8	6.3	0.0	0.0	0.0	0.0	16
WTG-13	General Electric, GE1.6-100	686134	5233118	596.0	105	77.1	0	0.0	-3.0	4.8	4.8	0.0	0.0	0.0	0.0	21
WTG-15	General Electric, GE1.6-100	686649	5232324	621.0	105	72.3	0	0.0	-3.0	0.0	3.2	0.0	0.0	0.0	0.0	33
WTG-17	General Electric, GE1.6-100	687439	5232843	591.0	105	76.3	0	0.0	-3.0	0.0	4.5	0.0	0.0	0.0	0.0	27
WTG-18	General Electric, GE1.6-100	687513	5233680	586.0	105	79.4	0	0.0	-3.0	4.8	5.8	0.0	0.0	0.0	0.0	18
WTG-19	General Electric, GE1.6-100	687810	5234468	594.7	105	81.8	0	0.0	-3.4	4.8	7.0	0.0	0.0	0.0	0.0	15
WTG-20	General Electric, GE1.6-100	688422	5234108	591.0	105	81.7	0	0.0	-3.3	0.0	6.9	0.0	0.0	0.0	0.0	20
WTG-21	General Electric, GE1.6-100	688580	5233776	586.0	105	81.2	0	0.0	-3.2	0.0	6.6	0.0	0.0	0.0	0.0	20
WTG-22	General Electric, GE1.6-100	689396	5233976	641.0	105	82.8	0	0.0	-3.7	0.0	7.5	0.0	0.0	0.0	0.0	18
WTG-23	General Electric, GE1.6-100	689097	5233410	601.0	105	81.4	0	0.0	-3.2	0.0	6.7	0.0	0.0	0.0	0.0	20
WTG-24	General Electric, GE1.6-100	689550	5233128	596.0	105	81.8	0	0.0	-3.4	0.0	7.0	0.0	0.0	0.0	0.0	20
WTG-25	General Electric, GE1.6-100	690322	5233201	626.0	105	83.4	0	0.0	-3.8	0.0	7.8	0.0	0.0	0.0	0.0	18
WTG-26	General Electric, GE1.6-100	689951	5232514	601.0	105	82.0	0	0.0	-3.4	0.0	7.1	0.0	0.0	0.0	0.0	19
WTG-27	General Electric, GE1.6-100	690404	5232305	646.0	105	82.8	0	0.0	-3.7	0.0	7.5	0.0	0.0	0.0	0.0	18
WTG-28	General Electric, GE1.6-100	689420	5232332	599.5	105	80.5	0	0.0	-3.0	0.0	6.3	0.0	0.0	0.0	0.0	21
WTG-29	General Electric, GE1.6-100	689790	5232049	601.0	105	81.2	0	0.0	-3.2	0.0	6.7	0.0	0.0	0.0	0.0	20
WTG-30	General Electric, GE1.6-100	690077	5231685	601.0	105	81.7	0	0.0	-3.4	0.0	6.9	0.0	0.0	0.0	0.0	20
WTG-32	General Electric, GE1.6-100	688270	5228924	601.0	105	79.9	0	0.0	-3.0	0.0	6.0	0.0	0.0	0.0	0.0	22
WTG-33	General Electric, GE1.6-100	688540	5229175	621.0	105	79.8	0	0.0	-3.0	0.0	6.0	0.0	0.0	0.0	0.0	22
WTG-34	General Electric, GE1.6-100	689006	5229416	589.6	105	80.3	0	0.0	-3.0	0.0	6.3	0.0	0.0	0.0	0.0	21
WTG-35	General Electric, GE1.6-100	689618	5229684	586.0	105	81.4	0	0.0	-3.3	4.8	6.8	0.0	0.0	0.0	0.0	15
WTG-36	General Electric, GE1.6-100	688772	5228426	601.0	105	81.8	0	0.0	-3.4	0.0	7.0	0.0	0.0	0.0	0.0	20
WTG-37	General Electric, GE1.6-100	689017	5228920	635.0	105	81.3	0	0.0	-3.2	0.0	6.7	0.0	0.0	0.0	0.0	20
WTG-38	General Electric, GE1.6-100	689354	5229176	625.7	105	81.5	0	0.0	-3.3	0.0	6.8	0.0	0.0	0.0	0.0	20
WTG-39	General Electric, GE1.6-100	689304	5228539	611.0	105	82.5	0	0.0	-3.6	0.0	7.3	0.0	0.0	0.0	0.0	19
T-1	Transformer	685851	5235017	312.6	108	82.9	0	0.0	-5.8	15.3	4.9	0.0	0.0	0.0	0.0	11
T-2	Transformer	685877	5235025	313.3	108	82.9	0	0.0	-5.8	14.0	5.0	0.0	0.0	0.0	0.0	12

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

R29	HC-6	691690	5232115	380.7												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
WTG-17	General Electric, GE1.6-100	687439	5232843	591.0	105	83.7	0	0.0	-3.9	4.8	8.0	0.0	0.0	0.0	0.0	12
WTG-18	General Electric, GE1.6-100	687513	5233680	586.0	105	84.0	0	0.0	-4.0	4.8	8.1	0.0	0.0	0.0	0.0	12
WTG-19	General Electric, GE1.6-100	687810	5234468	594.7	105	84.2	0	0.0	-4.0	4.8	8.2	0.0	0.0	0.0	0.0	12
WTG-20	General Electric, GE1.6-100	688422	5234108	591.0	105	82.7	0	0.0	-3.6	4.8	7.4	0.0	0.0	0.0	0.0	14
WTG-21	General Electric, GE1.6-100	688580	5233776	586.0	105	82.0	0	0.0	-3.4	4.8	7.0	0.0	0.0	0.0	0.0	15
WTG-22	General Electric, GE1.6-100	689396	5233976	641.0	105	80.4	0	0.0	-3.0	4.8	6.3	0.0	0.0	0.0	0.0	16
WTG-23	General Electric, GE1.6-100	689097	5233410	601.0	105	80.3	0	0.0	-3.0	4.8	6.2	0.0	0.0	0.0	0.0	17
WTG-24	General Electric, GE1.6-100	689550	5233128	596.0	105	78.5	0	0.0	-3.0	4.8	5.4	0.0	0.0	0.0	0.0	19
WTG-25	General Electric, GE1.6-100	690322	5233201	626.0	105	75.9	0	0.0	-3.0	4.8	4.4	0.0	0.0	0.0	0.0	23
WTG-26	General Electric, GE1.6-100	689951	5232514	601.0	105	76.1	0	0.0	-3.0	4.8	4.4	0.0	0.0	0.0	0.0	23
WTG-27	General Electric, GE1.6-100	690404	5232305	646.0	105	73.5	0	0.0	-3.0	0.0	3.5	0.0	0.0	0.0	0.0	31
WTG-28	General Electric, GE1.6-100	689420	5232332	599.5	105	78.2	0	0.0	-3.0	4.8	5.3	0.0	0.0	0.0	0.0	20
WTG-29	General Electric, GE1.6-100	689790	5232049	601.0	105	76.6	0	0.0	-3.0	0.0	4.6	0.0	0.0	0.0	0.0	27
WTG-30	General Electric, GE1.6-100	690077	5231685	601.0	105	75.5	0	0.0	-3.0	0.0	4.2	0.0	0.0	0.0	0.0	28
WTG-32	General Electric, GE1.6-100	688270	5228924	601.0	105	84.4	0	0.0	-4.1	0.0	8.4	0.0	0.0	0.0	0.0	16
WTG-33	General Electric, GE1.6-100	688540	5229175	621.0	105	83.7	0	0.0	-3.9	0.0	8.0	0.0	0.0	0.0	0.0	17
WTG-34	General Electric, GE1.6-100	689006	5229416	589.6	105	82.6	0	0.0	-3.6	0.0	7.4	0.0	0.0	0.0	0.0	19
WTG-35	General Electric, GE1.6-100	689618	5229684	586.0	105	81.1	0	0.0	-3.2	4.8	6.6	0.0	0.0	0.0	0.0	16
WTG-36	General Electric, GE1.6-100	688772	5228426	601.0	105	84.5	0	0.0	-4.1	4.8	8.4	0.0	0.0	0.0	0.0	11
WTG-37	General Electric, GE1.6-100	689017	5228920	635.0	105	83.4	0	0.0	-3.8	4.8	7.8	0.0	0.0	0.0	0.0	13
WTG-38	General Electric, GE1.6-100	689354	5229176	625.7	105	82.5	0	0.0	-3.6	4.8	7.3	0.0	0.0	0.0	0.0	14
WTG-39	General Electric, GE1.6-100	689304	5228539	611.0	105	83.7	0	0.0	-3.9	4.8	8.0	0.0	0.0	0.0	0.0	12
T-2	Transformer	693097	5228692	463.6	108	82.4	0	0.0	-5.8	23.8	5.2	0.0	0.0	0.0	0.0	2

R31	FV-2	690036	5230677	369.9												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
WTG-07	General Electric, GE1.6-100	685581	5232019	561.0	105	84.4	0	0.0	-4.1	4.8	8.3	0.0	0.0	0.0	0.0	12
WTG-09	General Electric, GE1.6-100	685577	5232844	561.0	105	84.9	0	0.0	-4.2	4.8	8.6	0.0	0.0	0.0	0.0	11
WTG-13	General Electric, GE1.6-100	686134	5233118	596.0	105	84.3	0	0.0	-4.0	0.0	8.3	0.0	0.0	0.0	0.0	16
WTG-15	General Electric, GE1.6-100	686649	5232324	621.0	105	82.5	0	0.0	-3.6	4.8	7.3	0.0	0.0	0.0	0.0	14
WTG-17	General Electric, GE1.6-100	687439	5232843	591.0	105	81.6	0	0.0	-3.3	0.0	6.9	0.0	0.0	0.0	0.0	20
WTG-18	General Electric, GE1.6-100	687513	5233680	586.0	105	82.9	0	0.0	-3.7	0.0	7.5	0.0	0.0	0.0	0.0	18
WTG-19	General Electric, GE1.6-100	687810	5234468	594.7	105	83.9	0	0.0	-3.9	0.0	8.1	0.0	0.0	0.0	0.0	17
WTG-20	General Electric, GE1.6-100	688422	5234108	591.0	105	82.6	0	0.0	-3.6	4.8	7.4	0.0	0.0	0.0	0.0	14
WTG-21	General Electric, GE1.6-100	688580	5233776	586.0	105	81.7	0	0.0	-3.4	4.8	6.9	0.0	0.0	0.0	0.0	15
WTG-22	General Electric, GE1.6-100	689396	5233976	641.0	105	81.6	0	0.0	-3.3	4.8	6.8	0.0	0.0	0.0	0.0	15
WTG-23	General Electric, GE1.6-100	689097	5233410	601.0	105	80.2	0	0.0	-3.0	4.8	6.2	0.0	0.0	0.0	0.0	17
WTG-24	General Electric, GE1.6-100	689550	5233128	596.0	105	79.0	0	0.0	-3.0	4.8	5.6	0.0	0.0	0.0	0.0	19
WTG-25	General Electric, GE1.6-100	690322	5233201	626.0	105	79.1	0	0.0	-3.0	4.8	5.7	0.0	0.0	0.0	0.0	18
WTG-26	General Electric, GE1.6-100	689951	5232514	601.0	105	76.4	0	0.0	-3.0	4.8	4.5	0.0	0.0	0.0	0.0	22
WTG-27	General Electric, GE1.6-100	690404	5232305	646.0	105	75.6	0	0.0	-3.0	0.0	4.2	0.0	0.0	0.0	0.0	28
WTG-28	General Electric, GE1.6-100	689420	5232332	599.5	105	76.0	0	0.0	-3.0	0.0	4.4	0.0	0.0	0.0	0.0	28
WTG-29	General Electric, GE1.6-100	689790	5232049	601.0	105	74.0	0	0.0	-3.0	0.0	3.7	0.0	0.0	0.0	0.0	30
WTG-30	General Electric, GE1.6-100	690077	5231685	601.0	105	71.3	0	0.0	-3.0	0.0	2.9	0.0	0.0	0.0	0.0	34
WTG-32	General Electric, GE1.6-100	688270	5228924	601.0	105	79.0	0	0.0	-3.0	4.8	5.6	0.0	0.0	0.0	0.0	19
WTG-33	General Electric, GE1.6-100	688540	5229175	621.0	105	77.6	0	0.0	-3.0	4.8	5.0	0.0	0.0	0.0	0.0	21
WTG-34	General Electric, GE1.6-100	689006	5229416	589.6	105	75.3	0	0.0	-3.0	0.0	4.1	0.0	0.0	0.0	0.0	29
WTG-35	General Electric, GE1.6-100	689618	5229684	586.0	105	71.8	0	0.0	-3.0	0.0	3.0	0.0	0.0	0.0	0.0	33
WTG-36	General Electric, GE1.6-100	688772	5228426	601.0	105	79.3	0	0.0	-3.0	4.8	5.8	0.0	0.0	0.0	0.0	18
WTG-37	General Electric, GE1.6-100	689017	5228920	635.0	105	77.2	0	0.0	-3.0	0.0	4.9	0.0	0.0	0.0	0.0	26
WTG-38	General Electric, GE1.6-100	689354	5229176	625.7	105	75.5	0	0.0	-3.0	0.0	4.2	0.0	0.0	0.0	0.0	28
WTG-39	General Electric, GE1.6-100	689304	5228539	611.0	105	78.1	0	0.0	-3.0	4.8	5.3	0.0	0.0	0.0	0.0	20
T-2	Transformer	693097	5228692	463.6	108	82.3	0	0.0	-5.8	5.8	6.9	0.0	0.0	0.0	0.0	19

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

R34	FV-5, Monzewski lodge	688657	5227556	374.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
WTG-28	General Electric, GE1.6-100	689420	5232332	599.5	105	84.7	0	0.0	-4.1	4.8	8.5	0.0	0.0	0.0	0.0	11
WTG-29	General Electric, GE1.6-100	689790	5232049	601.0	105	84.3	0	0.0	-4.1	4.8	8.3	0.0	0.0	0.0	0.0	12
WTG-30	General Electric, GE1.6-100	690077	5231685	601.0	105	83.8	0	0.0	-3.9	4.8	8.0	0.0	0.0	0.0	0.0	12
WTG-32	General Electric, GE1.6-100	688270	5228924	601.0	105	74.2	0	0.0	-3.0	0.0	3.7	0.0	0.0	0.0	0.0	30
WTG-33	General Electric, GE1.6-100	688540	5229175	621.0	105	75.3	0	0.0	-3.0	4.8	4.1	0.0	0.0	0.0	0.0	24
WTG-34	General Electric, GE1.6-100	689006	5229416	589.6	105	76.6	0	0.0	-3.0	4.8	4.6	0.0	0.0	0.0	0.0	22
WTG-35	General Electric, GE1.6-100	689618	5229684	586.0	105	78.4	0	0.0	-3.0	4.8	5.4	0.0	0.0	0.0	0.0	19
WTG-36	General Electric, GE1.6-100	688772	5228426	601.0	105	70.2	0	0.0	-3.0	0.0	2.6	0.0	0.0	0.0	0.0	35
WTG-37	General Electric, GE1.6-100	689017	5228920	635.0	105	74.1	0	0.0	-3.0	0.0	3.7	0.0	0.0	0.0	0.0	30
WTG-38	General Electric, GE1.6-100	689354	5229176	625.7	105	76.0	0	0.0	-3.0	4.8	4.4	0.0	0.0	0.0	0.0	23
WTG-39	General Electric, GE1.6-100	689304	5228539	611.0	105	72.6	0	0.0	-3.0	4.8	3.2	0.0	0.0	0.0	0.0	27
T-2	Transformer	693097	5228692	463.6	108	84.2	0	0.0	-5.8	4.8	8.1	0.0	0.0	0.0	0.0	17

Calculation Summary - Octave Band Format

R31	FV-2		690036	5230677	369.9												
Src ID	Src Name	Band	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr	Band
WTG-07	General Electric, GE1.6-100	63	685581	5232019	561.0	89	84.4	0	0.0	-4.1	4.8	0.6	0.0	0.0	0.0	0.0	3	63
WTG-07	General Electric, GE1.6-100	125	685581	5232019	561.0	94	84.4	0	0.0	-4.1	4.8	1.9	0.0	0.0	0.0	0.0	7	125
WTG-07	General Electric, GE1.6-100	250	685581	5232019	561.0	96	84.4	0	0.0	-4.1	4.8	4.9	0.0	0.0	0.0	0.0	6	250
WTG-07	General Electric, GE1.6-100	500	685581	5232019	561.0	99	84.4	0	0.0	-4.1	4.8	9.0	0.0	0.0	0.0	0.0	5	500
WTG-07	General Electric, GE1.6-100	1000	685581	5232019	561.0	101	84.4	0	0.0	-4.1	4.8	17.0	0.0	0.0	0.0	0.0	--	1000
WTG-07	General Electric, GE1.6-100	2000	685581	5232019	561.0	96	84.4	0	0.0	-4.1	4.8	45.0	0.0	0.0	0.0	0.0	--	2000
WTG-07	General Electric, GE1.6-100	4000	685581	5232019	561.0	86	84.4	0	0.0	-4.1	4.8	152.6	0.0	0.0	0.0	0.0	--	4000
WTG-07	General Electric, GE1.6-100	8000	685581	5232019	561.0	67	84.4	0	0.0	-4.1	4.8	544.3	0.0	0.0	0.0	0.0	--	8000
WTG-09	General Electric, GE1.6-100	63	685577	5232844	561.0	89	84.9	0	0.0	-4.2	4.8	0.6	0.0	0.0	0.0	0.0	3	63
WTG-09	General Electric, GE1.6-100	125	685577	5232844	561.0	94	84.9	0	0.0	-4.2	4.8	2.0	0.0	0.0	0.0	0.0	6	125
WTG-09	General Electric, GE1.6-100	250	685577	5232844	561.0	96	84.9	0	0.0	-4.2	4.8	5.2	0.0	0.0	0.0	0.0	5	250
WTG-09	General Electric, GE1.6-100	500	685577	5232844	561.0	99	84.9	0	0.0	-4.2	4.8	9.6	0.0	0.0	0.0	0.0	4	500
WTG-09	General Electric, GE1.6-100	1000	685577	5232844	561.0	101	84.9	0	0.0	-4.2	4.8	18.2	0.0	0.0	0.0	0.0	--	1000
WTG-09	General Electric, GE1.6-100	2000	685577	5232844	561.0	96	84.9	0	0.0	-4.2	4.8	48.0	0.0	0.0	0.0	0.0	--	2000
WTG-09	General Electric, GE1.6-100	4000	685577	5232844	561.0	86	84.9	0	0.0	-4.2	4.8	162.6	0.0	0.0	0.0	0.0	--	4000
WTG-09	General Electric, GE1.6-100	8000	685577	5232844	561.0	67	84.9	0	0.0	-4.2	4.8	579.9	0.0	0.0	0.0	0.0	--	8000
WTG-13	General Electric, GE1.6-100	63	686134	5233118	596.0	89	84.3	0	0.0	-4.0	0.0	0.6	0.0	0.0	0.0	0.0	8	63
WTG-13	General Electric, GE1.6-100	125	686134	5233118	596.0	94	84.3	0	0.0	-4.0	0.0	1.9	0.0	0.0	0.0	0.0	12	125
WTG-13	General Electric, GE1.6-100	250	686134	5233118	596.0	96	84.3	0	0.0	-4.0	0.0	4.8	0.0	0.0	0.0	0.0	11	250
WTG-13	General Electric, GE1.6-100	500	686134	5233118	596.0	99	84.3	0	0.0	-4.0	0.0	8.9	0.0	0.0	0.0	0.0	10	500
WTG-13	General Electric, GE1.6-100	1000	686134	5233118	596.0	101	84.3	0	0.0	-4.0	0.0	16.9	0.0	0.0	0.0	0.0	4	1000
WTG-13	General Electric, GE1.6-100	2000	686134	5233118	596.0	96	84.3	0	0.0	-4.0	0.0	44.5	0.0	0.0	0.0	0.0	--	2000
WTG-13	General Electric, GE1.6-100	4000	686134	5233118	596.0	86	84.3	0	0.0	-4.0	0.0	151.0	0.0	0.0	0.0	0.0	--	4000
WTG-13	General Electric, GE1.6-100	8000	686134	5233118	596.0	67	84.3	0	0.0	-4.0	0.0	538.6	0.0	0.0	0.0	0.0	--	8000
WTG-15	General Electric, GE1.6-100	63	686649	5232324	621.0	89	82.5	0	0.0	-3.6	4.8	0.5	0.0	0.0	0.0	0.0	5	63
WTG-15	General Electric, GE1.6-100	125	686649	5232324	621.0	94	82.5	0	0.0	-3.6	4.8	1.6	0.0	0.0	0.0	0.0	9	125
WTG-15	General Electric, GE1.6-100	250	686649	5232324	621.0	96	82.5	0	0.0	-3.6	4.8	3.9	0.0	0.0	0.0	0.0	8	250
WTG-15	General Electric, GE1.6-100	500	686649	5232324	621.0	99	82.5	0	0.0	-3.6	4.8	7.3	0.0	0.0	0.0	0.0	8	500
WTG-15	General Electric, GE1.6-100	1000	686649	5232324	621.0	101	82.5	0	0.0	-3.6	4.8	13.8	0.0	0.0	0.0	0.0	3	1000
WTG-15	General Electric, GE1.6-100	2000	686649	5232324	621.0	96	82.5	0	0.0	-3.6	4.8	36.5	0.0	0.0	0.0	0.0	--	2000
WTG-15	General Electric, GE1.6-100	4000	686649	5232324	621.0	86	82.5	0	0.0	-3.6	4.8	123.7	0.0	0.0	0.0	0.0	--	4000
WTG-15	General Electric, GE1.6-100	8000	686649	5232324	621.0	67	82.5	0	0.0	-3.6	4.8	441.1	0.0	0.0	0.0	0.0	--	8000
WTG-17	General Electric, GE1.6-100	63	687439	5232843	591.0	89	81.6	0	0.0	-3.3	0.0	0.4	0.0	0.0	0.0	0.0	10	63
WTG-17	General Electric, GE1.6-100	125	687439	5232843	591.0	94	81.6	0	0.0	-3.3	0.0	1.4	0.0	0.0	0.0	0.0	14	125
WTG-17	General Electric, GE1.6-100	250	687439	5232843	591.0	96	81.6	0	0.0	-3.3	0.0	3.5	0.0	0.0	0.0	0.0	14	250
WTG-17	General Electric, GE1.6-100	500	687439	5232843	591.0	99	81.6	0	0.0	-3.3	0.0	6.5	0.0	0.0	0.0	0.0	14	500
WTG-17	General Electric, GE1.6-100	1000	687439	5232843	591.0	101	81.6	0	0.0	-3.3	0.0	12.4	0.0	0.0	0.0	0.0	10	1000
WTG-17	General Electric, GE1.6-100	2000	687439	5232843	591.0	96	81.6	0	0.0	-3.3	0.0	32.7	0.0	0.0	0.0	0.0	--	2000
WTG-17	General Electric, GE1.6-100	4000	687439	5232843	591.0	86	81.6	0	0.0	-3.3	0.0	111.0	0.0	0.0	0.0	0.0	--	4000
WTG-17	General Electric, GE1.6-100	8000	687439	5232843	591.0	67	81.6	0	0.0	-3.3	0.0	396.0	0.0	0.0	0.0	0.0	--	8000

Src ID	Src Name	Band	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr	Band
WTG-18	General Electric, GE1.6-100	63	687513	5233680	586.0	89	82.9	0	0.0	-3.7	0.0	0.5	0.0	0.0	0.0	0.0	9	63
WTG-18	General Electric, GE1.6-100	125	687513	5233680	586.0	94	82.9	0	0.0	-3.7	0.0	1.6	0.0	0.0	0.0	0.0	13	125
WTG-18	General Electric, GE1.6-100	250	687513	5233680	586.0	96	82.9	0	0.0	-3.7	0.0	4.1	0.0	0.0	0.0	0.0	12	250
WTG-18	General Electric, GE1.6-100	500	687513	5233680	586.0	99	82.9	0	0.0	-3.7	0.0	7.6	0.0	0.0	0.0	0.0	12	500
WTG-18	General Electric, GE1.6-100	1000	687513	5233680	586.0	101	82.9	0	0.0	-3.7	0.0	14.4	0.0	0.0	0.0	0.0	7	1000
WTG-18	General Electric, GE1.6-100	2000	687513	5233680	586.0	96	82.9	0	0.0	-3.7	0.0	38.0	0.0	0.0	0.0	0.0	--	2000
WTG-18	General Electric, GE1.6-100	4000	687513	5233680	586.0	86	82.9	0	0.0	-3.7	0.0	128.7	0.0	0.0	0.0	0.0	--	4000
WTG-18	General Electric, GE1.6-100	8000	687513	5233680	586.0	67	82.9	0	0.0	-3.7	0.0	459.1	0.0	0.0	0.0	0.0	--	8000
WTG-19	General Electric, GE1.6-100	63	687810	5234468	594.7	89	83.9	0	0.0	-3.9	0.0	0.5	0.0	0.0	0.0	0.0	9	63
WTG-19	General Electric, GE1.6-100	125	687810	5234468	594.7	94	83.9	0	0.0	-3.9	0.0	1.8	0.0	0.0	0.0	0.0	12	125
WTG-19	General Electric, GE1.6-100	250	687810	5234468	594.7	96	83.9	0	0.0	-3.9	0.0	4.6	0.0	0.0	0.0	0.0	11	250
WTG-19	General Electric, GE1.6-100	500	687810	5234468	594.7	99	83.9	0	0.0	-3.9	0.0	8.5	0.0	0.0	0.0	0.0	10	500
WTG-19	General Electric, GE1.6-100	1000	687810	5234468	594.7	101	83.9	0	0.0	-3.9	0.0	16.1	0.0	0.0	0.0	0.0	5	1000
WTG-19	General Electric, GE1.6-100	2000	687810	5234468	594.7	96	83.9	0	0.0	-3.9	0.0	42.5	0.0	0.0	0.0	0.0	--	2000
WTG-19	General Electric, GE1.6-100	4000	687810	5234468	594.7	86	83.9	0	0.0	-3.9	0.0	144.2	0.0	0.0	0.0	0.0	--	4000
WTG-19	General Electric, GE1.6-100	8000	687810	5234468	594.7	67	83.9	0	0.0	-3.9	0.0	514.5	0.0	0.0	0.0	0.0	--	8000
WTG-20	General Electric, GE1.6-100	63	688422	5234108	591.0	89	82.6	0	0.0	-3.6	4.8	0.5	0.0	0.0	0.0	0.0	5	63
WTG-20	General Electric, GE1.6-100	125	688422	5234108	591.0	94	82.6	0	0.0	-3.6	4.8	1.6	0.0	0.0	0.0	0.0	8	125
WTG-20	General Electric, GE1.6-100	250	688422	5234108	591.0	96	82.6	0	0.0	-3.6	4.8	4.0	0.0	0.0	0.0	0.0	8	250
WTG-20	General Electric, GE1.6-100	500	688422	5234108	591.0	99	82.6	0	0.0	-3.6	4.8	7.3	0.0	0.0	0.0	0.0	8	500
WTG-20	General Electric, GE1.6-100	1000	688422	5234108	591.0	101	82.6	0	0.0	-3.6	4.8	13.9	0.0	0.0	0.0	0.0	3	1000
WTG-20	General Electric, GE1.6-100	2000	688422	5234108	591.0	96	82.6	0	0.0	-3.6	4.8	36.7	0.0	0.0	0.0	0.0	--	2000
WTG-20	General Electric, GE1.6-100	4000	688422	5234108	591.0	86	82.6	0	0.0	-3.6	4.8	124.5	0.0	0.0	0.0	0.0	--	4000
WTG-20	General Electric, GE1.6-100	8000	688422	5234108	591.0	67	82.6	0	0.0	-3.6	4.8	443.9	0.0	0.0	0.0	0.0	--	8000
WTG-21	General Electric, GE1.6-100	63	688580	5233775	586.0	89	81.7	0	0.0	-3.4	4.8	0.4	0.0	0.0	0.0	0.0	6	63
WTG-21	General Electric, GE1.6-100	125	688580	5233775	586.0	94	81.7	0	0.0	-3.4	4.8	1.4	0.0	0.0	0.0	0.0	9	125
WTG-21	General Electric, GE1.6-100	250	688580	5233775	586.0	96	81.7	0	0.0	-3.4	4.8	3.6	0.0	0.0	0.0	0.0	9	250
WTG-21	General Electric, GE1.6-100	500	688580	5233775	586.0	99	81.7	0	0.0	-3.4	4.8	6.6	0.0	0.0	0.0	0.0	9	500
WTG-21	General Electric, GE1.6-100	1000	688580	5233775	586.0	101	81.7	0	0.0	-3.4	4.8	12.5	0.0	0.0	0.0	0.0	5	1000
WTG-21	General Electric, GE1.6-100	2000	688580	5233775	586.0	96	81.7	0	0.0	-3.4	4.8	33.2	0.0	0.0	0.0	0.0	--	2000
WTG-21	General Electric, GE1.6-100	4000	688580	5233775	586.0	86	81.7	0	0.0	-3.4	4.8	112.4	0.0	0.0	0.0	0.0	--	4000
WTG-21	General Electric, GE1.6-100	8000	688580	5233775	586.0	67	81.7	0	0.0	-3.4	4.8	400.9	0.0	0.0	0.0	0.0	--	8000
WTG-22	General Electric, GE1.6-100	63	689396	5233976	641.0	89	81.6	0	0.0	-3.3	4.8	0.4	0.0	0.0	0.0	0.0	6	63
WTG-22	General Electric, GE1.6-100	125	689396	5233976	641.0	94	81.6	0	0.0	-3.3	4.8	1.4	0.0	0.0	0.0	0.0	9	125
WTG-22	General Electric, GE1.6-100	250	689396	5233976	641.0	96	81.6	0	0.0	-3.3	4.8	3.5	0.0	0.0	0.0	0.0	9	250
WTG-22	General Electric, GE1.6-100	500	689396	5233976	641.0	99	81.6	0	0.0	-3.3	4.8	6.5	0.0	0.0	0.0	0.0	9	500
WTG-22	General Electric, GE1.6-100	1000	689396	5233976	641.0	101	81.6	0	0.0	-3.3	4.8	12.3	0.0	0.0	0.0	0.0	6	1000
WTG-22	General Electric, GE1.6-100	2000	689396	5233976	641.0	96	81.6	0	0.0	-3.3	4.8	32.6	0.0	0.0	0.0	0.0	--	2000
WTG-22	General Electric, GE1.6-100	4000	689396	5233976	641.0	86	81.6	0	0.0	-3.3	4.8	110.5	0.0	0.0	0.0	0.0	--	4000
WTG-22	General Electric, GE1.6-100	8000	689396	5233976	641.0	67	81.6	0	0.0	-3.3	4.8	394.0	0.0	0.0	0.0	0.0	--	8000
WTG-23	General Electric, GE1.6-100	63	689097	5233410	601.0	89	80.2	0	0.0	-3.0	4.8	0.4	0.0	0.0	0.0	0.0	7	63
WTG-23	General Electric, GE1.6-100	125	689097	5233410	601.0	94	80.2	0	0.0	-3.0	4.8	1.2	0.0	0.0	0.0	0.0	11	125
WTG-23	General Electric, GE1.6-100	250	689097	5233410	601.0	96	80.2	0	0.0	-3.0	4.8	3.0	0.0	0.0	0.0	0.0	11	250

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

Src ID	Src Name	Band	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr	Band
WTG-23	General Electric, GE1.6-100	500	689097	5233410	601.0	99	80.2	0	0.0	-3.0	4.8	5.6	0.0	0.0	0.0	0.0	11	500
WTG-23	General Electric, GE1.6-100	1000	689097	5233410	601.0	101	80.2	0	0.0	-3.0	4.8	10.6	0.0	0.0	0.0	0.0	8	1000
WTG-23	General Electric, GE1.6-100	2000	689097	5233410	601.0	96	80.2	0	0.0	-3.0	4.8	28.0	0.0	0.0	0.0	0.0	--	2000
WTG-23	General Electric, GE1.6-100	4000	689097	5233410	601.0	86	80.2	0	0.0	-3.0	4.8	95.0	0.0	0.0	0.0	0.0	--	4000
WTG-23	General Electric, GE1.6-100	8000	689097	5233410	601.0	67	80.2	0	0.0	-3.0	4.8	338.8	0.0	0.0	0.0	0.0	--	8000
WTG-24	General Electric, GE1.6-100	63	689550	5233127	596.0	89	79.0	0	0.0	-3.0	4.8	0.3	0.0	0.0	0.0	0.0	8	63
WTG-24	General Electric, GE1.6-100	125	689550	5233127	596.0	94	79.0	0	0.0	-3.0	4.8	1.0	0.0	0.0	0.0	0.0	12	125
WTG-24	General Electric, GE1.6-100	250	689550	5233127	596.0	96	79.0	0	0.0	-3.0	4.8	2.6	0.0	0.0	0.0	0.0	12	250
WTG-24	General Electric, GE1.6-100	500	689550	5233127	596.0	99	79.0	0	0.0	-3.0	4.8	4.8	0.0	0.0	0.0	0.0	13	500
WTG-24	General Electric, GE1.6-100	1000	689550	5233127	596.0	101	79.0	0	0.0	-3.0	4.8	9.2	0.0	0.0	0.0	0.0	11	1000
WTG-24	General Electric, GE1.6-100	2000	689550	5233127	596.0	96	79.0	0	0.0	-3.0	4.8	24.2	0.0	0.0	0.0	0.0	--	2000
WTG-24	General Electric, GE1.6-100	4000	689550	5233127	596.0	86	79.0	0	0.0	-3.0	4.8	82.2	0.0	0.0	0.0	0.0	--	4000
WTG-24	General Electric, GE1.6-100	8000	689550	5233127	596.0	67	79.0	0	0.0	-3.0	4.8	293.1	0.0	0.0	0.0	0.0	--	8000
WTG-25	General Electric, GE1.6-100	63	690322	5233201	626.0	89	79.1	0	0.0	-3.0	4.8	0.3	0.0	0.0	0.0	0.0	8	63
WTG-25	General Electric, GE1.6-100	125	690322	5233201	626.0	94	79.1	0	0.0	-3.0	4.8	1.1	0.0	0.0	0.0	0.0	12	125
WTG-25	General Electric, GE1.6-100	250	690322	5233201	626.0	96	79.1	0	0.0	-3.0	4.8	2.7	0.0	0.0	0.0	0.0	12	250
WTG-25	General Electric, GE1.6-100	500	690322	5233201	626.0	99	79.1	0	0.0	-3.0	4.8	4.9	0.0	0.0	0.0	0.0	13	500
WTG-25	General Electric, GE1.6-100	1000	690322	5233201	626.0	101	79.1	0	0.0	-3.0	4.8	9.3	0.0	0.0	0.0	0.0	11	1000
WTG-25	General Electric, GE1.6-100	2000	690322	5233201	626.0	96	79.1	0	0.0	-3.0	4.8	24.7	0.0	0.0	0.0	0.0	--	2000
WTG-25	General Electric, GE1.6-100	4000	690322	5233201	626.0	86	79.1	0	0.0	-3.0	4.8	83.7	0.0	0.0	0.0	0.0	--	4000
WTG-25	General Electric, GE1.6-100	8000	690322	5233201	626.0	67	79.1	0	0.0	-3.0	4.8	298.4	0.0	0.0	0.0	0.0	--	8000
WTG-26	General Electric, GE1.6-100	63	689951	5232514	601.0	89	76.4	0	0.0	-3.0	4.8	0.2	0.0	0.0	0.0	0.0	11	63
WTG-26	General Electric, GE1.6-100	125	689951	5232514	601.0	94	76.4	0	0.0	-3.0	4.8	0.8	0.0	0.0	0.0	0.0	15	125
WTG-26	General Electric, GE1.6-100	250	689951	5232514	601.0	96	76.4	0	0.0	-3.0	4.8	1.9	0.0	0.0	0.0	0.0	16	250
WTG-26	General Electric, GE1.6-100	500	689951	5232514	601.0	99	76.4	0	0.0	-3.0	4.8	3.6	0.0	0.0	0.0	0.0	17	500
WTG-26	General Electric, GE1.6-100	1000	689951	5232514	601.0	101	76.4	0	0.0	-3.0	4.8	6.8	0.0	0.0	0.0	0.0	16	1000
WTG-26	General Electric, GE1.6-100	2000	689951	5232514	601.0	96	76.4	0	0.0	-3.0	4.8	17.9	0.0	0.0	0.0	0.0	0	2000
WTG-26	General Electric, GE1.6-100	4000	689951	5232514	601.0	86	76.4	0	0.0	-3.0	4.8	60.7	0.0	0.0	0.0	0.0	--	4000
WTG-26	General Electric, GE1.6-100	8000	689951	5232514	601.0	67	76.4	0	0.0	-3.0	4.8	216.6	0.0	0.0	0.0	0.0	--	8000
WTG-27	General Electric, GE1.6-100	63	690404	5232305	646.0	89	75.6	0	0.0	-3.0	0.0	0.2	0.0	0.0	0.0	0.0	16	63
WTG-27	General Electric, GE1.6-100	125	690404	5232305	646.0	94	75.6	0	0.0	-3.0	0.0	0.7	0.0	0.0	0.0	0.0	21	125
WTG-27	General Electric, GE1.6-100	250	690404	5232305	646.0	96	75.6	0	0.0	-3.0	0.0	1.8	0.0	0.0	0.0	0.0	21	250
WTG-27	General Electric, GE1.6-100	500	690404	5232305	646.0	99	75.6	0	0.0	-3.0	0.0	3.3	0.0	0.0	0.0	0.0	23	500
WTG-27	General Electric, GE1.6-100	1000	690404	5232305	646.0	101	75.6	0	0.0	-3.0	0.0	6.2	0.0	0.0	0.0	0.0	22	1000
WTG-27	General Electric, GE1.6-100	2000	690404	5232305	646.0	96	75.6	0	0.0	-3.0	0.0	16.3	0.0	0.0	0.0	0.0	7	2000
WTG-27	General Electric, GE1.6-100	4000	690404	5232305	646.0	86	75.6	0	0.0	-3.0	0.0	55.4	0.0	0.0	0.0	0.0	--	4000
WTG-27	General Electric, GE1.6-100	8000	690404	5232305	646.0	67	75.6	0	0.0	-3.0	0.0	197.7	0.0	0.0	0.0	0.0	--	8000
WTG-28	General Electric, GE1.6-100	63	689420	5232332	599.5	89	76.0	0	0.0	-3.0	0.0	0.2	0.0	0.0	0.0	0.0	16	63
WTG-28	General Electric, GE1.6-100	125	689420	5232332	599.5	94	76.0	0	0.0	-3.0	0.0	0.7	0.0	0.0	0.0	0.0	20	125
WTG-28	General Electric, GE1.6-100	250	689420	5232332	599.5	96	76.0	0	0.0	-3.0	0.0	1.9	0.0	0.0	0.0	0.0	21	250
WTG-28	General Electric, GE1.6-100	500	689420	5232332	599.5	99	76.0	0	0.0	-3.0	0.0	3.4	0.0	0.0	0.0	0.0	22	500
WTG-28	General Electric, GE1.6-100	1000	689420	5232332	599.5	101	76.0	0	0.0	-3.0	0.0	6.5	0.0	0.0	0.0	0.0	21	1000
WTG-28	General Electric, GE1.6-100	2000	689420	5232332	599.5	96	76.0	0	0.0	-3.0	0.0	17.2	0.0	0.0	0.0	0.0	6	2000

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

Src ID	Src Name	Band	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr	Band
WTG-28	General Electric, GE1.6-100	4000	689420	5232332	599.5	86	76.0	0	0.0	-3.0	0.0	58.3	0.0	0.0	0.0	0.0	--	4000
WTG-28	General Electric, GE1.6-100	8000	689420	5232332	599.5	67	76.0	0	0.0	-3.0	0.0	208.1	0.0	0.0	0.0	0.0	--	8000
WTG-29	General Electric, GE1.6-100	63	689790	5232049	601.0	89	74.0	0	0.0	-3.0	0.0	0.2	0.0	0.0	0.0	0.0	18	63
WTG-29	General Electric, GE1.6-100	125	689790	5232049	601.0	94	74.0	0	0.0	-3.0	0.0	0.6	0.0	0.0	0.0	0.0	22	125
WTG-29	General Electric, GE1.6-100	250	689790	5232049	601.0	96	74.0	0	0.0	-3.0	0.0	1.5	0.0	0.0	0.0	0.0	23	250
WTG-29	General Electric, GE1.6-100	500	689790	5232049	601.0	99	74.0	0	0.0	-3.0	0.0	2.7	0.0	0.0	0.0	0.0	25	500
WTG-29	General Electric, GE1.6-100	1000	689790	5232049	601.0	101	74.0	0	0.0	-3.0	0.0	5.2	0.0	0.0	0.0	0.0	25	1000
WTG-29	General Electric, GE1.6-100	2000	689790	5232049	601.0	96	74.0	0	0.0	-3.0	0.0	13.7	0.0	0.0	0.0	0.0	12	2000
WTG-29	General Electric, GE1.6-100	4000	689790	5232049	601.0	86	74.0	0	0.0	-3.0	0.0	46.3	0.0	0.0	0.0	0.0	--	4000
WTG-29	General Electric, GE1.6-100	8000	689790	5232049	601.0	67	74.0	0	0.0	-3.0	0.0	165.1	0.0	0.0	0.0	0.0	--	8000
WTG-30	General Electric, GE1.6-100	63	690077	5231685	601.0	89	71.3	0	0.0	-3.0	0.0	0.1	0.0	0.0	0.0	0.0	21	63
WTG-30	General Electric, GE1.6-100	125	690077	5231685	601.0	94	71.3	0	0.0	-3.0	0.0	0.4	0.0	0.0	0.0	0.0	25	125
WTG-30	General Electric, GE1.6-100	250	690077	5231685	601.0	96	71.3	0	0.0	-3.0	0.0	1.1	0.0	0.0	0.0	0.0	26	250
WTG-30	General Electric, GE1.6-100	500	690077	5231685	601.0	99	71.3	0	0.0	-3.0	0.0	2.0	0.0	0.0	0.0	0.0	29	500
WTG-30	General Electric, GE1.6-100	1000	690077	5231685	601.0	101	71.3	0	0.0	-3.0	0.0	3.8	0.0	0.0	0.0	0.0	29	1000
WTG-30	General Electric, GE1.6-100	2000	690077	5231685	601.0	96	71.3	0	0.0	-3.0	0.0	10.0	0.0	0.0	0.0	0.0	18	2000
WTG-30	General Electric, GE1.6-100	4000	690077	5231685	601.0	86	71.3	0	0.0	-3.0	0.0	33.9	0.0	0.0	0.0	0.0	--	4000
WTG-30	General Electric, GE1.6-100	8000	690077	5231685	601.0	67	71.3	0	0.0	-3.0	0.0	120.9	0.0	0.0	0.0	0.0	--	8000
WTG-32	General Electric, GE1.6-100	63	688270	5228924	601.0	89	79.0	0	0.0	-3.0	4.8	0.3	0.0	0.0	0.0	0.0	8	63
WTG-32	General Electric, GE1.6-100	125	688270	5228924	601.0	94	79.0	0	0.0	-3.0	4.8	1.0	0.0	0.0	0.0	0.0	12	125
WTG-32	General Electric, GE1.6-100	250	688270	5228924	601.0	96	79.0	0	0.0	-3.0	4.8	2.6	0.0	0.0	0.0	0.0	12	250
WTG-32	General Electric, GE1.6-100	500	688270	5228924	601.0	99	79.0	0	0.0	-3.0	4.8	4.8	0.0	0.0	0.0	0.0	13	500
WTG-32	General Electric, GE1.6-100	1000	688270	5228924	601.0	101	79.0	0	0.0	-3.0	4.8	9.1	0.0	0.0	0.0	0.0	11	1000
WTG-32	General Electric, GE1.6-100	2000	688270	5228924	601.0	96	79.0	0	0.0	-3.0	4.8	24.2	0.0	0.0	0.0	0.0	--	2000
WTG-32	General Electric, GE1.6-100	4000	688270	5228924	601.0	86	79.0	0	0.0	-3.0	4.8	81.9	0.0	0.0	0.0	0.0	--	4000
WTG-32	General Electric, GE1.6-100	8000	688270	5228924	601.0	67	79.0	0	0.0	-3.0	4.8	292.1	0.0	0.0	0.0	0.0	--	8000
WTG-33	General Electric, GE1.6-100	63	688540	5229175	621.0	89	77.6	0	0.0	-3.0	4.8	0.3	0.0	0.0	0.0	0.0	9	63
WTG-33	General Electric, GE1.6-100	125	688540	5229175	621.0	94	77.6	0	0.0	-3.0	4.8	0.9	0.0	0.0	0.0	0.0	14	125
WTG-33	General Electric, GE1.6-100	250	688540	5229175	621.0	96	77.6	0	0.0	-3.0	4.8	2.2	0.0	0.0	0.0	0.0	14	250
WTG-33	General Electric, GE1.6-100	500	688540	5229175	621.0	99	77.6	0	0.0	-3.0	4.8	4.1	0.0	0.0	0.0	0.0	15	500
WTG-33	General Electric, GE1.6-100	1000	688540	5229175	621.0	101	77.6	0	0.0	-3.0	4.8	7.8	0.0	0.0	0.0	0.0	14	1000
WTG-33	General Electric, GE1.6-100	2000	688540	5229175	621.0	96	77.6	0	0.0	-3.0	4.8	20.6	0.0	0.0	0.0	0.0	--	2000
WTG-33	General Electric, GE1.6-100	4000	688540	5229175	621.0	86	77.6	0	0.0	-3.0	4.8	70.0	0.0	0.0	0.0	0.0	--	4000
WTG-33	General Electric, GE1.6-100	8000	688540	5229175	621.0	67	77.6	0	0.0	-3.0	4.8	249.6	0.0	0.0	0.0	0.0	--	8000
WTG-34	General Electric, GE1.6-100	63	689006	5229415	589.6	89	75.3	0	0.0	-3.0	0.0	0.2	0.0	0.0	0.0	0.0	17	63
WTG-34	General Electric, GE1.6-100	125	689006	5229415	589.6	94	75.3	0	0.0	-3.0	0.0	0.7	0.0	0.0	0.0	0.0	21	125
WTG-34	General Electric, GE1.6-100	250	689006	5229415	589.6	96	75.3	0	0.0	-3.0	0.0	1.7	0.0	0.0	0.0	0.0	22	250
WTG-34	General Electric, GE1.6-100	500	689006	5229415	589.6	99	75.3	0	0.0	-3.0	0.0	3.2	0.0	0.0	0.0	0.0	23	500
WTG-34	General Electric, GE1.6-100	1000	689006	5229415	589.6	101	75.3	0	0.0	-3.0	0.0	6.0	0.0	0.0	0.0	0.0	23	1000
WTG-34	General Electric, GE1.6-100	2000	689006	5229415	589.6	96	75.3	0	0.0	-3.0	0.0	15.9	0.0	0.0	0.0	0.0	8	2000
WTG-34	General Electric, GE1.6-100	4000	689006	5229415	589.6	86	75.3	0	0.0	-3.0	0.0	53.9	0.0	0.0	0.0	0.0	--	4000
WTG-34	General Electric, GE1.6-100	8000	689006	5229415	589.6	67	75.3	0	0.0	-3.0	0.0	192.1	0.0	0.0	0.0	0.0	--	8000
WTG-35	General Electric, GE1.6-100	63	689618	5229684	586.0	89	71.8	0	0.0	-3.0	0.0	0.1	0.0	0.0	0.0	0.0	20	63

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

Src ID	Src Name	Band	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr	Band
WTG-35	General Electric, GE1.6-100	125	689618	5229684	586.0	94	71.8	0	0.0	-3.0	0.0	0.5	0.0	0.0	0.0	0.0	25	125
WTG-35	General Electric, GE1.6-100	250	689618	5229684	586.0	96	71.8	0	0.0	-3.0	0.0	1.1	0.0	0.0	0.0	0.0	26	250
WTG-35	General Electric, GE1.6-100	500	689618	5229684	586.0	99	71.8	0	0.0	-3.0	0.0	2.1	0.0	0.0	0.0	0.0	28	500
WTG-35	General Electric, GE1.6-100	1000	689618	5229684	586.0	101	71.8	0	0.0	-3.0	0.0	4.0	0.0	0.0	0.0	0.0	28	1000
WTG-35	General Electric, GE1.6-100	2000	689618	5229684	586.0	96	71.8	0	0.0	-3.0	0.0	10.6	0.0	0.0	0.0	0.0	17	2000
WTG-35	General Electric, GE1.6-100	4000	689618	5229684	586.0	86	71.8	0	0.0	-3.0	0.0	36.0	0.0	0.0	0.0	0.0	--	4000
WTG-35	General Electric, GE1.6-100	8000	689618	5229684	586.0	67	71.8	0	0.0	-3.0	0.0	128.5	0.0	0.0	0.0	0.0	--	8000
WTG-36	General Electric, GE1.6-100	63	688772	5228426	601.0	89	79.3	0	0.0	-3.0	4.8	0.3	0.0	0.0	0.0	0.0	8	63
WTG-36	General Electric, GE1.6-100	125	688772	5228426	601.0	94	79.3	0	0.0	-3.0	4.8	1.1	0.0	0.0	0.0	0.0	12	125
WTG-36	General Electric, GE1.6-100	250	688772	5228426	601.0	96	79.3	0	0.0	-3.0	4.8	2.7	0.0	0.0	0.0	0.0	12	250
WTG-36	General Electric, GE1.6-100	500	688772	5228426	601.0	99	79.3	0	0.0	-3.0	4.8	5.0	0.0	0.0	0.0	0.0	13	500
WTG-36	General Electric, GE1.6-100	1000	688772	5228426	601.0	101	79.3	0	0.0	-3.0	4.8	9.5	0.0	0.0	0.0	0.0	10	1000
WTG-36	General Electric, GE1.6-100	2000	688772	5228426	601.0	96	79.3	0	0.0	-3.0	4.8	25.1	0.0	0.0	0.0	0.0	--	2000
WTG-36	General Electric, GE1.6-100	4000	688772	5228426	601.0	86	79.3	0	0.0	-3.0	4.8	84.9	0.0	0.0	0.0	0.0	--	4000
WTG-36	General Electric, GE1.6-100	8000	688772	5228426	601.0	67	79.3	0	0.0	-3.0	4.8	302.9	0.0	0.0	0.0	0.0	--	8000
WTG-37	General Electric, GE1.6-100	63	689017	5228919	635.0	89	77.2	0	0.0	-3.0	0.0	0.3	0.0	0.0	0.0	0.0	15	63
WTG-37	General Electric, GE1.6-100	125	689017	5228919	635.0	94	77.2	0	0.0	-3.0	0.0	0.8	0.0	0.0	0.0	0.0	19	125
WTG-37	General Electric, GE1.6-100	250	689017	5228919	635.0	96	77.2	0	0.0	-3.0	0.0	2.1	0.0	0.0	0.0	0.0	19	250
WTG-37	General Electric, GE1.6-100	500	689017	5228919	635.0	99	77.2	0	0.0	-3.0	0.0	4.0	0.0	0.0	0.0	0.0	21	500
WTG-37	General Electric, GE1.6-100	1000	689017	5228919	635.0	101	77.2	0	0.0	-3.0	0.0	7.5	0.0	0.0	0.0	0.0	19	1000
WTG-37	General Electric, GE1.6-100	2000	689017	5228919	635.0	96	77.2	0	0.0	-3.0	0.0	19.8	0.0	0.0	0.0	0.0	2	2000
WTG-37	General Electric, GE1.6-100	4000	689017	5228919	635.0	86	77.2	0	0.0	-3.0	0.0	67.2	0.0	0.0	0.0	0.0	--	4000
WTG-37	General Electric, GE1.6-100	8000	689017	5228919	635.0	67	77.2	0	0.0	-3.0	0.0	239.5	0.0	0.0	0.0	0.0	--	8000
WTG-38	General Electric, GE1.6-100	63	689354	5229176	625.7	89	75.5	0	0.0	-3.0	0.0	0.2	0.0	0.0	0.0	0.0	16	63
WTG-38	General Electric, GE1.6-100	125	689354	5229176	625.7	94	75.5	0	0.0	-3.0	0.0	0.7	0.0	0.0	0.0	0.0	21	125
WTG-38	General Electric, GE1.6-100	250	689354	5229176	625.7	96	75.5	0	0.0	-3.0	0.0	1.7	0.0	0.0	0.0	0.0	21	250
WTG-38	General Electric, GE1.6-100	500	689354	5229176	625.7	99	75.5	0	0.0	-3.0	0.0	3.2	0.0	0.0	0.0	0.0	23	500
WTG-38	General Electric, GE1.6-100	1000	689354	5229176	625.7	101	75.5	0	0.0	-3.0	0.0	6.1	0.0	0.0	0.0	0.0	22	1000
WTG-38	General Electric, GE1.6-100	2000	689354	5229176	625.7	96	75.5	0	0.0	-3.0	0.0	16.1	0.0	0.0	0.0	0.0	8	2000
WTG-38	General Electric, GE1.6-100	4000	689354	5229176	625.7	86	75.5	0	0.0	-3.0	0.0	54.7	0.0	0.0	0.0	0.0	--	4000
WTG-38	General Electric, GE1.6-100	8000	689354	5229176	625.7	67	75.5	0	0.0	-3.0	0.0	195.1	0.0	0.0	0.0	0.0	--	8000
WTG-39	General Electric, GE1.6-100	63	689304	5228539	611.0	89	78.1	0	0.0	-3.0	4.8	0.3	0.0	0.0	0.0	0.0	9	63
WTG-39	General Electric, GE1.6-100	125	689304	5228539	611.0	94	78.1	0	0.0	-3.0	4.8	0.9	0.0	0.0	0.0	0.0	13	125
WTG-39	General Electric, GE1.6-100	250	689304	5228539	611.0	96	78.1	0	0.0	-3.0	4.8	2.4	0.0	0.0	0.0	0.0	13	250
WTG-39	General Electric, GE1.6-100	500	689304	5228539	611.0	99	78.1	0	0.0	-3.0	4.8	4.4	0.0	0.0	0.0	0.0	15	500
WTG-39	General Electric, GE1.6-100	1000	689304	5228539	611.0	101	78.1	0	0.0	-3.0	4.8	8.3	0.0	0.0	0.0	0.0	13	1000
WTG-39	General Electric, GE1.6-100	2000	689304	5228539	611.0	96	78.1	0	0.0	-3.0	4.8	22.0	0.0	0.0	0.0	0.0	--	2000
WTG-39	General Electric, GE1.6-100	4000	689304	5228539	611.0	86	78.1	0	0.0	-3.0	4.8	74.5	0.0	0.0	0.0	0.0	--	4000
WTG-39	General Electric, GE1.6-100	8000	689304	5228539	611.0	67	78.1	0	0.0	-3.0	4.8	265.7	0.0	0.0	0.0	0.0	--	8000
T-2	Transformer	32	693097	5228692	463.6	65	82.3	0	0.0	-5.8	4.9	0.1	0.0	0.0	0.0	0.0	--	32
T-2	Transformer	63	693097	5228692	463.6	84	82.3	0	0.0	-5.8	5.0	0.4	0.0	0.0	0.0	0.0	2	63
T-2	Transformer	125	693097	5228692	463.6	96	82.3	0	0.0	-5.8	5.2	1.5	0.0	0.0	0.0	0.0	13	125
T-2	Transformer	250	693097	5228692	463.6	99	82.3	0	0.0	-5.8	5.5	3.8	0.0	0.0	0.0	0.0	13	250

Src ID	Src Name	Band	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr	Band
T-2	Transformer	500	693097	5228692	463.6	104	82.3	0	0.0	-5.8	6.2	7.0	0.0	0.0	0.0	0.0	15	500
T-2	Transformer	1000	693097	5228692	463.6	101	82.3	0	0.0	-5.8	7.2	13.4	0.0	0.0	0.0	0.0	4	1000
T-2	Transformer	2000	693097	5228692	463.6	98	82.3	0	0.0	-5.8	8.8	35.3	0.0	0.0	0.0	0.0	--	2000
T-2	Transformer	4000	693097	5228692	463.6	92	82.3	0	0.0	-5.8	10.9	119.6	0.0	0.0	0.0	0.0	--	4000
T-2	Transformer	8000	693097	5228692	463.6	83	82.3	0	0.0	-5.8	13.3	426.6	0.0	0.0	0.0	0.0	--	8000

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

PROLEC *ISO 9001 CERTIFIED*

Form 3.2.1-D Rev. 0

TECHNICAL PROPOSAL INFORMATION

Customer: *BluEarth Renewables* Date: **11/03/11**

Proposal No: - Spec No: - Item No: **2209931/A**

RATING									
Type	Transformer		Class	H Winding		X Winding		Y Winding	
Phase	3			122 Delta	kV	34.5 Wye	kV	-	kV
Hertz	60		ONAN	30,000	KVA	30,000	KVA	-	KVA
Temp Rise	65 °C		ONAF	40,000	KVA	40,000	KVA	-	KVA
Insul Liquid	NON PCB OIL TYPE I		ONAF	50,000	KVA	50,000	KVA	-	KVA
			-	-	KVA	-	KVA	-	KVA

ADDITIONAL TAP VOLTAGES		
H Winding (Kv)	± 2 of 2.5 %	DETC
X Winding (Kv)	-	
-	-	

CONNECTIONS FOR OPERATION						
Transformers in Bank	To Transformer From	Phase	Connected	To Transformer To	Phase	Connected
-	-	-	-	-	-	-

PERFORMANCE BASED ON A LOADING OF				
H Winding	122.0	kV	30.0	MVA
X Winding	34.5	kV	30.0	MVA
Y Winding	-	kV	-	MVA
-	-	-	-	-
-	-	-	-	-

DIELECTRIC TESTS			
Applied Voltage (To other winding and ground)	H Winding	185	kV
	X Winding	50	kV
	Y Winding	-	kV
Induced Voltage	One Hour	105	kV
	Enhancement	120	kV

INSULATION LEVELS		
ITEMS	Basic Lightning Impulse (kV)	
	Winding	Bushing
H Line	450	650
H neutral	110	110
X line	200	200
X neutral	-	-
Y line	-	-

PERFORMANCE DATA, Based on **85** °C Reference Temperature, **30** MVA Altitude: **1000** Mts.

Losses and Exciting Current				Regulation	
Excitation	% Ex	No Load Kw (20°C)	Total Loss Kw	Power Factor	% Regulation
100%	0.506	21	108	0.80	5.876
110%	.741	27.9 *	114.9 *	1.0	0.694
-	-	* Not Guaranteed		-	-

AUXILIARY (COOLING) LOSSES		
Transformer KVA	Class	KWatts Loss
30,000 -	ONAN	0
40,000 -	ONAF	1
50,000 -	ONAF	2
- -	-	-
- -	-	-
Average Sound Level	75/77/78	dB ONAN/ONAF/ONAF

PERCENT IMPEDANCE VOLTS					
% IZ	Between Windings	At kVA	% IZ Zero	Between Windings	At kVA
8	H-X	30,000	6.8*	H-X	30,000
*	-	-	*	-	-
*	-	-	*	-	-

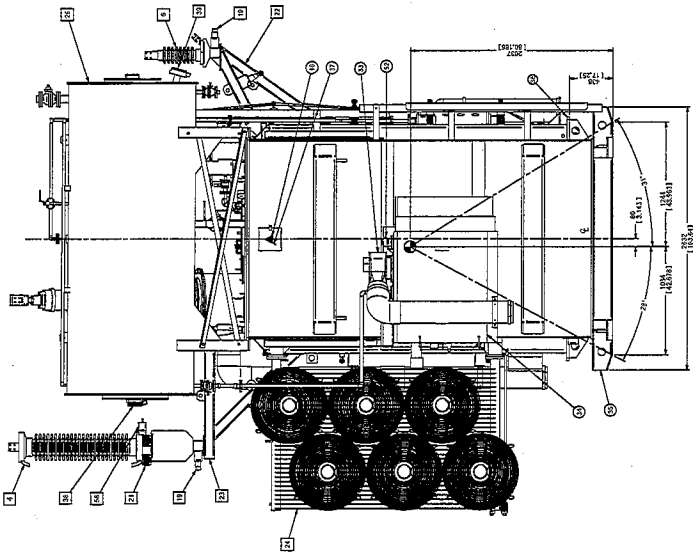
* APPROXIMATE ONLY, NOT GUARANTEED

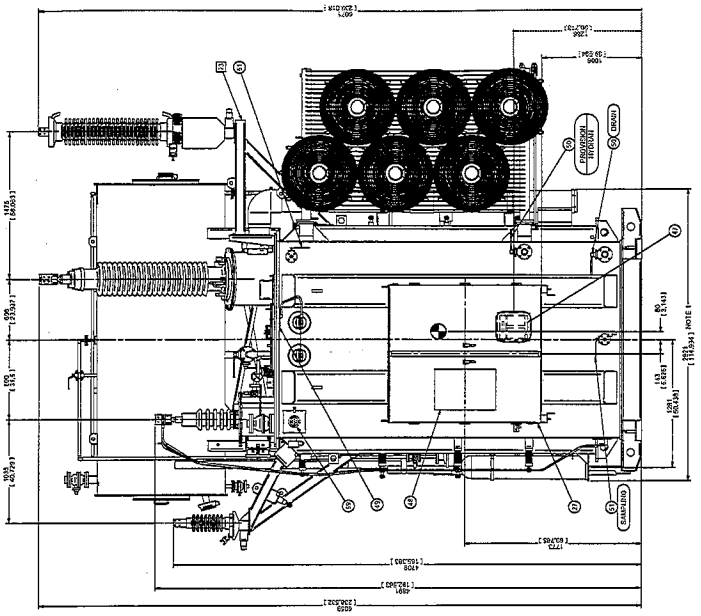
EFFICIENCIES (p.f = 1) AT 30 MVA				
Load	Full Load	3/4 Load	1/2 Load	1/4 Load
%	99.642	99.69	99.716	99.649

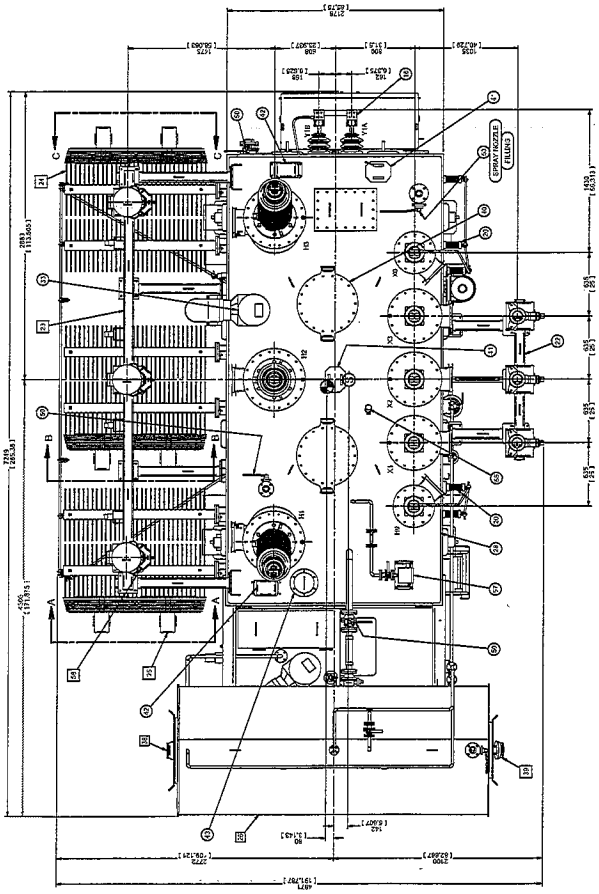
MECHANICAL DATA
Not for Construction Purposes

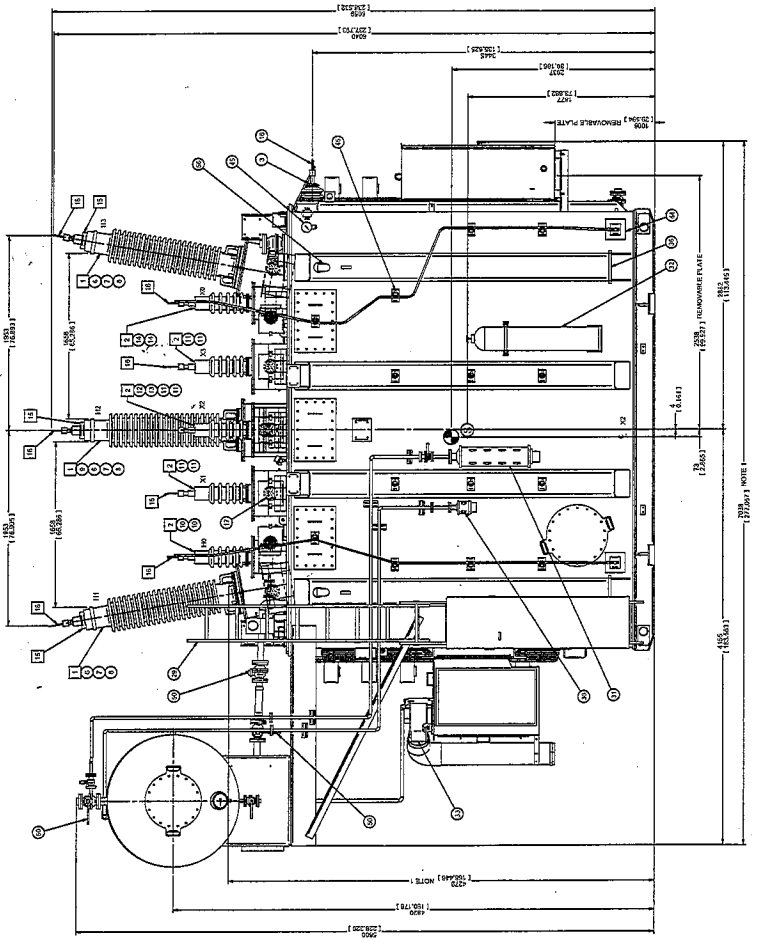
Outline Dwg No: B1

Dimensions (Approximate)		Ft. (Mts.)
Height	(A)	18.2 (5.56)
Width	(B)	25.6 (7.80)
Depth	(C)	16.6 (5.07)
Height over Cover	(D)	12.6 (3.85)
Untanking (Plus slings)	(E)	21.7 (6.63)
Shipping Dimensions:Ft	WxDxH	19.8 x 10.4 x 12.7
Masses (Approximate)		pounds (Kg)
Core and Coils		79,340 (35,990)
Tank and Fittings		37,490 (17,010)
Liquid 5,990	Gal	44,970 (20,400)
Total Mass		161,800 (73,400)
Shipping without OIL		105,570 (47,890)
Shipping with OIL H= 14.8´		146,320 (66,380)









FRONT VIEW - ITEM 22 NOT SHOWN
1:20

Appendix C

Environmental Effects Monitoring Plan for Wildlife and Wildlife Habitat

BOW LAKE WIND FARM
ENVIRONMENTAL EFFECTS MONITORING PLAN
FOR WILDLIFE

File No.: 160960734
January 2013

Prepared for:

Nodin Kitagan Limited Partnership and
Nodin Kitagan 2 Limited Partnership
by its General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp
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1.0 Introduction

1.1 PROJECT OVERVIEW

Nodin Kitagan Limited Partnership and Nodin Kitagan 2 Limited Partnership, by their General Partners Shongwish Nodin Kitagan GP Corp. and Shongwish Nodin Kitagan 2 GP Corp., respectively ("the Proponent") are proposing to develop Phase 1 and Phase 2 of the Bow Lake Wind Farm ("the Project") within the Algoma District, Ontario. The proposed Project Location for this report includes all parts of the land in, on or over which the Project is proposed.

The basic components of the Project include 36 wind turbines for a total maximum installed nameplate capacity of up to 58.32 MW. The Project would also include access roads, meteorological tower, 34.5 kV above and below ground electrical collector lines, communication lines, pad-mounted transformers, two permanent meteorological (Met) towers, an operations and maintenance building, and a substation which would connect the Project with the provincial high voltage transmission system via an existing transmission line that runs through the Project Study Area. Temporary components during construction may include storage and staging areas at the turbine locations, crane pads or mats, staging areas along access roads, delivery truck turnaround areas, construction compounds and welfare buildings, and a central laydown area.

1.2 REPORT REQUIREMENTS

This Environmental Effects Monitoring Plan ("EEMP"), which includes the Post-Construction Monitoring Plan is one component of the Renewable Energy Approval ("REA") application for the Project, and has been prepared in accordance with O. Reg. 359/09, the Ontario Ministry of Natural Resources' (MNR's) *Approval and Permitting Requirements Document for Renewable Energy Projects* (MNR, 2009), the Ministry of Environment's ("MOE") *Technical Guide to Renewable Energy Approvals* (MOE, 2011), MNR's *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNR, 2011b) and MNR's *Birds and Bird Habitats: Guidelines for Wind Power Projects* (MNR, 2011a).

As discussed in the Project's **Natural Heritage Assessment and Environmental Impact Study** ("NHA/EIS"), primary data were collected through bird and wildlife baseline studies in the Project Study Area. These data were augmented with secondary data from published and unpublished sources to generate a dataset from which to assess the potential effects of the Project.

The potential environmental effects to wildlife and wildlife habitat and associated mitigation measures, based upon this dataset, ornithological advice, and professional opinion, among other factors, are provided **in Section 5.6** of the NHA/EIS and summarized in **Table 1.1, Appendix A** of this EEMP. Additionally, **Section 5.6** of the NHA/EIS describes wildlife and wildlife habitat post-construction monitoring commitments, which are summarized in Table 1.2 of

this EEMP. These commitments provide the first step of confirming the predictions of the EIS and provide the basis from which actions contained in the EEMP may stem.

The purpose of this EEMP is to outline post-construction monitoring survey requirements to address potential negative environmental effects for birds and bats, to assess the effectiveness of the proposed mitigation measures and to verify compliance of the Project with applicable provincial and federal legislation and guidelines. This monitoring plan provides details on habitat use studies for several features treated as significant wildlife habitat in the NHA/EIS, including: turtle wintering areas, snake hibernacula, waterfowl nesting areas, moose aquatic feeding areas, amphibian breeding habitat (woodland), marsh breeding bird habitat (including Yellow Rail) and breeding habitat for bird species of conservation concern, including Canada Warbler and Olive-sided Flycatcher. The plan also includes a post-construction wildlife monitoring program to assess mortality of birds and bats and disturbance effects to nesting waterfowl and bird species of conservation concern.

Based on the MNR bird and bat guidance documents referenced above, post-construction mortality monitoring should begin on May 1st of the year that the wind power project is fully operational. If full project commissioning is delayed, post-construction monitoring of a partially completed project should not be delayed for longer than 1 year. If the project is constructed in phases, mortality monitoring for each phase should coincide with the commencement of operation of that phase.

2.0 Pre-Construction Habitat Use Surveys

2.1 PURPOSE AND TIMING

As per the requirements of Appendix D of the Natural Heritage Assessment Guide for Renewable Energy Projects (MNR, 2011a), habitat use studies must be undertaken to determine the actual use of the habitat prior to any construction activities occurring within 120 m of the habitat. As per **Section 5.6** of the NHA/EIS, the Proponent must undertake habitat use studies due to the location of select Project components in or within 120 m of candidate significant wildlife habitat for: turtle wintering areas, snake hibernacula, waterfowl nesting areas, moose aquatic feeding areas, amphibian breeding habitat (woodland), marsh breeding bird habitat (including Yellow Rail) and breeding habitat for bird species of conservation concern (i.e., Canada Warbler and Olive-sided Flycatcher). Methodologies for undertaking these habitat use studies for candidate significant wildlife habitat are described in the following sections. If the habitat is deemed significant as a result of habitat use studies, the mitigation proposed in **Table 1.1, Appendix A** of this EEMP will be applied. However, if the feature is deemed not significant, no mitigation will be applied for that feature.

2.2 METHODS

2.2.1 Turtle Wintering Areas

The primary mitigation strategy applied to this feature was avoidance. The Project Location is not sited within significant wildlife habitat for turtle wintering areas ("TWA"s). Features TWA-1, 4, and 7 are within 120 m of access road upgrades.

In accordance with Appendix D of the Natural Heritage Assessment Guide (MNR, 2011c), due to the location of proposed access road upgrades within 120 m of candidate TWAs, the proponent must commit to undertaking studies to determine the actual use of the habitat by turtles prior to any construction activities occurring within 120 m of the habitat. Habitat use surveys will be conducted in the spring of 2013 to determine the use of TWA-1, 4 and 7. Over-wintering areas will be searched for congregations (basking area) of turtles on warm, sunny days during the spring (April-May). Each feature will be surveyed a minimum of 3 times: once early in the season (e.g. mid- to late-April); once in mid-season (e.g. early- to mid-May), and once later in the season (e.g. mid- to late-May). For each survey, the surveyor will walk the boundary of the wetland where turtles are likely to be basking. Data, including species and numbers of individuals, will be recorded on Reptile Hibernacula Observation Forms. Additional information that will be recorded on the appropriate data forms include:

- Weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation should be recorded);
- Date and time of day;

- GPS coordinates of the point location; and
- Name of the observer doing field work.

Turtle species expected to be observed include the Midland Painted Turtle. Pending completion of these studies, site specific mitigation is being proposed for candidate SWH for turtle wintering areas. If the habitat use studies in 2013 conclude that the wintering areas do not constitute SWH, the site specific mitigation measures proposed will not be required and best management practices will be substituted.

2.2.2 Snake Hibernacula Surveys

The primary mitigation strategy applied to candidate snake hibernacula ("SH") was avoidance. In accordance with Appendix D of the Natural Heritage Assessment Guide (MNR, 2011a), candidate snake hibernacula are being treated as significant. Habitat use surveys will be conducted in the spring of 2013 to determine the use of SH-2, 4, 8, 9 and 11. Hibernacula emergence/exit surveys will be conducted between the hours of 10:00 am and 3:00 pm on sunny warm days in spring (April/May) at the location of the candidate hibernacula. Each feature will be surveyed a minimum of 3 times: once early in the season (e.g., mid to late April); once in mid-season (e.g., early to mid May), and once later in the season (e.g., mid to late May).

For each survey, the surveyor will observe for 20 minutes, recording all snake species and number of individuals observed entering or exiting the candidate hibernacula. The search pattern at each hibernaculum will include surveying all potential basking and sheltering habitat within the location (i.e., an area including a 30 m radius around the hibernaculum). The search route will be tracked using a GPS unit so the search pattern can be easily repeated. Data will be recorded on Reptile Hibernacula Observation Forms. Additional information that will be recorded on the appropriate data forms include:

- Weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation);
- Date and time of day;
- GPS coordinates of the point location; and
- Name of the observer doing field work.

Given the size and characteristics of the forest communities containing SH-2, 4, 8, 9 and 11, and the historic ranges of snake species in the Project Study Area, it is anticipated that the habitats could potentially support one of the indicator snake species identified in the Draft Significant Wildlife Habitat EcoRegion 5E Criterion Schedule (MNR, 2012), namely Eastern Gartersnake.

2.2.3 Waterfowl Nesting Areas

The primary mitigation strategy applied to this feature was avoidance. As per the requirements of Appendix D of the Natural Heritage Assessment Guide (MNR, 2011a), due to the location of Project infrastructure within the forested upland portion of the SWH (i.e., uplands within 120 m of core wetland), the proponent must commit to undertaking studies to determine the actual use of the habitat by waterfowl prior to any construction activities occurring within 120 m of the habitat.

Habitat use studies will be conducted according to "*Bird and Bird Habitats: Guidelines for Wind Power Projects*" (MNR, 2011b) and will include nesting studies to be completed in the spring, during the breeding season (April-June). Specifically, nesting studies will consist of modified area searches in WNA-2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 16, and 18. Nesting studies will take place by walking along wetland perimeters or through wetlands in order to observe waterfowl that may be out of sight due to dense vegetation. Surveys will be conducted twice to account for early nesting (e.g., Mallards and Wood Ducks in early- to mid-April) and late nesting (e.g., Blue-winged Teal and Ring-necked Ducks in late May to mid-June) as will include species that breed throughout the season. All waterfowl species seen and heard will be recorded. Additional information that will be recorded on the appropriate data forms include:

- Weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation should be recorded);
- Date and time of day;
- GPS coordinates of the start and end location; and
- Name of the observer doing field work.

From data gathered from these surveys, if waterfowl nesting areas are deemed significant, data will be brought forward and utilized as baseline results during post-construction monitoring in habitats that are within 120 m of a wind turbine. Waterfowl species anticipated to be observed from the Draft Significant Wildlife Habitat Ecoregion 5E Criterion Schedule include: American Black Duck, Northern Pintail, Northern Shoveler, Gadwall, Blue-winged Teal, Green-winged Teal, Wood Duck, Hooded Merganser, Common Merganser, Red-breasted Merganser, Mallard, Canada Goose, American Widgeon, Bufflehead and Common Goldeneye.

2.2.4 Moose Aquatic Feeding Area Surveys

As per the requirements of Appendix D of the NHA Guide (MNR, 2011a), due to the location of a proposed collector line in the forested component of MAFA-1, and turbines/laydown area and within 120 m of MAFA-1, the proponent must commit to undertaking studies to determine the actual use of the habitat prior to any construction activities occurring within 120 m of the habitat. A Moose aquatic feeding habitat use survey at MAFA-1 will be conducted once from mid-June to the end of July, when submergent aquatic vegetation has peaked and can be recorded for cover (%) and species level identification.

A habitat use survey will be conducted to determine the use of MAFA-1 using criteria provided in the Significant Wildlife Habitat Technical Guide ("SWHTG"), Table Q-2 (MNR, 2000). Habitat use surveys will consist of area searches during the month of June around the MAFA, denoting any Moose observations, bedding/resting areas, tracks and trails. Habitat surveys will determine the level of use, what areas of the MAFA are being used, access points, shelter areas and areas of aquatic vegetation. Specific criteria that will be collected include: abundance of preferred aquatic food plants; quality of adjacent forest habitat; degree of disturbance of the site; access to foraging areas, and history of consistent use (where background data are available). Data will be recorded on Moose Aquatic Feeding Areas forms. Additional information that will be recorded on the data form includes:

- Weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation);
- Date and time of day;
- GPS coordinates of the point location; and
- Name of the observer doing field work.

If MAFA-1 is deemed significant as a result of the habitat use survey, habitat mitigation will be applied, but no additional post-construction monitoring will be required..

2.2.5 Breeding Amphibian Habitat (Woodlands)

Turbines/laydown areas, access roads and associated constructible areas are found in and within 120 m of amphibian woodland breeding habitat. As per the requirements of Appendix D of the Natural Heritage Assessment Guide (MNR, 2011a), due to the location of these Project components, the proponent must commit to undertaking studies to determine the actual use of the breeding habitat by amphibians in ABHW-4, 5, 7, 9, 11, 12, 13, 14, 15, 16 and 17 prior to any construction activities occurring within 120 m of the habitat.

Presence for amphibians (salamanders, frogs and toads) will be executed in two different stages: salamander egg mass surveys, and call count surveys for breeding frogs and toads.

Egg mass surveys are time sensitive, and will be conducted in spring, prior to leaf-out for all ponds suitable for salamander egg mass habitat. Egg mass surveys will consist of perimeter surveys, supported by dip-netting and minnow-trapping of adults. The timing window will vary depending on spring temperatures, and will occur in mid-late April.

Based on the protocols set out in the Marsh Monitoring Program (BSC, 2003), three separate call surveys will be completed for breeding amphibians (frogs and toads) in woodland ponds. Surveys are temperature dependant. The first survey window will fall between May 1 and May 15, or when the night-time temperatures are consistently above 5ºC. The second survey window will fall between June 1 and June 15, or when the night-time temperatures are consistently

above 10ºC. The third survey window will fall between July 1 and July 15, or when the night-time temperatures are consistently above 17ºC. Surveys are time sensitive, and will be conducted half an hour after sunset, with appropriate temperature conditions (as noted above). Surveys during the second and third windows will be repeated at the stations established during the first survey. For each survey, the surveyor will observe for 3 minutes at each station, recording the different amphibian species heard and observed, and the approximated level of calling heard by each individual(s). Additional information will be recorded on the appropriate data forms, which include:

- Weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation);
- Date and time of day;
- GPS coordinates of the point location; and
- Name of the observer doing field work.

Given the size and characteristics of the forest communities containing ABHW-4, 5, 7, 9, 11, 12, 13, 14, 15, 16 and 17 and the historic ranges of amphibian species in the Project Study Area, it is anticipated that the habitats could potentially support several of the indicator amphibian species identified in the Draft Significant Wildlife Habitat Ecoregion 5E Criterion Schedule (MNR, 2012), namely Eastern Newt, Blue-Spotted Salamander, Spotted Salamander, Four-Toed Salamander, Northern Two-lined Salamander, Spring Peeper, Wood Frog and American Toad.

As discussed in Section 5.6.6 of the NHA/EIS, the access road to Turbine 39 may interfere with amphibian movement in ABWH-6, particularly movement of salamanders between ponds and surrounding woodland habitat associated with SWET-16 and SWET-17. To mitigate this potential effect two salamander passages will be constructed under the access road. The salamander passages will be inspected twice per year, once in early October before significant snowfall and once in the early spring, as soon as snow melt has proceeded sufficiently to expose the culvert openings.

2.2.6 Marsh Breeding Bird (including Yellow Rail) Habitat

All components of the Project are sited outside of wetland features. No loss of habitat or alteration of groundwater or surface water flow is anticipated from the Project. Potential effects to wetland habitats, proposed mitigation and net effects are described in **Section 5.5** of the NHA/EIS.

As per the requirements of Appendix D of the Natural Heritage Assessment Guide (MNR, 2011a), due to the location of turbines within 120 m of habitats treated as SWH for marsh breeding birds (MBBH-8 and 9), the proponent must commit to undertaking studies to determine the actual use of the habitat by marsh breeding birds prior to any construction activities occurring within 120 m of the habitat.

Habitat use studies will be conducted according to *"Bird and Bird Habitats: Guidelines for Wind Power Projects"* (MNR, 2011b) and will include breeding surveys in May/June when marsh bird species are actively nesting in wetland habitats. Specifically, nesting studies will consist of point counts at stations established in MBBH-8 and 9. An adequate number of stations (i.e., a minimum of one station per 3 ha of habitat, depending on habitat shape). Point counts will be performed in the early morning, between dawn (one half hour before sunrise) and about 4 hours after sunrise. Each station will be surveyed a minimum of 3 times, conducted early in the season, mid-season and later in the season, with at least 10 days between surveys at a particular station. Point counts should be performed when there is as little wind as possible (i.e., wind speeds should be 3 or less on the Beaufort scale) and should begin as early as possible in the morning (but not earlier than one half-hour before local sunrise), when the wind is generally calm so that windy conditions that may arise later in the morning can be avoided. Point counts should not be conducted if it is raining unless precipitation is not more than a light drizzle.

At each station, the surveyor will observe for ten minutes, recording all species seen or heard (including marsh birds), along with an estimate of the number of individuals of each species and the highest level of breeding evidence observed for each observation. Surveyors will estimate the distance to each bird using a scale of 0–50 m, 50–100 m and further than 100 m. Birds that move during the survey will be recorded in the closest distance category that they entered during the survey. Data that will be reported are the number of birds of each species detected in each distance band. Birds that fly over without stopping should be recorded separately as "fly-overs". Additional information that will be recorded on the appropriate data forms include:

- Weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation should be recorded);
- Date and time of day;
- GPS coordinates of the point location; and
- Name of the observer doing field work.

From data gathered from these surveys, if marsh bird breeding habitats are confirmed as significant, data will be brought forward and utilized as baseline results during post-construction monitoring in habitats that are within 120 m of a wind turbine. Marsh species anticipated to be observed from the Draft Significant Wildlife Habitat Ecoregion 5E Criterion Schedule include: American Bittern, Sora, Red-necked Grebe, Pie-billed Grebe, Redhead, Ring-necked Duck, Lesser Scaup, Ruddy Duck, Common Moorhen, American Coot, Wilson's Pharlarope, Common Loon, Sandhill Crane, Green Heron, Sedge Wren, Marsh Wren, Trumpeter Swan, Yellow Rail and Black Tern.

2.2.7 Canada Warbler and Olive-sided Flycatcher Breeding Habitat

Canada Warbler was recorded in CWH-11, 18 and 30, which represent SWH for the species. Olive-sided Flycatcher was not recorded within candidate habitat in the ZOI, therefore no SWH

has been verified for this species. As per the requirements of Appendix D of the Natural Heritage Assessment Guide (MNR, 2011a), due to the location of access roads, collector lines and associated constructible areas in habitats treated as SWH for Canada Warbler (CWH-1,3, 6, 8, 9, 10, 12, 15, 20, 21, 22, 23, 25, 29, 35, 36, 39 and 40) and Olive-sided Flycatcher (OFH-1, 4, 5, 6, and 13) the proponent must commit to undertaking studies to determine the actual use of the habitat by these two species prior to any construction activities occurring within 120 m of the habitat. Habitat use studies will be conducted according to *"Bird and Bird Habitats: Guidelines for Wind Power Projects"* (MNR, 2011b).

Point count stations in each habitat will be established and surveyed during the habitat use surveys. An adequate number of stations (i.e., a minimum of one station per 3 ha of habitat, depending on habitat shape) will be located in each of CWH-1,3, 6, 8, 9, 10, 12, 15, 20, 21, 22, 23, 25, 29, 35, 36, 39 and 40 and OFH-1, 4, 5, 6, and 13. Each of the surveys will include a ten-minute point count at each location, conducted during peak of the breeding season (mid-May to early July). Each station will be surveyed a minimum of 3 times: once early in the season; once in mid-season; and, once later in the season with at least 10 days between surveys at a particular station. Point counts must be performed in the early morning, between dawn (one half hour before sunrise) and about 4 hours after sunrise. Where appropriate, sound meters will be used to record singing birds. Surveys in late June and early July should usually be completed within 3 hours of sunrise. Surveys will be performed when the wind speed is 3 or less on the Beaufort scale and when there is no precipitation unless it is a light drizzle. Additional information that will be recorded on the appropriate data forms include:

- Weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation should be recorded);
- Date and time of day;
- GPS coordinates of the point location; and
- Name of the observer doing field work.

From data gathered from these surveys, if Canada Warbler and/or Olive-sided Flycatcher breeding evidence is confirmed and habitat is confirmed as significant, data will be brought forward and utilized as baseline results during post-construction monitoring in habitats that are within 120 m of a wind turbine.

2.2.8 Summary

Should the results of the habitat use studies result in the determination that these habitats are considered significant (as determined by the Proponent or their agents and confirmed by MNR), the monitoring plan will be expanded to include additional post-construction habitat disturbance monitoring. If a determination of significance is made, the results of the habitat use studies will constitute the baseline for habitat disturbance monitoring. Methodologies implemented in undertaking the habitat use studies will be replicated during habitat disturbance monitoring, and

undertaken as per the schedule presented in **Table 1.2, Appendix A**. If required, post-construction habitat disturbance monitoring will take place for a minimum of three (3) years for: waterfowl nesting areas, marsh breeding bird habitat and Canada Warbler or Olive-sided Flycatcher habitats that are within 120 m of a wind turbine.

3.0 Post-Construction Monitoring Program

3.1 PURPOSE AND TIMING

The purpose of the wildlife post-construction monitoring program is to identify performance objectives, assess the effectiveness of the proposed mitigation measures and to identify contingency measures that will be implemented if performance objectives cannot be met. Furthermore, any unanticipated potentially significant adverse environmental effects discovered during the post-construction monitoring program will be mitigated as described in **Section 4.0** of this EEMP. Post-construction monitoring for wildlife and wildlife habitat recommended in the NHA/EIS includes the following:

- *Bird and bat mortality monitoring:* twice weekly (3-4 day intervals) mortality monitoring at a minimum of 12 turbines (or 33% of turbines) beginning May 1 to October 31. Weekly monitoring for raptors at the 12 turbines will continue until November 30. Monitoring of all 36 turbines for raptor fatalities will take place once monthly from May through November. Monitoring will be conducted for a period of three years. Searcher efficiency and carcass removal trials will be conducted each year according to current MNR guidance documents.
- *Potential disturbance effects to waterfowl nesting areas:*
- *Potential disturbance to marsh breeding bird habitat (including Yellow Rail); and,*
- *Potential disturbance effects to bird species of conservation concern - Canada Warbler and Olive-sided Flycatcher.*

3.2 PRIMARY DATA COLLECTION

Mortality monitoring of birds and bats will be conducted within a 50 m radius from each turbine base. Physical carcass searches and data collection will be conducted by field personnel skilled at identifying birds and bats by sight. All carcasses found will be photographed and recorded/labelled with the following information; species, sex, date, time, location (UTM coordinates), carcass condition, searcher, injuries, ground cover, and distance and direction to nearest turbine. Carcasses in good condition will be placed in a heavy-duty plastic bag and stored in an on-site freezer for later use in searcher efficiency and scavenger removal trials,

Field data collection sheets will also include weather conditions such as wind speed and precipitation, ground cover visibility class, the estimated number of days since death, and condition of each carcass collected.

Although all reasonable effort will be made to conduct surveys as scheduled, surveys will not be conducted if weather (e.g. lightning, heavy snow, severe fog) presents safety concerns. Weather

conditions will be noted when surveys were not conducted as scheduled, and every attempt will be made to complete the missed survey(s) as soon as possible.

The detailed monitoring methods, including duration, frequency and survey locations are discussed in the following sections.

The 12 turbines will be selected to provide representative coverage of the habitats and layout of the Project Location and will exclude any turbines where vegetation cover precludes searches (i.e. Visibility Classes 3 and 4 [MNR, 2011b]). MNR will be consulted to select the 12 turbines for post-construction monitoring. The search area of each turbine will be mapped into visibility classes according to the following table:

Table 1: Ground Cover Visibility Classes (Ministry of Natural Resources, 2011)

% Vegetation Cover	Vegetation Height	Visibility Class
≥90% bare ground	≤15%cm tall	Class 1 (Easy)
≥25% bare ground	≤15cm tall	Class 2 (Moderate)
≤25% bare ground	≤25% >30cm tall	Class 3 (Difficult)
Little or no bare ground	≥25% >30cm tall	Class 4 (Very Difficult)

Portion Area Searched

Most birds and bats will fall within 50 m of the turbine base (MNR, 2011b and c) and therefore this distance represents the maximum recommended search area. This value will be used to determine the portion of area searched (P_s). When the entire 50 m radius search area is searched, P_s will equal 100%. If portions of the 50 m radius search area are impossible or futile to search due to site conditions, P_s will be adjusted accordingly based on the searchers' ongoing estimates of the proportion of the search area that was physically searched. If feasible, a GPS will be used to delineate the search area and calculate the P_s.

The area searched will be determined for each turbine by mapping searchable areas on a grid (by visibility class) and counting the number of searched grid cells within 50 m. A map of the actual search area for each turbine searched and a description of areas deemed to be unsearchable due to vegetation height, type, slope, etc., will be provided in the monitoring report and maps of the varying search areas will be made available to review agencies. The aggregate area of those cells will be divided by the total area within a 50 m radius circle to determine the percent area searched for that turbine (Ps_x, where x is the turbine number).

$$Ps_x = \frac{\text{actual area searched}}{\pi r^2}$$

The overall Ps for the facility will be calculated as the average of Ps_1 through Ps_{12}.

Observed fatalities will be photographed, and the species, GPS coordinates, substrate, carcass conditions, possible injuries, sex (if possible) and distance and direction to the nearest turbine

will be recorded along with the date, time and searcher. This approach to mortality monitoring will facilitate any potential correlation between mortality occurrences, turbine location, habitat/land use features, weather conditions and season.

Searcher Efficiency Trials

Searcher efficiency trials require a known number of discreetly marked carcasses to be placed around a regularly monitored wind turbine. Searchers examine the wind turbine area, and the number of carcasses that they find is compared to the number of carcasses placed. Searcher efficiency trials will typically be conducted once in each of spring, summer and fall, but will be repeated if searchers change during the monitoring year. Searcher efficiency trials are designed to correct for carcasses that may be overlooked by surveyors during the survey periods. Searcher efficiency trials involve a "tester" that places bird and bat carcasses under turbines prior to the standard carcass searches to test the searcher's detection rate. Each trial will consist of a minimum of 10 carcasses per searcher, per visibility class, per season and will coincide with the regular carcass searches. No more than 3 trial carcasses would be placed at any one time. Trial carcasses will be placed randomly within the search area and the location will be recorded (UTM coordinates) to ensure easy retrieval by the "tester" at the end of the trial day. Trial carcasses will be marked with a unique identifying mark and should be as fresh as possible, with bat carcasses making up at least one third of the carcass removal trials and birds comprising another third, if available, or small brown mammals or dark-coloured poultry chicks.

Searcher efficiency (Se) is calculated for each searcher as follows:

$$Se = \frac{\text{number of test carcasses found}}{\text{number of test carcasses placed} - \text{number of test carcasses scavenged}}$$

A weighted average, or "overall Se", will be calculated to account for varying survey effort between searchers. The overall Se will be calculated as follows:

$$Se_o = Se_1(n_1/T) + Se_2(n_2/T) + Se_3(n_3/T) + Se_4(n_4/T)$$

where:	Se_o	is the overall searcher efficiency;
	$Se_1 – Se_4$	are individual searcher efficiency ratings;
	$n_1 – n_4$	are number of turbines searched by each searcher
	T	is the total number of turbines searched by all searchers.

Carcass Removal Trials

Levels of carcass scavenging must be determined through carcass removal trials. In these trials, carcasses are planted around the wind turbines and monitored until they disappear or have completely decomposed (generally 2 weeks). Carcass removal trials will be conducted once per season (spring, summer, and fall) and will involve a minimum of 10 bird and bat

carcasses as fresh as possible, with bat carcasses making up at least one third of the trial carcasses and birds comprising another third, if available, or dark-coloured poultry chicks. If available, at least one raptor carcass (if available) will be used for some trials.

Discreetly marked test carcasses (e.g. clipping of ear, wing, leg, hole punching of ear) will be placed out singly at turbines and distributed across the monitored turbines before dusk using gloves and boots to avoid imparting human smell. These trials involve the distribution of carcasses in different substrate/habitat types and visibility classes being searched, at known locations at each wind turbine generator being monitored, followed by monitoring every 3-4 days in conjunction with carcass searches, checking to determine the rate of removal. The average carcass removal time is a factor in determining the estimated bird and bat mortality. Carcass removal trials are designed to correct for carcasses that are removed by predators before the search period. Proportions of carcasses remaining after each search interval are pooled to calculate the overall scavenger correction factor:

$$Sc = \frac{n_{visit1} + n_{visit2} + n_{visit3} + n_{visit4}}{n_{visit0} + n_{visit1} + n_{visit2} + n_{visit3}} \quad \text{where}$$

Sc is the proportion of carcasses not removed by scavengers over the search period

$\mathbf{n_{visit0}}$ is the total number of carcasses placed

$\mathbf{n_{visit1} - n_{visit4}}$ are the numbers of carcasses remaining on visits 1 through 4

Corrected Mortality Estimates

In addition to total bird and bat mortalities observed, estimated mortality rates will also consider the results of searcher efficiency, carcass removal trials and portion area searched. MNR recommends the following formula to calculate the estimated bird and bat mortality:

$$\mathbf{C = c / (S_{e0} \times S_c \times P_s),} \quad \text{where}$$

C is the corrected number of bird or bat fatalities

c is the number of carcasses found

$\mathbf{S_{e0}}$ is the weighted proportion of carcasses expected to be found by searchers (overall searcher efficiency)

$\mathbf{S_c}$ is the proportion of carcasses not removed by scavengers over the search period

$\mathbf{P_s}$ is the portion of the area searched.

3.2.1 Bird Mortality Monitoring

Background

Data from wind projects currently operating in Ontario and around the world indicates that very low numbers of bird fatalities occur as result of wind power projects (MNR 2011b). Data from Ontario and the United States indicates that approximately two birds per year are killed by individual turbines, which is very low compared to other existing sources of human caused avian mortality (MNR 2011a). Birds can be killed through collisions with turbine blades and towers, meteorological towers and maintenance vehicles. Mortality rates and patterns can be affected by density and behavior of birds found in the area, the presence of landscape features such as ridges, valleys, peninsulas and shorelines and weather conditions.

Monitoring

Post-construction bird mortality monitoring surveys may identify specific species and/or specific periods of high bird mortality or specific turbines/turbine groups linked to bird morality. This information can be used to established protocols for operational mitigation and inform adaptive management. Bird mortality monitoring will be conducted according to MNR's *Birds and Bird Habitats: Guidelines for Wind Power Projects* (MNR, 2011b). **Table 1.2, Appendix A** of this EEMP summarizes the post-construction wildlife monitoring program for mortality monitoring of birds.

Mortality monitoring at 12 turbines (33% of the total number of turbines contained within the Project) with minimally-vegetated ground cover (i.e., Visibility Classes 1 and 2 [MNR, 2011b]) within a 50 m radius using transects spaced 5.0 -6.0 m apart starting from the base of the wind turbine will be conducted twice-weekly (3-4 day intervals) beginning May 1 to October 31. Monitoring for raptors will continue at the 12 turbines until November 30. Monitoring of all 36 turbines for raptor fatalities will take place once monthly from May 1 through November 30. This will occur for a three year period.

Bird carcasses in good condition may be collected and stored in a freezer for future use in searcher efficiency and/or carcass removal trials. Searchers handling bird carcasses will take reasonable precautions (e.g. gloves, tools etc.) to protect their personal health. Bird carcasses will be placed in heavy-duty plastic bags and transported that day to a freezer, where they will be stored until required for the trials.

Authorization under the *Migratory Bird Convention Act, 1994* ("MBCA") will be required for handling carcasses of migratory birds. Likewise, carcasses of threatened or endangered species are covered under the *Endangered Species Act, 2007* ("ESA") or the federal *Species at Risk Act* ("SARA") and raptor carcasses are covered under the *Fish and Wildlife Conservation Act* ("FWCA"). The Proponent and its agents will consult with the MNR and Environment Canada/Canadian Wildlife Service prior to commencing the field program to ensure proper permits and/or procedure are in place to collect, possess, transport and utilize bird carcasses for scientific purposes.

Other permits, approvals, authorizations, etc., are not likely to be required from the MNR or Environment Canada to permit the monitoring activities contemplated in this Plan.

3.2.2 Bat Mortality Monitoring

Background

Bat mortality has been documented at wind power facilities in a variety of habitats across North America. Nearly every monitored wind power facility in the United States and Canada has reported bat mortality with minimum annual mortality varying from < 1 to 50 bat fatalities/turbine/year (MNR, 2006). The majority of bat fatalities at wind power facilities occur in the late summer and fall, and the long-distance migratory bats (i.e., Hoary Bat, Eastern Red Bat, Silver-haired Bat) appear to be most vulnerable to collisions with moving turbine blades. Specific factors causing bat mortality and affecting species vulnerability to wind turbine mortality remain unclear, although recent evidence from Alberta suggests that air pressure differences in the blade vortices may contribute to bat mortality (barotrauma).

Monitoring

In Ontario, the post-construction monitoring season for bats is based on bat activity patterns, covering spring activity through fall swarming and migration and is consistent with the post-construction monitoring season for birds; thus occurring from May 1- October 31. Bat mortality monitoring will be conducted according to MNR's *Bats and Bat Habitats: Guidelines for Wind Power Projects* (2011c). In general, the mortality monitoring requirements for bats will be captured in conjunction with bird mortality monitoring, as described in **Section 3.2.1**. **Table 1.2, Appendix A** of this EEMP. The post-construction monitoring program for bat mortality is summarized below:

- Bat mortality monitoring will be conducted twice-weekly (3-4 day intervals) within minimally-vegetated portions (i.e., Visibility Classes 1 and 2 [MNR, 2011c]) of a 50 m search area radius from the base of 12 turbines beginning May 1 to October 31st for a three-year period in accordance with MNR guidelines. This time period includes the core season when resident and migratory bats are active. Bat mortality monitoring will be conducted in conjunction with other monitoring activities (birds) for efficiency.

- Searcher efficiency and carcass removal trials will be conducted seasonally (spring, summer, and fall) between May 1 and October 31st. Searcher efficiency and carcass removal rates are known to be more variable for bats than for birds throughout the year and depending on habitat (in part due to the relative size of the species).

As with birds, trial carcasses will be discreetly marked so they can be identified as study carcasses. Each trial will consist of a minimum of 10 carcasses per searcher per visibility class (for searcher efficiency trials) or per trial (for scavenger removal trials). At least one-third of the trial carcasses should be bats.

Bat carcasses in good condition may be collected and stored in a freezer for future use in searcher efficiency and/or scavenger removal trials. Searchers handling bat carcasses will take reasonable precautions (e.g., gloves, tools etc.) to protect their personal health. All searchers will ensure they have updated rabies pre-exposure vaccinations. Biological material will be disposed of in a way to ensure that it does not pose a public or environmental health risk and in accordance with any applicable federal or provincial.

3.2.3 Waterfowl Nesting Area Surveys

Background

Based on results from habitat use studies, if any of WNA-2, 4, 9, 13 and 18 is deemed significant during pre-construction habitat use surveys (**Section 2.2.3**), a 3-year post-construction monitoring program will be implemented as there are turbines proposed in the adjacent upland areas within 120 m of the core wetlands of these features.

Monitoring

Post-construction survey methodologies for waterfowl nesting areas will be replicated based on pre-construction monitoring survey methodology. For these survey methodologies, please refer to **Section 2.2.3.**

3.2.4 Marsh Breeding Bird and Yellow Rail Habitat

Background

Based on results from habitat use studies, if MBBH-8 or 9 is deemed significant during pre-construction habitat use surveys (**Section 2.2.6**), a 3-year post-construction program will be implemented as there are turbines proposed within 120 m of these features.

Monitoring

Two post-construction point count stations in marsh habitat will be established and surveyed at a turbine location with confirmed significance based on the pre-construction habitat use studies. One station will be situated 120 metres from the turbine location, and the other station located approximately 200 metres of the turbine, and used as ‘control’ sites.

Each of the surveys will include a ten-minute point count at each location, conducted during the breeding season (May -June), for a minimum of three years during post-construction surveys. Each station should be surveyed a minimum of 3 times: once early in the season; once in mid-season; and, once later in the season with at least 10 days between surveys at a particular station. Point counts must be performed in the early morning, between dawn (one half hour before sunrise) and about 4 hours after sunrise. Surveys in late June and early July should usually be completed within 3 hours of sunrise. Surveys will be performed when the wind speed is 3 or less on the Beaufort scale and when there is no precipitation unless it is a light drizzle. Breeding pair density is a standard measure that will be used to compare among years or

between control (> 120 m) and impact sites (< 120 m). The marsh species observed will be compared to pre-construction conditions. Additional information that will be recorded on the appropriate data forms can be found in **Section 2.2.6**.

3.2.5 Canada Warbler and Olive-sided Flycatcher Habitat

Background

Based on results from habitat use studies, if CWH-6, 8, 9, 10, 12, 20, 23 or 25 is deemed significant (**Section 2.2.7**), a 3-year post-construction program will be implemented as there are turbines proposed within 120 m of these features. Post-construction monitoring will also be undertaken in confirmed Canada Warbler habitats CWH-11 and 18. There are no proposed turbines within 120 m of potential habitat for Olive-sided Flycatcher; as such no post-construction monitoring is required.

Monitoring

Two post-construction point count stations in woodland habitat will be established and surveyed at a turbine location with confirmed significance based on the pre-construction habitat use studies. One station will be situated 120 metres from the turbine location, and the other station located approximately 200 metres of the turbine, and used as ‘control’ sites.

Each of the surveys will include a ten-minute point count at each location, conducted during the breeding season (May 5-August 8), for a minimum of three years during post-construction surveys. Each station should be surveyed a minimum of 3 times: once early in the season; once in mid-season; and, once later in the season with at least 10 days between surveys at a particular station. Point counts must be performed in the early morning, between dawn (one half hour before sunrise) and about 4 hours after sunrise. Surveys in late June and early July should usually be completed within 3 hours of sunrise. Surveys will be performed when the wind speed is 3 or less on the Beaufort scale and when there is no precipitation unless it is a light drizzle. Breeding pair density is a standard measure that will be used to compare among years or between control (> 120 m) and impact sites (< 120 m). The woodland species observed will be compared to pre-construction conditions. Additional information that will be recorded on the appropriate data forms can be found in **Section 2.2.7**.

3.3 Reporting and Review of Results

Annual post-construction monitoring reports will summarize and analyze the results of all wildlife surveys. Reports will be submitted to the MOE and MNR within three months of the conclusion of the November mortality monitoring.

The monitoring program will be reassessed by MNR and the Proponent at the end of each monitoring year. Pending the reassessment results, the program methods and frequencies may be reasonably modified to better reflect the findings.

4.0 Adaptive Management Program

The adaptive management program described in this section outlines performance objectives, and contingency measures that will be implemented should the performance objectives not be met.

Contingency plans address immediate mitigation actions necessary in case of a significant bird or bat mortality event, or if mitigation actions fail. Contingency measures may include an adaptive management approach. An adaptive management program allows mitigation measures to be implemented in the event that unanticipated potentially significant adverse environmental effects are observed. Potentially significant adverse effects will be assessed through review of the annual report.

The following sections describe the procedures for notifications, reporting, and adaptive management for mortality and disturbance effects monitoring.

4.1 MORTALITY MONITORING

All bird and bat mortality will be reported in the annual report submission. Mortality rate is expressed as the number of fatalities per turbine per year (e.g., from May 1 to November 30). Mortality of priority species in Bird Conservation Region ("BCR") 12 (Boreal Hardwood Transition) and mortality of all species of conservation concern in EcoRegion 5E (MNR, 2012) will be highlighted in the annual post-construction monitoring reports. A threshold approach will be used to identify and mitigate significant bird and bat mortality resulting from the operation of wind turbines.

4.1.1 Birds

Post-construction mitigation, including operational controls, will be considered if annual mortality of birds exceeds any of the following thresholds defined by the MNR (2011b):

- 14 birds/turbine/year at individual turbines or turbine groups;
- 0.2 raptors/turbine/year (all raptors) across a wind power project; or
- 0.1 raptors of provincial conservation concern/turbine/year across a wind power project.

Or if bird mortality during a single mortality monitoring survey exceeds:

- 10 or more birds at any one turbine; or
- 33 or more birds (including raptors) at multiple turbines.

Mortality levels maintained below these thresholds are considered unlikely to affect bird populations (MNR 2011b).

Any and all observed mortality of species at risk (i.e., a species listed as Endangered, Threatened or Special Concern under Schedule 1 of the federal SARA or a species listed on the Species at Risk in Ontario list as Extirpated, Endangered, or Threatened under the provincial ESA) that occurs will be reported within 48 hours to MNR.

If with due consideration of seasonal abundance and species composition, annual mortality levels at turbines exceed the thresholds noted above, two years of subsequent scoped mortality and cause and effects monitoring will be conducted. Following scoped monitoring, post-construction mitigation (e.g., operational mitigation) and effectiveness monitoring may be required at individual turbines where a mortality effect has been identified or significant annual mortality persists (MNR 2011b).

If significant annual mortality persists, immediate post-construction mitigation (including operational mitigation), and 3 years of effectiveness monitoring may be required. Avoidance-disturbance effects monitoring may also be required. MNR will be engaged to initiate an appropriate response plan as set out in the MNR's Bird Guidelines (2011a). The response plan would include an analysis of the species, timing and distribution of fatalities to determine potential risk factors leading to mortality. The analysis may include an evaluation of the mortality data and/or behavioral studies to better refine when and where species are most at risk of collision. The results of this analysis will be used to develop operational mitigation measures, which may include the following

- Periodic shut-down of select turbines at specific times of year, when mortality risks to the affected bird species is particularly high (i.e., migration)[1]
- Blade feathering at specific times of year, when mortality risks to the affected bird species is particularly high (i.e., migration)
- Or alternate plan agreed to between the Proponent and MNR

4.1.2 Bats

Operational mitigation is required where annual post-construction mortality monitoring exceeds 10 bats/turbine/year (MNR, 2011c).

This threshold of 10 bats/turbine/year has been determined based on bat mortality reported at wind power projects in Ontario and comparison with jurisdictions across North America.

[1] MNR 2011a

Operational mitigation to be implemented includes changing the wind turbine cut-in speed to a wind speed of 5.5 m/s (measured at hub height) or feathering of wind turbine blades when wind speeds are below 5.5 m/s.

The majority of bat mortalities from wind turbine operations occur during fall migration. Where post-construction monitoring indicates that annual bat mortality threshold of 10/bats/turbine/year has been exceeded, operational monitoring will be implemented across the wind power project from sunset to sunrise, from July 15-September 30 and will continue for the duration of the project. If site specific monitoring indicates a shifted peak mortality period (due to higher latitude projects), operational mitigation may be shifted to match the peak mortality, with mitigation maintained for a minimum of 10 weeks. Any shift in the operational mitigation period to match peak mortality will be determined in consultation with the MNR. Where post-construction mitigation is applied, an additional 3 years of effectiveness monitoring is required, as set out in the MNR's Bat Guidelines (MNR, 2011c).

4.1.3 Contingency Plan

4.1.3.1 Contingency Plan for Mass Mortality of Birds

To date, there have been no recorded events of mass mortality of birds at wind farms in Ontario. The various post-construction monitoring projects in Ontario typically record between 0 to 2 bird fatalities at individual turbines during any one survey, with only a single record of 3 birds fatalities observed at one turbine during a single visit (Friesen, 2011). As such, the risk of a mass mortality event for birds is anticipated to be very low.

In the event of a mass mortality event, defined as 10 or more bird fatalities at any one turbine, or 33 or more bird fatalities (including raptors) at multiple turbines on a single survey, the following steps will be implemented:

1. MNR will be notified of the event within 48 hours and will be provided with any available details (e.g. species, number and distribution of turbines involved).

2. An emergency search of all turbines in the Project will be conducted as soon as practicable to determine the extent and the distribution of the mortality event.

3. An analysis of the results of the emergency search will be completed to identify potential risk factors (e.g., weather conditions, proximity to natural heritage features) leading to the mortality event.

4. Based on the risk factors identified, additional mitigation and scoped monitoring recommendations will be developed in conjunction with MNR with the goal of avoiding future mortality events.

4.1.3.2 Contingency Plan for Continued Significant Bat Mortality

Additional mitigation measures may be implemented in the event of continued significant bat mortality (i.e., more than 10 bats/turbine/year) after the mitigation measures outlined in Section 3.1.2 have been implemented. Should the cut-in speed mitigation be implemented and the bat mortality thresholds continue to be exceeded, the Proponent will work with the MNR to reasonably determine additional mitigation and scoped monitoring requirements.

5.0 Best Management Practices

The Proponent will include the following best management practices as part of the post-construction monitoring program (as outlined in MNR, 2011b and 2011c).

5.1 DATA MANAGEMENT

All pre- and post-construction data, collected in accordance with MNR guidance and reported to the MOE, will be submitted to the joint Canadian Wildlife Service – Canadian Wind Energy Association – Bird Studies Canada – Ontario Ministry of Natural Resources Wind Power and Birds Monitoring Database.

5.2 WHITE-NOSE SYNDROME

Carcasses of the following species found during bat mortality searches may be sent to the Canadian Cooperative Wildlife Health Centre for analysis of White-nose Syndrome and should not be used in carcass removal or searcher efficiency trials:

- Northern Long-eared Bat (Myotis septentrionalis)
- Little Brown Bat (Myotis lucifugus)
- Small-footed Bat (Myotis leibii)
- Tri-coloured Bat/Eastern Pipistrelle (Perimyotis subflavus)
- Big Brown Bat (Eptesicus fuscus)

5.3 BAT TISSUE SAMPLES

Tissue samples from bat carcasses may be used in a number of DNA analyses to provide insight into population size and structure, as well as the geographic origin migrants. The Proponent will contact the local MNR office prior to disposing bat carcasses, to determine if this type of research is occurring in the area.

6.0 Closure

This Environmental Effects Monitoring Plan for the Bow Lake Wind Farm has been prepared in accordance with O. Reg. 359/09, s. 23.1, the MNR's *Approval and Permitting Requirements Document for Renewable Energy Projects* (MNR, 2009), the *MOE's Technical Guide to Renewable Energy Approvals* (MOE, 2011), MNR's *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNR, 2011c) and MNR's *Birds and Bird Habitats: Guidelines for Wind Power Projects* (MNR, 2011b).

Stantec Consulting Ltd. prepared this Environmental Effects Monitoring Plan for the Proponent for the Bow Lake Wind Farm. The Proponent is committed to implementing the appropriate protection and mitigation measures as they apply to the construction and operation of the proposed Project.

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Appendix A

Tables

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
Wetlands (Grey highlighted wetlands are considered significant according to page 36 of the NHA Guide. SWET-4 is a component of the Bull's-Eye PSW complex. SWET-28 and 50 have been recommended for inclusion as part of the Bull's-Eye PSW complex)							
SWET-1		CL-40m	- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines	- Degradation of wetland through changes in water flow or surface water contamination.	- All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from wetlands. - Maintain surface flow patterns to wetlands by installing properly designed and sited culverts under access roads or in other areas, as required.	- Culvert installations - flow conveyance, with no restrictions or ponding.	- Construction Supervisor to monitor twice weekly and after significant rainfall events.
SWET-2		CL-40m					
SWET-3		BU-4m, CL-3m					
SWET-4		CL-1m					
SWET-9		AR-2m					
SWET-11		AR-1m					
SWET-12		AR-39m		- Wetland desiccation or drying resulting from removal of riparian or buffering vegetation.	- Prior to construction the limits of vegetation clearing will be staked in the field. The Construction Supervisor will ensure that no construction disturbance occurs beyond the staked limits. - Access roads (AR) and collector lines (CL) distances are measured from the edge of planning corridors, not from actual construction; during construction wetland boundaries will be staked and the maximum buffer possible will be provided to the wetland See Figures 7, 8 and 11 for site specific details. - Should monitoring reveal that clearing occurred beyond defined limits, mitigation action will be taken that could include rehabilitation of the disturbed area at the direction of a qualified ecologist. - Prior to the start of construction activity, the topsoil/seedbank (where present) will be stripped and preserved; material will be reapplied in suitable rehabilitation areas post construction. - Excavated soil will be re-used on site. Soil conditions at temporary laydown areas and other disturbed sites will be restored, and depending on surrounding habitat, natural regeneration and/or seeding will be relied on to restore native vegetation cover. Once the laydown areas are no longer required, vegetation will be surveyed to assess disturbance and the potential for natural regeneration. If required, areas will be reseeded with species native to EcoDistrict 5E-13 or the local area, and in consultation with MNR. - Re-vegetate disturbed areas with fast growing native species as soon as practical after construction activity within the disturbed areas is complete.	- Construction limit staking and fencing – visible and effective - Rehabilitation areas -	- Weekly - Once after seeding area. - Once in late spring the year following seeding. - Ensure that seed establishes in areas of disturbance within one growing season.
SWET-13		WT-50m, WTL-40m, AR-61m, CL-7m					
SWET-14		AR-37m					
SWET-15		AR-8m					
SWET-16		WT-82m, WTL-72m, AR-10m					
SWET-17		WT-22m, WTL-12m, AR-5m					
SWET-19		CL-1m					
SWET-20		CL-1m					
SWET-21		WT-114m, WTL-104m, CL-1m					
SWET-22		WT-68m, WTL-58m, CL-1m					
SWET-25		WT-11m, WTL-1, AR-29, CL-19					
SWET-26		BU-10					
SWET-27		WT-80, WTL-70, AR-50, CL-46					
SWET-28		CL-93					
SWET-29		CL-75					
SWET-30		CL-1					
SWET-31		CL-1					
SWET-33		CL-12					
SWET-35		AR-6					
SWET-36		AR-3					
SWET-38		AR-8		- Degradation of wetland through sedimentation.	- Sediment control materials, which may include erosion control blankets, silt curtains, mud mats (access roads), check dams (rock or strawbales), wooden stakes, and sediment bags (dewatering) will be kept on-site in sufficient quantities during construction to allow timely installation if required; - Silt barriers (e.g., fencing) will be erected along wetland community edges as appropriate to minimize potential sediment transport to the natural features. These barriers will be regularly monitored by the Construction Supervisor and properly maintained during and following construction until	- All E&S control points.	- All E&S control measures to be monitored twice weekly and after significant rainfall events by Construction Supervisor to ensure they are functioning as intended.
SWET-39		WT-101, WTL-91, AR-106					
SWET-40		AR-54					
SWET-41		AR-31					
SWET-44		WT-91, WTL-81, CL-1					
SWET-45		WT-68, WTL-58, CL-46					

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
SWET-46		CL-59, AR-112			soils in the construction area are re-stabilized with vegetation; - Where the installation of an equalizing culvert is proposed, appropriate erosion control measures (i.e., rip rap, strawbales, seeding) will be installed at the ends of each culvert to prevent erosion; and - Where culverts are proposed within 30 m of a wetland, enhanced sediment and erosion control measures (i.e., straw bales, double rows of sediment fencing, check dams) will be installed as added protection to filter runoff and further minimize potential sedimentation within the down-gradient features (wetlands, woodlands and water bodies). This added protection is proposed to reduce environmental risk.		
SWET-48		CL-1					
SWET-50		CL-1					
SWET-51		CL-1					
SWET-52		CL-26					
SWET-53		CL-94					
SWET-56		CL-1					
SWET-57		CL-1					
SWET-60		AR-1					
SWET-62		CL-1					
SWET-63		CL-1, AR-109					
SWET-64		CL-110					
SWET-65		CL-15					
SWET-66		CL-1					
SWET-67		CL-1					
SWET-68		AR-1			- Stockpile materials >30m from wetland edge. Where this is not possible stockpiles will be covered when not in use, especially during rain events or high wind events.	- All stockpiles within 30m of wetlands (if applicable).	- All covers on stockpiles to be put in place and checked when inclement weather events anticipated (i.e., high winds, rain events). - Stockpiles to be regularly monitored by Construction Supervisor and any deficiencies will be rectified as soon as practicable.
Wildlife Habitat – Seasonal Concentration Areas							
Turtle Overwintering Area							
TWA-1*		AR-103	- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines - Operational phase	- Habitat avoidance/ disturbance from construction activities.	- Construction within 120 m of turtle wintering areas will avoid sensitive periods during emergence in spring (March/April) and entrance in fall (September/October) to the extent reasonably possible - When construction activity is unavoidable during these periods silt fencing will be used to exclude turtles from construction areas , the silt fencing will be located to ensure turtles can access the overwintering areas without traversing the construction zone - If turtles are found inside the construction zone they will be relocated to the outside of the exclusion fencing.	- Not required.	- Not required.
TWA-4*		AR-26					
TWA-7*		AR-21					
				- Degradation of wintering areas through changes in water flow or surface water drainage patterns.	- Maintain surface flow patterns to wintering areas by installing properly designed and sited culverts under access roads.	- Culvert locations.	- Construction Supervisor to regularly visually monitor culvert installations to ensure flow conveyance, with no restrictions or ponding.
				- Degradation of wintering ponds through surface flow contamination.	- Implement Sediment and Erosion control measures (see Section 5.2.1.2). - Implement Dewatering measures if applicable (see Section 5.2.1.3). - All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from habitat. - Dust-suppression along roads in the vicinity of turtle wintering areas.	- All E&S control points.	- All E&S control measures to be monitored by Construction Supervisor, twice weekly or after significant rainfall events - .

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
Reptile Hibernacula (Snakes)							
SH-2*		WT-68, WTL-58, CL-13	- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines - Operational phase	- Habitat avoidance, disturbance and mortality from construction activities.	- Construction in the vicinity of snake hibernacula will avoid sensitive periods during emergence in spring (April/May) and entrance in fall (September/October) to the extent reasonably possible. - When construction activity is unavoidable during these periods silt fencing will be used to exclude snakes from construction areas , the silt fencing will be located to ensure snakes can access the hibernacula without traversing the construction zone See Figures 9 and 10 for site specific examples. - If snakes are found inside the construction zone they will be relocated to the outside of the exclusion fencing. - Restrict vehicle traffic to daytime hours, and limit speeds to 30 km or less on roads near snake hibernacula (including signage) during sensitive periods.	- Not required.	- Not required.
SH-4*		WT-39, WTL-29, CL-51					
SH-8*	WT, WTL	CL-4					
SH-9*	CL	WT-18, WTL-8, CL-1, AR-62					
SH-11*	CL			- Degradation of hibernacula through changes in water flow or surface water drainage patterns.	- Maintain surface flow patterns in vicinity of hibernacula by installing properly designed and sited culverts under access roads or in other areas, as required.	- Culvert locations.	- Construction Supervisor to regularly visually monitor culvert installations to ensure flow conveyance, with no restrictions or ponding.
				- Degradation of hibernacula through surface flow contamination.	- Implement Sediment and Erosion control measures (see Section 5.2.1.2). - Implement Dewatering measures if applicable (see Section 5.2.1.3). - All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from habitat.	- All E&S control points.	- All E&S control measures to be regularly monitored by Construction Supervisor, particularly when inclement weather events anticipated (i.e., high winds, rain events) to ensure they are functioning as intended.
Wildlife Habitat – Rare Vegetation Communities or Specialized Habitat for Wildlife							
Waterfowl Nesting Area							
WNA-2*	CL	WT-116, WTL-106	- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines	- Loss and degradation of the upland areas surrounding core wetlands.	- Prior to construction the limits of vegetation clearing will be staked in the field. The Construction Supervisor will ensure that no construction disturbance occurs beyond the staked limits and that edges of habitat adjacent to the work areas are not disturbed. Regular monitoring of the limits of clearing will be undertaken to ensure that disturbance is minimized. Should monitoring reveal that clearing occurred beyond defined limits, mitigation action will be taken that could include rehabilitation of the disturbed area at the direction of a qualified ecologist. - To the extent practical, tree and/or brush clearing will be completed prior to or after the core nesting season for migratory birds (May 9 to August 8). - Should clearing be required during the breeding bird season, prior to any clearing, surveys will be undertaken to identify the presence/absence of nesting birds. If a nest is located, a designated buffer will be marked off within which no construction activity will be allowed while the nest is active. The radius of the buffer width will range from 5 - 60 m depending on the species. Buffer widths are based on the species sensitivity and on buffer width recommendations that have been reviewed and approved by Environment Canada. - Prior to the start of construction activity, the topsoil/seedbank (where present) will be stripped and preserved; material will be reapplied in	- All areas of disturbance will be monitored to ensure that seed establishes within one growing season.	- Once after seeding area. - Once in late spring the year following seeding.
WNA-3*	AR						
WNA-4*	WT, WTL, CL						
WNA-5*	AR						
WNA-7*	AR	BO-1					
WNA-8*	AR						
WNA-9*		WT-64, WTL-54, CL-19					
WNA-10*	CL						
WNA-11*	CL						
WNA-13*	CL	WT-119, WTL-109					
WNA-16*	CL, BU						
WNA-18*	CL	WT-80, WTL-70					

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
					suitable rehabilitation areas post construction. - All disturbed areas of the construction site will be re-vegetated with native species as soon as conditions allow. - Excavated soil will be re-used on site as feasible. If not feasible, the soil will be disposed of at an approved off-site facility. Soil conditions at temporary laydown areas and other disturbed sites will be restored, and depending on surrounding habitat, natural regeneration and/or seeding will be relied on to restore native vegetation cover. Once the laydown areas are no longer required, vegetation will be surveyed to assess disturbance and the potential for natural regeneration. If required, areas will be reseeded with species native to EcoDistrict 5E-13 or the local area, and in consultation with MNR. - Re-vegetate disturbed areas with fast growing native species as soon as practical after construction activity within the disturbed areas is complete within the same growing season).		
				- Degradation of core wetland habitat through surface flow contamination.	- All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from habitat.	- Not required.	- Not required.
				- Degradation of upland and wetland vegetation through changes in water flow or surface water drainage patterns.	- Maintain surface flow patterns to uplands and wetlands by installing properly designed and sited culverts under access roads or in other areas, as required.	- Culvert locations.	- Construction Supervisor to regularly visually monitor culvert installations to ensure flow conveyance, with no restrictions or ponding.
				- Degradation of core wetland through sedimentation.	- Implement Sediment and Erosion control measures (see Section 5.2.1.2).	- All E&S control points.	- All E&S control measures checked when inclement weather events anticipated (i.e., high winds, rain events). - All E&S control measures to be regularly monitored by Construction Supervisor to ensure they are functioning as intended.
				- Habitat avoidance/loss of nesting habitat.	- Conduct tree/brush clearing outside the core nesting season (May 9-August 8). - If unavoidable, conduct nest surveys in areas where vegetation will be removed to identify presence/absence of nesting birds. - If a nest is located, a designated buffer will be clearly marked in the field within which no clearing will be allowed while the nest is active. The radius of the buffer will be 5 to 60 m depending on the species.	- All WFN areas where vegetation removal is required.	- Once prior to vegetation removal if it is unavoidable during the nesting season.

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
Seeps and Springs							
Entire forested ecosite (G058Tt + G067Tt) Attributes supporting habitat:			- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines - Operational Phase	- Degradation of seep or reduction in infiltration through changes in water flow or surface water contamination.	- Prior to construction the limits of vegetation clearing will be staked in the field. The Construction Supervisor will ensure that no construction disturbance occurs beyond the staked limits. - Vegetation clearing and construction will avoid seepage areas. See Figure 12 for site specific details. - All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from seeps. - Maintain surface flow patterns to seeps by installing properly designed and sited culverts under access roads or in other areas, as required. - Imported fill, if any, will be restricted to coarse and free draining material to allow for continued infiltration and support of seeps.	- Culvert installations - flow conveyance, with no restrictions or ponding.	- Construction Supervisor to monitor twice weekly and after significant rainfall events.
SEEP-1		WT-40, WTL-30, CL-52		- Degradation of seepage area through sedimentation.	- Sediment control materials, which may include erosion control blankets, silt curtains, mud mats (access roads), check dams (rock or strawbales), wooden stakes, and sediment bags (dewatering) will be kept on-site in sufficient quantities during construction to allow timely installation if required; - Silt barriers (e.g., fencing) will be erected along seep boundaries as appropriate to minimize potential sediment transport to the natural features. These barriers will be regularly monitored by the Construction Supervisor and properly maintained during and following construction until soils in the construction area are re-stabilized with vegetation; - Where the installation of an equalizing culvert is proposed, appropriate erosion control measures (i.e., rip rap, strawbales, seeding) will be installed at the ends of each culvert to prevent erosion; and - Where culverts are proposed within 30 m of a seep, enhanced sediment and erosion control measures (i.e., straw bales, double rows of sediment fencing, check dams) will be installed as added protection to filter runoff and further minimize potential sedimentation within the down-gradient features (ex. seeps and other water bodies, wetlands, woodlands). This added protection is proposed to reduce environmental risk. - - - Stockpile materials >30m from wetland edge. Where this is not possible stockpiles will be covered when not in use, especially during rain events or high wind events.	- All E&S control points. - All stockpiles within 30m of wetlands (if applicable).	- All E&S control measures to be monitored twice weekly and after significant rainfall events by Construction Supervisor to ensure they are functioning as intended. - All covers on stockpiles to be put in place and checked when inclement weather events anticipated (i.e., high winds, rain events). - Stockpiles to be regularly monitored by Construction Supervisor and any deficiencies will be rectified as soon as practicable.
SEEP-2		CL-120					
SEEP-4		WT-110, WTL-100, AR-77					
SEEP-5		AR-119					
SEEP-6		CL-3					
SEEP-7		CL-3					
SEEP-9		CL-2					
SEEP-11		AR-33					
SEEP-19		CL-34, BU-44					
SEEP-20		CL-32, BU-53					
SEEP-21		CL-5, BU-58					
SEEP-22		CL-5, BU-55					
SEEP-24		BU-65					
SEEP-25		BU-37					
SEEP-26		BU-71					
SEEP-27		CL-50					
SEEP-28		CL-95, BU-90					
SEEP-29		CL-20					
SEEP-30		CL-13					
SEEP-31		CL-21					
SEEP-33		AR-104					
SEEP-34		CL-14					
SEEP-36		AR-12, WT-79, WTL-69					
SEEP-37		CL-67					
SEEP-38		CL-90					
SEEP-40		CL-39, WTL-120					
SEEP-41		CL-6, WT-65, WTL-55					
SEEP-42		CL-7, WT-30, WTL-					

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
		20					
SEEP-43		CL-91, BU-22					
SEEP-44		CL-5					
SEEP-46		CL-13					
SEEP-48		CL-9, WT-90, WTL-80					
Moose Aquatic Feeding Area							
MAFA-1*	CL	WT-99, WTL-89	- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines - Operational phase	- Loss and degradation of the lowland conifer and mixed forests surrounding core wetlands.	- Prior to construction the limits of vegetation clearing will be staked in the field. The Construction Supervisor will ensure that no construction disturbance occurs beyond the staked limits and that edges of habitat adjacent to the work areas are not disturbed. Regular monitoring of the limits of clearing will be undertaken to ensure that disturbance is minimized. Should monitoring reveal that clearing occurred beyond defined limits, mitigation action will be taken that could include rehabilitation of the disturbed area at the direction of a qualified ecologist. - Prior to the start of construction activity, the topsoil/seedbank (where present) will be stripped and preserved; material will be reapplied in suitable rehabilitation areas post construction. - All disturbed areas of the construction site will be re-vegetated with native species as soon as conditions allow. - Excavated soil will be re-used on site as feasible. If not feasible, the soil will be disposed of at an approved off-site facility. Soil conditions at temporary laydown areas and other disturbed sites will be restored, and depending on surrounding habitat, natural regeneration and/or seeding will be relied on to restore native vegetation cover. Once the laydown areas are no longer required, vegetation will be surveyed to assess disturbance and the potential for natural regeneration. If required, areas will be reseeded with species native to EcoDistrict 5E-13 or the local area, and in consultation with MNR. - Re-vegetate disturbed areas with fast growing native species as soon as practical after construction activity within the disturbed areas is complete.	- All areas of disturbance will be monitored to ensure that seed establishes within one growing season.	- Once after seeding area. - Once in late spring the year following seeding.
				- Degradation of core wetland habitat through surface flow contamination.	- All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from habitat. -	- Not required.	- Not required.
				- Degradation of upland and wetland vegetation through changes in water flow or surface water drainage patterns.	- Maintain surface flow patterns to uplands and wetlands by installing properly designed and sited culverts under access roads or other locations, as required.	- Culvert locations.	- Construction Supervisor to regularly visually monitor culvert installations to ensure flow conveyance, with no restrictions or ponding.
				- Reduced water quality and species composition of submerged aquatic vegetation through sedimentation.	- Implement Sediment and Erosion control measures (see Section 5.2.1.2).	- All E&S control points.	- All E&S control measures checked when inclement weather events anticipated (i.e., high winds, rain events). - All E&S control measures to be regularly monitored by Construction Supervisor to ensure they are functioning as intended.

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
				- Disturbance of moose by construction activity	- Restrict construction, where feasible, within 120m of the core wetlands, during the Aril to August period when moose are intensively using the MAFA. - When construction activity is unavoidable during this period the construction will be completed as quickly as possible (generally within several days) to minimize the time that moose may be disturbed in their feeding habits		
Amphibian Breeding Habitat – Woodlands							
ABHW-1	AR, BO		- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines	- Loss of, or disturbance to, breeding ponds and adjacent woodland habitat.	- Prior to construction the limits of vegetation clearing will be staked in the field. The Construction Supervisor will ensure that no construction disturbance occurs beyond the staked limits the limits of construction are well outside breeding ponds - Site disturbance and alterations to surface drainage patterns within 200 m of breeding ponds will be minimized. - Tree clearing in areas within 200 m of woodland amphibian breeding ponds will be completed outside the amphibian breeding season (April – June). - When construction activity is unavoidable during the breeding period, the MNR will be consulted and silt fencing will be used to exclude amphibians from construction areas. The silt fencing will be located to allow amphibians to enter and exit the breeding ponds without traversing the construction zone. - Prior to the start of construction activity, the topsoil/seedbank (where present) will be stripped and preserved; material will be reapplied in suitable rehabilitation areas post construction. - All disturbed areas of the construction site will be re-vegetated with native species as soon as conditions allow. - Excavated soil will be re-used on site as feasible. If not feasible, the soil will be disposed of at an approved off-site facility. Soil conditions at temporary laydown areas and other disturbed sites will be restored, and depending on surrounding habitat, natural regeneration and/or seeding will be relied on to restore native vegetation cover. Once the laydown areas are no longer required, vegetation will be surveyed to assess disturbance and the potential for natural regeneration. If required, areas will be reseeded with species native to EcoDistrict 5E-13 or the local area, and in consultation with MNR. - Re-vegetate disturbed areas with fast growing native species as soon as practical after construction activity within the disturbed areas is complete.	- All areas of disturbance will be monitored to ensure that seed establishes within one growing season.	- Once after seeding area. - Once in late spring the year following seeding.
ABHW-2	AR						
ABHW-3	AR						
ABHW-4*	AR						
ABHW-5*	WT, WTL, AR, CL						
ABHW-6	WT, WTL, AR						
ABHW-7*	AR						
ABHW-8	WT, WTL, CL, AR						
ABHW-9*	AR						
ABHW-10	CL	WT-36, WTL-26					
ABHW-11*	AR						
ABHW-12*	WT, WTL, CL, AR						
ABHW-13*	CL	WT-48, WTL-38, AR-25					
ABHW-14*	WT, WTL, CL						
ABHW-15*	WT, WTL, AR, CL						
ABHW-16*	CL, BU						
ABHW-17*	AR	WT-21, WTL-11, CL-63					
				- Degradation of breeding ponds through surface flow contamination.	- Implement Dewatering measures (see Section 5.2.1.3). - All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from habitat.	- Not required.	- Not required.
				- Degradation of breeding ponds through sedimentation.	- Implement Sediment and Erosion control measures (see Section 5.2.1.2).	- All E&S control points.	- All E&S control measures checked when inclement weather events anticipated (i.e., high winds, rain events). - All E&S control measures to be regularly monitored by Construction Supervisor to ensure they are functioning as intended.

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
				- Degradation of breeding ponds through changes in water flow or surface water drainage patterns.	- Maintain surface flow patterns to breeding ponds by installing properly designed and sited culverts under access roads or other locations, as required.	- Culvert locations.	- Construction Supervisor to regularly visually monitor culvert installations to ensure flow conveyance, with no restrictions or ponding.
				- Road mortality.	- Restrict vehicle traffic to daytime hours, and limit speeds to 30 km or less on roads near woodland amphibian breeding ponds (including signage).	- Not required.	- Not required.
Habitat for Species of Special Concern							
Marsh Bird Breeding Habitat							
MBBH-8*		WT-110, WTL-100, CL-115	- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines	- Loss and degradation of the upland areas surrounding core wetlands.	- Prior to construction the limits of vegetation clearing will be staked in the field. The Construction Supervisor will ensure that no construction disturbance occurs beyond the staked limits and that edges of habitat adjacent to the work areas are not disturbed. Regular monitoring of the limits of clearing will be undertaken to ensure that disturbance is minimized. Should monitoring reveal that clearing occurred beyond defined limits, mitigation action will be taken that could include rehabilitation of the disturbed area at the direction of a qualified ecologist. - To the extent practical, tree and/or brush clearing will be completed prior to or after the core nesting season for migratory birds (May 9 to August 8). - Should clearing be required during the breeding bird season, prior to any clearing, surveys will be undertaken to identify the presence/absence of nesting birds. If a nest is located, a designated buffer will be marked off within which no construction activity will be allowed while the nest is active. The radius of the buffer width will range from 5 - 60 m depending on the species. Buffer widths are based on the species sensitivity and on buffer width recommendations that have been reviewed and approved by Environment Canada. - Prior to the start of construction activity, the topsoil/seedbank (where present) will be stripped and preserved; material will be reapplied in suitable rehabilitation areas post construction. - All disturbed areas of the construction site will be re-vegetated with native species as soon as conditions allow. - Excavated soil will be re-used on site as feasible. If not feasible, the soil will be disposed of at an approved off-site facility. Soil conditions at temporary laydown areas and other disturbed sites will be restored, and depending on surrounding habitat, natural regeneration and/or seeding will be relied on to restore native vegetation cover. Once the laydown areas are no longer required, vegetation will be surveyed to assess disturbance and the potential for natural regeneration. If required, areas will be reseeded with species native to EcoDistrict 5E-13 or the local area, and in consultation with MNR. - Re-vegetate disturbed areas with fast growing native species as soon as practical after construction activity within the disturbed areas is complete.	- Ensure that seed becomes established in areas of disturbance within one growing season.	- Once after seeding area. - Once in late spring the year following seeding.
MBBH-9*		WT-80, WTL-79, AR-50, CL-46					
				- Degradation of core wetland habitat through surface flow contamination.	- All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from habitat.	- Not required.	- Not required.

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
				- Degradation of upland and wetland vegetation through changes in water flow or surface water drainage patterns.	- Maintain surface flow patterns to uplands and wetlands by installing properly designed and sited culverts under access roads or in other areas, as required.	- Culvert locations.	- Construction Supervisor to regularly visually monitor culvert installations to ensure flow conveyance, with no restrictions or ponding.
				- Degradation of core wetland through sedimentation.	- Implement Sediment and Erosion control measures (see Section 5.2.1.2).	- All E&S control points.	- All E&S control measures checked when inclement weather events anticipated (i.e., high winds, rain events). - All E&S control measures to be regularly monitored by Construction Supervisor to ensure they are functioning as intended.
				- Habitat avoidance/loss of nesting habitat.	- Conduct tree/brush clearing outside the core nesting season (May 9-August 8). - If unavoidable, conduct nest surveys in areas where vegetation will be removed to identify presence/absence of nesting birds. - If a nest is located, a designated buffer will be clearly marked in the field within which no clearing will be allowed while the nest is active. The radius of the buffer will be 5 to 60 m depending on the species.	- All MBBH areas where vegetation removal is required.	- Once prior to vegetation removal if it is unavoidable during the nesting season.
Canada Warbler and Olive-sided Flycatcher							
CWH-1*	AR		- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines	- Loss of breeding habitat.	- Prior to construction the limits of vegetation clearing will be staked in the field. The Construction Supervisor will ensure that no construction disturbance occurs beyond the staked limits and that edges of sensitive areas adjacent to the work areas are not disturbed. Regular monitoring of the limits of clearing will be undertaken to ensure that disturbance is minimized. Should monitoring reveal that clearing occurred beyond defined limits, mitigation action will be taken that could include rehabilitation of the disturbed area at the direction of a qualified ecologist. - To the extent practical, tree and/or brush clearing will be completed prior to or after the core nesting season for migratory birds (May 9 to August 8). Should clearing be required during the breeding bird season, prior to any clearing, surveys will be undertaken to identify the presence/absence of nesting birds. If a nest is located, a designated buffer will be marked off within which no construction activity will be allowed while the nest is active. The radius of the buffer width will range from 5 - 60 m depending on the species. Buffer widths are based on the species sensitivity and on buffer width recommendations that have been reviewed and approved by Environment Canada. - Tree clearing in areas adjacent to woodland amphibian breeding ponds will also avoid the amphibian breeding season (April – June). - Prior to the start of construction activity, the topsoil/seedbank (where present) will be stripped and preserved; material will be reapplied in suitable rehabilitation areas post construction. - All disturbed areas of the construction site will be re-vegetated with native species as soon as conditions allow. - Excavated soil will be re-used on site as feasible. If not feasible, the soil will be disposed of at an approved off-site facility. Soil conditions at temporary laydown areas and other disturbed sites will be restored, and	- Ensure that seed becomes established in areas of disturbance within one growing season.	- Once after seeding area. - Once in late spring the year following seeding.
CWH-3*	AR						
CWH-6*		WT-50, WTL-40					
CWH-8*		WT-82, WTL-72					
CWH-9*		WT-22, WTL-12					
CWH-10*		WT-114, WTL-107					
CWH-11	CL	WT-68, WTL-58					
CWH-12*		WT-11, WTL-1					
CWH-15*	CL						
CWH-18	AR	WT-106, WTL-96					
CWH-20*		WT-101, WTL-91					
CWH-21*	AR						
CWH-22*	AR						
CWH-23*		WT-102, WTL-92					
CWH-25*		WT-68, WTL-58					
CWH-29*	CL						
CWH-30	CL						
CWH-35*	CL						

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
					depending on surrounding habitat, natural regeneration and/or seeding will be relied on to restore native vegetation cover. Once the laydown areas are no longer required, vegetation will be surveyed to assess disturbance and the potential for natural regeneration. If required, areas will be reseeded with species native to EcoDistrict 5E-13 or the local area, and in consultation with MNR. - Re-vegetate disturbed areas with fast growing native species as soon as practical after construction activity within the disturbed areas is complete.		
CWH-36*	CL		- Operational phase	- Habitat avoidance/loss of nesting habitat.	- Conduct tree/brush clearing outside the core nesting season (May 9-August 8). - If unavoidable, conduct nest surveys in areas where vegetation will be removed to identify presence/absence of nesting birds. - If a nest is located, a designated buffer will be clearly marked in the field within which no clearing will be allowed while the nest is active. The radius of the buffer will be 5 to 60 m depending on the species.	- Canada Warbler and Olive-sided Flycatcher breeding habitat where vegetation removal is required.	- Once prior to vegetation removal if it is unavoidable during the nesting season.
CWH-39*	CL, BU						
CWH-40*	CL						
OFH-1*	CL						
OFH-4*	CL						
OFH-5*	AR						
OFH-6*	AR						
OFH-13*	CL						
Rare Plants							
BBH-63		AR-76	- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines	- Disturbance to microhabitat, potentially causing increased sunlight exposure, changes to soil moisture content, compaction of soil, and introduction of invasive species.	- The most effective strategy to prevent disturbance is avoidance of the population. This strategy has already been implemented through mapping of specimens and determination of microhabitat; this avoidance was incorporated into the project layout. Where a population occurred within the active project layout, the proposed constructible area was reduced in size to avoid or minimize impacts to the habitat. Where removal of habitat could not be avoided, the constructible area was reduced in size to avoid areas where population density was known to be higher. See Figure 13 for site specific examples. - In areas where construction will abut or dissect habitat, mitigation will consist of staking the boundary of areas to be protected. Within these protected areas, access will be restricted to prevent disturbance of plants and habitat. - To minimize the effects of canopy removal, overhanging perimeter shrubs, trees and saplings will be left intact. - Surface flow patterns and saturated soils will be maintained through installation of properly designed and silted culverts under access roads. - Silt fencing will be used around abutting protected areas to prevent surface runoff from construction areas.	- Boreal bedstraw habitat where a breach or dissection of microhabitat is required.	- Protected habitat will be staked before the removal of vegetation - Monitoring of protected areas will occur throughout the construction phase - Monitoring of silt fencing will occur throughout the construction phase - Construction Supervisor to regularly visually monitor culvert installations to ensure flow conveyance, with no restrictions or ponding.
BBH-64		AR-105					
BBH-66	WT, WTL, AR						
BBH-67	CL						
BBH-68	CL						
BBH-69	CL						
BBH-71	CL						
BBH-74	CL						
BBH-75	CL						
BBH-76	CL						
BBH-78	CL						
BBH-79	CL						
BBH-80		AR-98					
BBH-81	WT, WTL, CL						
BBH-84	CL						
BBH-86	CL	AR-111					
BBH-88	AR, CL						
BBH-89	CL						
BBH-90	CL						
BBH-91	CL						
BBH-92	CL						
BBH-94	CL						
BBH-96		AR-111					
BBH-97	CL	AR-30					
BBH-99	CL						
BHFH-40	CL		- Construction phase – installation of fencing,	- Disturbance to microhabitat, potentially influencing air	- The most effective strategy to prevent disturbance is avoidance of the population. This strategy has already been implemented through mapping	- Braun's holly fern habitat where a breach or dissection	- Protected habitat will be staked before the removal of
BHFH-42	CL						

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
BHFH-43	BU	AR-8	construction of road, installation of wind turbine, installation of collector lines	temperature and humidity, trampling of specimens, and introduction of invasive species.	of specimens and determination of microhabitat; this avoidance was incorporated into the project layout. Where a population occurred within the active project layout, the proposed constructible area was reduced in size to avoid or minimize impacts to the habitat. Where removal of habitat could not be avoided, the constructible area was reduced in size to avoid areas where population density was known to be higher. See Figure 14 for site specific examples. - In areas where construction will abut or dissect habitat, mitigation will consist of staking the boundary of areas to be protected. Within these protected areas, access will be restricted to prevent disturbance of plants and habitat. - To minimize the effects of canopy removal, overhanging perimeter shrubs, trees and saplings will be left intact to improve shade cover, reduce wind velocity, and reduce dust.	of microhabitat is required.	vegetation - Monitoring of protected areas will occur throughout the construction phase -
BHFH-44	CL	AR-95					
OBH-51	WT, WTL, AR		- Construction phase – installation of fencing, construction of road, installation of wind turbine, installation of collector lines	- Disturbance to microhabitat, potentially increasing the risk of invasive species, and trampling of specimens by use of construction equipment.	- The most effective strategy to prevent disturbance is avoidance of the population. This strategy has already been implemented through mapping of specimens and determination of microhabitat; this avoidance was incorporated into the project layout. Where a population occurred within the active project layout, the proposed constructible area was reduced in size to avoid or minimize impacts to the habitat. Where removal of habitat could not be avoided, the constructible area was reduced in size to avoid areas where population density was known to be higher. See Figure 15 for site specific examples. - In areas where construction will abut or dissect habitat, mitigation will consist of staking the boundary of areas to be protected. Within these protected areas, access will be restricted to prevent disturbance of plants and habitat. - Silt fencing will be used around abutting protected areas to prevent surface runoff from construction areas.	- Oval-leaved bilberry habitat where a breach or dissection of microhabitat is required.	- Protected habitat will be staked before the removal of vegetation - Monitoring of protected areas will occur throughout the construction phase
OBH-52	BU, AR						
OBH-53	AR						
OBH-54	AR						
OBH-55	AR						
OBH-56	WT, WTL, AR						
OBH-57		AR-70					
OBH-59	CL						
OBH-61	CL						
OBH-63	CL						
OBH-65	CL						
OBH-66	CL						
OBH-67	CL						
OBH-68	CL						
OBH-69		AR-40					
OBH-70		AR-8					
OBH-71		AR-10					
OBH-72		AR-5					
OBH-73	CL						
OBH-75		AR-29					
OBH-78		AR-6					
OBH-79		AR-3					
OBH-80		AR-8					
OBH-81		AR-106					
OBH-82		AR-54					
OBH-83		AR-31					
OBH-85		WT-68, WTL-58, AR-46					
OBH-86		CL-59, AR-112					
OBH-87	CL						
OBH-88	CL						

Table 1.1: Summary of potential environmental effects and mitigation related to construction and decommissioning for Bow Lake Wind Farm

Feature ID	Overlap with Project Components	Distance (m) to Project Components (within 120m)	Project Phase and Activity	Potential Negative Environmental Effects	Mitigation Strategy	Effectiveness Monitoring of Mitigation	
						Monitoring Locations	Frequency of Monitoring
OBH-94	AR						
OBH-95	CL						
OBH-96	CL	AR-109					
OBH-98		AR-24					

Legend:
* Feature treated as significant. Significance to be determined by future habitat use survey as described in EIS.
WT: Wind Turbine; WTL: Turbine Laydown Area; CL: Collector Line Corridor ; AR: Access Road corridor; BO: Balance of Operations (Proposed Water Extraction); BU: Building/Substation (Proposed Construction Laydown & Transformer Station, construction compound and welfare building).

Table 1: Summary of Environmental Effects Monitoring Plan for Operation of the Bow Lake Wind Farm

Potential Negative Effect	Mitigation Strategy	Performance Objective	Monitoring Plan					Contingency Measures
			Methods	Location	Frequency	Rationale	Reporting	
Disturbance Monitoring for Waterfowl Nesting Areas								
Disturbance to waterfowl nesting areas during operation	Post-construction Disturbance Monitoring Program The breeding density of nesting waterfowl (combined and individual), within the habitat, will be monitored and compared to pre-construction conditions. In addition to density, the waterfowl nesting activity observed should be recorded and compared to pre-construction conditions. Particular attention should be paid to those species identified as waterfowl nesting area indicator species as per the Draft SWH Ecoregion 5E Criterion Schedule (MNR, 2012), including: American Black Duck, Northern Pintail, Northern Shoveler, Gadwall, Blue-winged Teal, Wood Duck, Hooded Merganser, Common Merganser, Red-breasted Merganser, Mallard, Canada Goose, American Widgeon, Bufflehead, and Common Goldeneye.	MNR, along with the proponent and other relevant agencies, will collectively review the results of the post-construction monitoring to determine if an ecologically significant disturbance/avoidance effect to nesting waterfowl is occurring, and whether such effect is attributed to the wind turbines and not external factors. These discussions will determine whether contingency measures will be undertaken.	Modified area searches using pre-construction methods. Modified area searches extending from the base of wind turbine generators located within 120 m of waterfowl nesting areas with an equal number of search areas located more than 120 m from wind turbine generators in waterfowl nesting areas (i.e., control sites) Methods are outlined in detail in the Environmental Effects Monitoring Plan.	In Features WNA-2, 4, 9, 13 and 18, if they are determined to be significant as a result of habitat use studies.* Turbines are proposed in the adjacent upland areas within 120 m of the core wetlands of these features.	Three times during the spring breeding season (May 9-August 8), with at least 10 days between surveys, annually for three years.	Breeding pair density is a standard measure that can be compared among years or between control/impact sites.	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	Should performance objectives not be met: - Compare declines to population trends noted through regional, provincial or continent-wide breeding bird surveys - develop additional studies to determine extent of disturbance effect - investigate habitat management means to increase breeding density Additional monitoring and/or mitigation may be required where post-construction monitoring identifies ecologically significant disturbance/avoidance effects associated with waterfowl nesting areas. Results will be reviewed collectively by the proponent, MNR and other relevant agencies to determine if and when additional monitoring and/or mitigation is required. The best available science and information should be considered when determining appropriate mitigation. MNR will be consulted on contingency measures to be implemented.
Amphibian Movement Passages During Operation								
Loss of travel corridors for salamanders within ABWH-6	Travel culverts under the access road to Turbine 39.	Maintain culverts and silt fencing as a passage for salamanders.	Annual visual inspection and cleaning/maintenance as necessary.	ABHW-6.	Twice annually, during spring and fall.	Presence of salamanders using ABWH-6 and access road bisecting the forested component of the habitat.	Not required.	Clean and repair the culverts as necessary. Maintain silt fencing used to funnel amphibians through culverts.
Disturbance Monitoring for Birds of Conservation Concern								
Disturbance to Marsh Breeding Birds (including Yellow Rail)	Post-construction Disturbance Monitoring Program. The breeding density of marsh species (combined and individual), within the habitat, will be monitored and compared to pre-construction conditions. In addition to density, the marsh breeding species observed should be monitored and compared to pre-construction conditions. Particular attention	MNR, along with the proponent and other relevant agencies, will collectively review the results of the post-construction monitoring to determine if an ecologically significant disturbance/avoidance effect to marsh breeding birds is occurring, and whether such effect is attributed to the wind turbines and not external factors. These discussions will determine whether contingency measures will be undertaken.	Point count survey and area searches using pre-construction methods. Paired point counts extending from the base of wind turbine generators located within 120 m of marsh habitat with an equal number of paired point counts located more than 120 m from wind turbine generators in marsh habitat (i.e., control sites). Methods are outlined in detail in the Environmental Effects Monitoring Plan.	MBBH-8 and 9, if they are determined to be significant as a result of habitat use studies*, as there are turbines proposed within 120 m of these features.	Three times during the spring breeding season (May-June), with at least 10 days between surveys, annually for three years.	Breeding pair density is a standard measure that can be compared among years or between control/impact sites	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	Should performance objectives not be met: - Compare declines to population trends noted through province or continent-wide breeding bird surveys - Develop additional studies to determine extent of disturbance effect - Investigate habitat management means to increase breeding density Additional monitoring and/or mitigation may be required where post-construction monitoring identifies ecologically significant disturbance/avoidance effects

Table 1: Summary of Environmental Effects Monitoring Plan for Operation of the Bow Lake Wind Farm

Potential Negative Effect	Mitigation Strategy	Performance Objective	Monitoring Plan					Contingency Measures
			Methods	Location	Frequency	Rationale	Reporting	
	should be paid to those species identified as marsh breeding habitat indicator species as per the draft SWH Ecoregion 5E Criterion Schedule (MNR, 2012), including: American Bittern, Sora, Red-necked Grebe, Pie-billed Grebe, Redhead, Ring-necked Duck, Lesser Scaup, Ruddy Duck, Common Moorhen, American Coot, Wilson's Phalarope, Common Loon, Sandhill Crane, Green Heron, Sedge Wren, Marsh Wren, Trumpeter Swan, Black Tern and Yellow Rail.							associated with marsh breeding bird habitat. Mitigation techniques may include (but are not limited to) operational controls, such as periodic shut-down and/or blade feathering. Results will be reviewed collectively by the proponent, MNR and other relevant agencies to determine if and when additional monitoring and/or mitigation is required. The best available science and information should be considered when determining appropriate mitigation. MNR will be consulted on contingency measures to be implemented.
Disturbance to bird species of conservation concern (Canada Warbler) during operation	Post-construction Disturbance Monitoring Program The breeding density of Canada Warbler, within the habitat, will be monitored and compared to pre-construction conditions.	MNR, along with the proponent and other relevant agencies, will collectively review the results of the post-construction monitoring to determine if an ecologically significant disturbance/avoidance effect to Canada Warbler is occurring, and whether such effect is attributed to the wind turbines and not external factors. These discussions will determine whether contingency measures will be undertaken.	Point count survey using pre-construction methods. Point counts extending from the base of wind turbine generators located within 120 m of breeding habitat with an equal number of point counts located more than 120 m from wind turbine generators in appropriate woodland habitat (i.e., control sites). Methods are outlined in detail in the Environmental Effects Monitoring Plan	In Features CWH-6, 8, 9, 10, 12, 20, 23, and 25, if they are determined to be significant as a result of habitat use studies*, CWH-11 and 18, as there are turbines proposed within 120 m of these features.	Three times during the breeding season (mid-May to early July), with at least 10 days between surveys, annually for three years.	Breeding pair density is a standard measure that can be compared among years or between control/impact sites	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	Should performance objectives not be met: - Compare declines to population trends noted through regional, provincial or continent-wide breeding bird surveys - develop additional studies to determine extent of disturbance effect - investigate habitat management means to increase breeding density Additional monitoring and/or mitigation may be required where post-construction monitoring identifies ecologically significant disturbance/avoidance effects associated with breeding habitat for Canada Warbler. Results will be reviewed collectively by the proponent, MNR and other relevant agencies to determine if and when additional monitoring and/or mitigation is required. The best available science and information should be considered when determining appropriate mitigation. MNR will be consulted on contingency measures to be implemented.
Mortality Monitoring for Birds and Bats								
Direct mortality to birds through turbine collisions	Post-construction mortality monitoring program	Maintain mortality below thresholds	Post-construction monitoring of mortality rates; carcass searches Searcher efficiency trials Methods are outlined in detail in the Environmental Effects Monitoring Plan	At 12 turbines (all birds) and 36 turbines (raptors) MNR will be consulted to determine location of turbines to be monitored.	Conducted twice-weekly (3-4 day intervals) at 12 turbines from May 1-October 31. Weekly monitoring for raptors will continue until November 30. Monitoring of all 36	Bird and Bird Habitats: Guidelines for Wind Power Projects, 2011	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016	Post-construction mitigation, including operational controls, will be considered if annual mortality of birds exceeds any of the following thresholds defined by the MNR (2011a): - 14 birds/turbine/year at individual turbines or turbine groups; - 0.2 raptors/turbine/year (all raptors) across a wind power project; or

Table 1: Summary of Environmental Effects Monitoring Plan for Operation of the Bow Lake Wind Farm

Potential Negative Effect	Mitigation Strategy	Performance Objective	Monitoring Plan					Contingency Measures
			Methods	Location	Frequency	Rationale	Reporting	
					turbines for raptor fatalities once a month from May 1-November 30. Monitoring to be conducted for three years.		February 2017	- 0.1 raptors of provincial conservation concern/turbine/year across a wind power project. - Or if bird mortality during a single mortality monitoring survey exceeds: - 10 or more birds at any one turbine; or - 33 or more birds (including raptors) at multiple turbines. Mitigation may include operational controls, such as periodic shut-down on select turbines or blade feathering at specific times of the year, or alternate plan agreed to by the Proponent and MNR MNR will be consulted on contingency measures to be implemented.
Direct mortality to bats through turbine collisions	Post-construction mortality monitoring program	Maintain mortality below thresholds	Post-construction monitoring of mortality rates; carcass searches Searcher efficiency trials Methods are outlined in detail in the Environmental Effects Monitoring Plan	At 12 turbines MNR will be consulted to determine location of turbines to be monitored.	Conducted twice-weekly (3-4 day intervals) at 12 turbines from May 1-October 31. Monitoring to be conducted for three years.	Bats and Bat Habitats: Guidelines for Wind Power Projects, 2011	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	Operational mitigation is required where annual post-construction mortality monitoring exceeds 10bats/turbine/year (MNR, 2011). Mitigation may include operational controls, such as changing the rotor cut-in speed or blade feathering at specific times of the year, or alternate plan agreed to by the Proponent and MNR. MNR will be consulted on contingency measures to be implemented.