

# Noise Impact Assessment

For the

## Sugar Maple Wind Power Project



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## **1.0 Introduction**

The proposed Sugar Maple Wind Power Project is located approximately 20 km southwest of Town of Antigonish and 7 km North of Garden of Eden Lake, Nova Scotia. The proposed project is expected to be built with wind turbine generators (WTG's) which will have hub heights up to 118 m and maximum rotor diameters of 163 m. For the purposes of this assessment, the Nordex N163 6.X WTG rated at 7.0 MW was used as it has the highest sound power level of the WTG's being considered.

The following report summarizes the results of sound modeling which will be incorporated into the Nova Scotia Environmental Assessment Registration Document for the project.

## **2.0 Sound Analysis**

### **2.1 Background**

Nortek Resource Solutions Inc. has completed a noise impact assessment for the proposed Sugar Maple Wind Power Project. The objective of the analysis was to assess the impact of the wind turbine sound emissions on surrounding dwellings. Noise modeling is based on sound levels that are adjusted to take into account how humans perceive sound with a lower sensitivity to very low and very high frequencies. The A-weight decibel (dBA) provides a measure of the loudness of sound in human terms.

The Nova Scotia Department of Environment and Climate Change (NSECC) requires that predicted noise levels are not to exceed 40 dBA for permanent and seasonal residential receptors which include homes, daycare facilities, hospitals and schools. The 40 dBA limit also includes a 35 dBA background noise consideration which is included in the modeling.

### **2.2 Methodology**

The sound analysis was completed using WindPro 4.2.285 which provides a comprehensive suite of wind farm design and modeling software. The sound model is based on the *ISO 9613-2 – Attenuation of sound during propagation outdoors, Part 2*. This international standard provides a conservative estimate of sound propagation and subsequent environmental attenuation as a result of ground porosity, atmospheric attenuation and geometric spreading. A conservative modeling approach was utilized for this project by using the General Model with ground attenuation porosity set at 0.7 to represent a mix of well forested and cleared areas, where 0 is a hard surface (i.e.. concrete, asphalt, rock, water or ice) and 1 is a soft surface (i.e. vegetation, trees or snow). The ISO 9613-2 standard assumes an ambient air temperature of 10° C and 70% relative humidity which are ideal for atmospheric sound transfer. A meteorological coefficient can be assigned to the model to simulate sound damping due to unique meteorological conditions and noise propagation in the upwind direction. To maintain a conservative approach, a meteorological coefficient was not applied for this analysis. Additionally, the modeling assumes that all receptors are downwind of each wind turbine, which contributes to the conservative nature of the analysis.

### 2.2.1 Digital Elevation Model

A digital elevation model (DEM) that was derived from aerial LiDAR (Light Detection and Ranging) data was used to model the sound and attenuation in this analysis. The original DEM was resampled from 1 m to 4 m resolution to minimize the file size for the project and adjacent areas.

### 2.2.2 Modeled Turbines

In addition to the proposed 16 turbines, NSECC requires that existing turbines within 2.0 km of the proposed project be included in the sound modeling. One turbine currently under construction at the Weavers Mountain Wind Energy Project is located within 3 km of the proposed turbines and was included in the analysis. Table 1 summarizes the proposed turbine positions (including the updated position for turbine S10). Table 2 summarizes the location of the turbine currently under construction at the Weavers Mountain Wind Energy Project. Tables 3 and 4 summarize each of the turbine specifications. The total sound power output at various wind speeds for each turbine model were supplied by their respective manufacturers and shown in Table 5.

Table 1: Sugar Maple Wind Power Project - Proposed Turbine Positions

<b>Id</b>	<b>Model</b>	<b>Easting (m)*</b>	<b>Northing (m)*</b>
S1	N163 6.X	560,047	5,034,628
S2	N163 6.X	558,751	5,034,733
S3	N163 6.X	558,041	5,035,211
S4	N163 6.X	558,515	5,035,890
S5	N163 6.X	557,678	5,036,180
S6	N163 6.X	558,577	5,036,948
S7	N163 6.X	559,745	5,035,971
S8	N163 6.X	560,957	5,036,249
S9	N163 6.X	561,605	5,034,810
S10R	N163 6.X	561,602	5,036,905
S11	N163 6.X	564,428	5,038,216
S12	N163 6.X	563,307	5,038,318
S13	N163 6.X	564,543	5,037,219
S14	N163 6.X	564,890	5,036,561
S15	N163 6.X	564,927	5,034,956
S16	N163 6.X	565,981	5,035,320

\* UTM, NAD83(CSRS), Zone 20

Table 2: Weavers Mountain Wind Energy Project Turbine Position Included in Modeling (currently under construction).

<b>Id</b>	<b>Model</b>	<b>Easting (m)*</b>	<b>Northing (m)*</b>
WM1	N163 5.X	559,531	5,039,204

\*UTM, NAD83(CSRS), Zone 20

Table 3: Proposed Turbine Specifications

<b>Item</b>	<b>Specification</b>
Manufacturer	Nordex
Model	N163/6.X
Hub Height	118 m
Rotor Diameter	163 m
Operation Mode	Level 0
Rated Power Output	7,000 kW

Table 4: Existing Turbine Specifications

<b>Item</b>	<b>Specification</b>
Manufacturer	Nordex
Model	N163 5.X
Hub Height	125 m
Rotor Diameter	163 m
Operation Mode	Level 0
Rated Power Output	5,900 kW

Table 5: Sound Power Levels for the Proposed and Existing Turbines (dBA).

<b>Wind Farm</b>	<b>Model</b>	<b>Wind Speed (m/s @ 10 m)</b>							
		<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>Up to cut-out</b>
Sugar Maple	N163 6.X 7000	108.6	109.4	109.4	109.4	109.4	109.4	109.4	109.4
Weavers Mountain	N163 5.X 5900	108.9	109.2	109.2	109.2	109.2	109.2	109.2	109.2

All of the turbines were modeled with regular blades and operating at full power or Level 0 which means the turbines are generating power at full capacity and therefore also operating at their highest noise level.

### 2.2.3 Receptors

The spatial location of all the buildings located within 3.0 km of the proposed turbines were extracted from the Nova Scotia Topographic database. Recent satellite imagery was manually reviewed, and additional potential receptors were identified and included in the analysis.

A total of 22 receptors were modeled using a ground attenuation of 0.7 (Figure 1). The individual coordinates, elevation and modeled A-weighted sound pressure levels for each receptor are shown in Table 6.

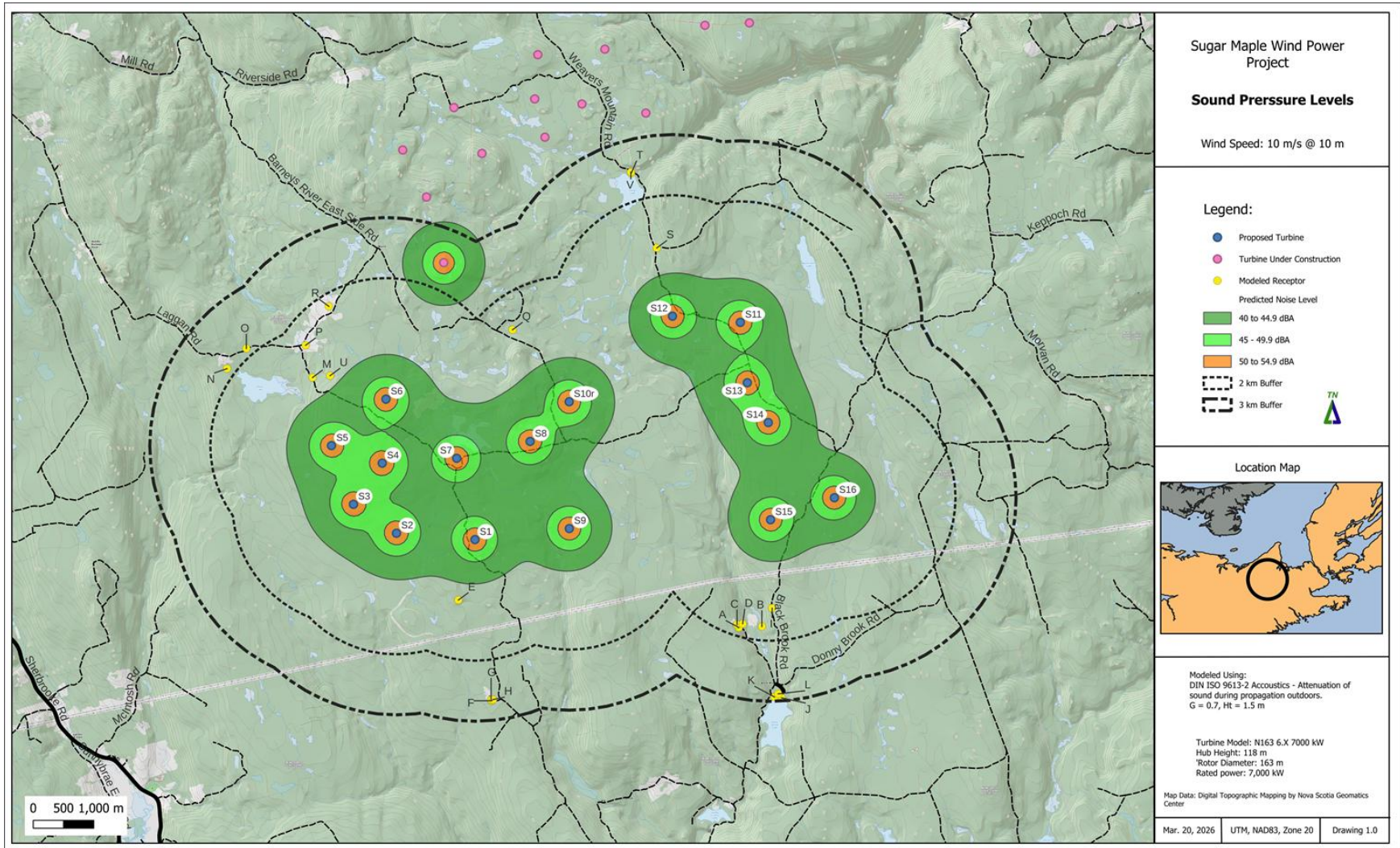


Figure 1: Modeled Sound Pressure Levels for the Proposed Sugar Maple Wind Power Project.

### 3.0 Sound Modeling Results

The results of the analysis indicate that predicted sound pressure levels will not exceed 40 dBA for the modeled receptors based on the proposed turbine locations. Figure 1 and Table 6 show that all of the modeled receptors within 3.0 km of the proposed wind farm meet the 40 dBA threshold for sound power levels (including 35.0 dBA background noise). Therefore, no noise mitigation measures are required.

Receptor ID	Easting* (m)	Northing * (m)	Immisison Height (m)	dBA
A	564,404	5,033,177	1.5	36.0
B	564,784	5,033,195	1.5	36.1
C	564,374	5,033,224	1.5	36.1
D	564,466	5,033,240	1.5	36.1
E	559,774	5,033,631	1.5	38.4
F	560,325	5,031,967	1.5	35.7
G	560,313	5,031,985	1.5	35.7
H	560,344	5,031,986	1.5	35.7
I	564,953	5,033,496	1.5	36.5
J	565,109	5,032,014	1.5	35.4
K	564,992	5,032,029	1.5	35.4
L	565,054	5,032,081	1.5	35.4
M	557,366	5,037,307	1.5	38.3
N	555,953	5,037,453	1.5	35.9
O	556,272	5,037,787	1.5	36.0
P	557,252	5,037,839	1.5	36.9
Q	560,667	5,038,096	1.5	37.6
R	557,633	5,038,483	1.5	36.6
S	563,050	5,039,447	1.5	37.4
T	562,627	5,040,680	1.5	35.7
U	557,655	5,037,337	1.5	39.0
V	562,621	5,040,698	1.5	35.7

## 4.0 References

International Organization for Standardization (1996). ISO 9613-2: Acoustics –Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

Nova Scotia Department of Environment and Climate Change. Environmental Assessment Supplemental Checklist: Wind Energy Projects, <https://novascotia.ca/nse/ea/docs/environmental-assessment-supplemental-checklist-wind-energy-projects-en.pdf>

Nova Scotia Topographic Database, <https://gis8.nsgc.gov.ns.ca/DataLocatorASP/main.html>.