REPORT

Windy Ridge Wind Power Project

Noise Assessment

Submitted to:

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April 15, 2024

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1.0 INTRODUCTION

Windy Ridge Wind (Windy Ridge) is proposing development of the Windy Ridge Wind Power Project (the Project) in the Municipality of the County of Colchester (Colchester County). The Project will be located approximately 20 kilometres (km) northwest of the Town of Truro, Nova Scotia.

EverWind Fuels LLC, majority owner of Windy Ridge, retained WSP Canada Inc. (WSP) to prepare an assessment of potential environmental noise effects from the Project in accordance with provincial requirements. The results of the Project noise assessment are presented in this report.

The noise assessment report is structured as follows:

- Section 1.0 provides a brief introduction.
- Section 2.0 presents a description of the noise sources proposed for the Project.
- Section 3.0 describes the provincial regulations applicable to noise from the Project, including compliance criteria.
- Section 4.0 outlines the assessment approach, including a description of noise receptors, representative baseline noise levels, and methods used to predict Project noise levels.
- Section 5.0 presents noise emissions for the Project and for the Kmtnuk Wind Power Project (Kmtnuk), which is being proposed for development east of the Project.
- Section 6.0 presents the results of the Project noise assessment, including comparison of noise level predictions to provincial compliance criteria.
- Section 7.0 summarizes and discusses the results of the Project noise assessment.

2.0 PROJECT DESCRIPTION

The Project will consist of 49 Nordex N163 7.0-megawatt (MW) wind turbines, along with a collector system and electrical substation. The Project wind turbines will have a hub height of 118 metres (m). Each Project wind turbine will be configured to operate in Mode 0 (i.e., full-power operating mode) 24 hours per day.

The major noise sources associated with the Project substation will be two transformers, each with a power rating of 190 megavolt-amperes (MVA). Maximum noise emissions from the Project substation will occur when the transformers operate in Oil Natural Air-Forced 2nd-Stage Cooling (ONAF2) mode.

Table 1 presents the locations of the Project noise sources and the source operating modes used when predicting potential Project noise effects. The operating modes specified in Table 1 correspond to the maximum noise emissions from each Project source. A map showing the locations of Project noise sources is presented in Section 4.0 (see Figure 1). Additional details on noise emissions from Project sources are provided in Section 5.0 (see Table 5).

Table 1: Project Noise Sources and Operating Modes

Source Identification Code[a]	Source Description	Universal Transverse Mercator Coordinates [Zone 20]		Source Operating Mode[b]
		Easting [m]	Northing [m]	
T01	Nordex N163 7.0-MW wind turbine	462185	5049631	Mode 0
T02	Nordex N163 7.0-MW wind turbine	462324	5048848	Mode 0
T03	Nordex N163 7.0-MW wind turbine	462504	5048115	Mode 0
T04	Nordex N163 7.0-MW wind turbine	463175	5049112	Mode 0
T05	Nordex N163 7.0-MW wind turbine	463697	5048754	Mode 0
T06	Nordex N163 7.0-MW wind turbine	463716	5050480	Mode 0
T07	Nordex N163 7.0-MW wind turbine	464458	5050100	Mode 0
T08	Nordex N163 7.0-MW wind turbine	464817	5049502	Mode 0
T09	Nordex N163 7.0-MW wind turbine	465186	5048971	Mode 0
T14	Nordex N163 7.0-MW wind turbine	463270	5047629	Mode 0
T16	Nordex N163 7.0-MW wind turbine	464501	5047251	Mode 0
T17	Nordex N163 7.0-MW wind turbine	464413	5046308	Mode 0
T18	Nordex N163 7.0-MW wind turbine	463796	5045763	Mode 0
T20	Nordex N163 7.0-MW wind turbine	463614	5045047	Mode 0
T21	Nordex N163 7.0-MW wind turbine	464060	5044629	Mode 0
T28	Nordex N163 7.0-MW wind turbine	461400	5042101	Mode 0
T29	Nordex N163 7.0-MW wind turbine	461890	5042126	Mode 0
T30	Nordex N163 7.0-MW wind turbine	462166	5041722	Mode 0
T31	Nordex N163 7.0-MW wind turbine	462556	5041401	Mode 0
T32	Nordex N163 7.0-MW wind turbine	463369	5041376	Mode 0
T33	Nordex N163 7.0-MW wind turbine	463950	5040934	Mode 0
T34	Nordex N163 7.0-MW wind turbine	462259	5043336	Mode 0
T35	Nordex N163 7.0-MW wind turbine	462946	5042563	Mode 0
T37	Nordex N163 7.0-MW wind turbine	463094	5044285	Mode 0
T38	Nordex N163 7.0-MW wind turbine	463493	5043499	Mode 0
T39	Nordex N163 7.0-MW wind turbine	464052	5042775	Mode 0
T40	Nordex N163 7.0-MW wind turbine	459968	5038532	Mode 0
T41	Nordex N163 7.0-MW wind turbine	460585	5039108	Mode 0
T42	Nordex N163 7.0-MW wind turbine	462433	5039240	Mode 0
T43	Nordex N163 7.0-MW wind turbine	463940	5039010	Mode 0
T44	Nordex N163 7.0-MW wind turbine	464596	5039103	Mode 0
T45	Nordex N163 7.0-MW wind turbine	466105	5044229	Mode 0
T46	Nordex N163 7.0-MW wind turbine	466401	5044570	Mode 0
T47	Nordex N163 7.0-MW wind turbine	467250	5044807	Mode 0
T52	Nordex N163 7.0-MW wind turbine	467552	5040935	Mode 0
T53	Nordex N163 7.0-MW wind turbine	467988	5040234	Mode 0
T55	Nordex N163 7.0-MW wind turbine	468383	5042790	Mode 0
T56	Nordex N163 7.0-MW wind turbine	469026	5042254	Mode 0

Table 1: Project Noise Sources and Operating Modes

Source Identification Code[a]	Source Description	Universal Transverse Mercator Coordinates [Zone 20]		Source Operating Mode[b]
		Easting [m]	Northing [m]	
T57	Nordex N163 7.0-MW wind turbine	469351	5041875	Mode 0
T58	Nordex N163 7.0-MW wind turbine	470101	5042750	Mode 0
T60	Nordex N163 7.0-MW wind turbine	470690	5044771	Mode 0
T61	Nordex N163 7.0-MW wind turbine	471543	5044896	Mode 0
T62	Nordex N163 7.0-MW wind turbine	472074	5044470	Mode 0
T63	Nordex N163 7.0-MW wind turbine	472358	5045374	Mode 0
T65	Nordex N163 7.0-MW wind turbine	474017	5044989	Mode 0
T67	Nordex N163 7.0-MW wind turbine	474746	5044985	Mode 0
T68	Nordex N163 7.0-MW wind turbine	474750	5044392	Mode 0
T69	Nordex N163 7.0-MW wind turbine	471955	5041251	Mode 0
T72	Nordex N163 7.0-MW wind turbine	473846	5041399	Mode 0
SS	substation; two 190 MVA transformers	464460	5043253	ONAF2

(a) Although there are 49 turbine locations in the Project, the turbine identification codes are not sequential because some locations were removed during the planning process.

(b) Planned operating mode corresponding to maximum noise emissions.

3.0 REGULATORY FRAMEWORK

The Province of Nova Scotia provides guidance for assessing potential environmental effects from wind power facilities in the *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia* (Nova Scotia 2021), which will hereafter be referred to as the EA Guide. The Province of Nova Scotia provides additional guidance for assessing potential environmental noise effects from industrial activities in *Guidelines for Environmental Noise Measurement and Assessment* (Nova Scotia 2023), which will hereafter be referred to as the Noise Guidelines. When preparing the Project noise assessment, WSP considered guidance and compliance criteria from both the EA Guide (Nova Scotia 2021) and the Noise Guidelines (Nova Scotia 2023).

It should be noted that environmental noise from wind power facilities in Colchester County is also regulated through *Chapter 56 – Wind Turbine Development By-law* (Colchester 2023). The present noise assessment was prepared in the support of the provincial environmental assessment process and so only considered applicable provincial guidance (i.e., the EA Guide and Noise Guidelines). However, a separate noise assessment in accordance with the county bylaw (Colchester 2023) will be prepared and submitted to Colchester County as part of the development agreement permit application.

3.1 EA Guide

The EA Guide requires that noise levels from wind turbines not exceed 40 A-weighted decibels (dBA) at receptors within 2 km of the Project. The EA Guide defines a receptor as *"…an adjacent dwelling including, but not limited to, a building or structure that contains one or more dwellings, educational facility, daycare/nursery, place of worship, hospital, seniors' residence and could also include a vacant lot where appropriate zoning or permits to build such dwellings have been approved"* (Nova Scotia 2021).

The EA Guide also requires a description of potential noise effects during construction of the Project, and a discussion of potential effects from low frequency noise or infrasound during Project operations. However, the EA Guide does not provide quantitative thresholds or limits for assessing potential effects from construction noise or low frequency noise.

3.2 Noise Guidelines

The Noise Guidelines require that comprehensive sound levels not exceed permissible sound level (PSL) limits at receptors. The comprehensive sound level consists of the combined contribution from existing natural and anthropogenic sources and from new industrial sources being proposed for development. Much like the EA Guide, the Noise Guidelines define receptor as *"…a building or structure including, but not limited to, a building or structure that contains one or more dwellings, an educational facility, daycare/nursery, place of worship, hospital, or seniors' residence"* (Nova Scotia 2023).

The Noise Guidelines set PSL limits for each receptor based on the type of environment and the time of day. For rural receptors, the PSL limit is 53 dBA during the daytime period (i.e., 7 am and 7 pm), 48 dBA during the evening period (i.e., 7 pm to 11 pm), and 40 dBA during the nighttime period (i.e., 11 pm to 7 am). Because the Project will operate continuously 24 hours per day, the Project noise assessment focused exclusively on the most restrictive nighttime period when evaluating Project compliance with the Noise Guidelines. If comprehensive sound levels are compliant with the nighttime PSL limit, they will also be compliant with the less restrictive daytime and evening PSL limits.

To evaluate potential effects from low frequency noise, which may not be fully captured by the broadband dBA metric, the Noise Guidelines also require application of a two-part low frequency noise test. The first part of the test compares comprehensive sound levels expressed in dBA to comprehensive sound levels expressed in C-weighted decibels (dBC), a unit which emphasizes low frequency content. The second part of the test looks for a low frequency tonal component in the one-third octave band frequency spectrum and provides a complex quantitative method for identifying such a tone. If the difference between comprehensive sound levels expressed in dBA and dBC is ≥20 **and** one or more low frequency tones is present, then a low frequency noise issue exists, and a 5 dBA penalty must be added to the comprehensive sound level before assessing compliance with PSL limits.

4.0 ASSESSMENT APPROACH

4.1 Noise Study Area and Receptors

The EA Guide requires that potential noise effects be assessed at houses, cottages, camps, and other sensitive receptors (e.g., schools, campgrounds, hospitals) located within 2 km of the Project wind turbines (Nova Scotia 2021). WSP established a study area for the noise assessment as a 2 km buffer on the Project noise sources (i.e., wind turbines and substation). All receptors within this study area were considered in the Project noise assessment. Potential noise receptors were initially identified using publicly available satellite imagery and information provided to WSP by Windy Ridge and their other consultants. In January 2024, WSP executed a field program that attempted to visit and verify potential noise receptors. A total of 14 noise receptors were identified within the study area. Another seven noise receptors were identified just outside the study area; these receptors were maintained in the assessment in the interest of fully capturing all potential noise effects.

Table 2 presents locations and a brief description for each of the 21 receptors considered in the Project noise assessment. For each receptor, Table 2 identifies and provides the distance to the closest Project noise source. As noted above, some receptors are located slightly more than 2 km from the closest Project noise source (i.e., just beyond the 2 km study area). These receptors were maintained in the assessment in the interest of fully capturing all potential noise effects.

Table 2: Noise Receptors

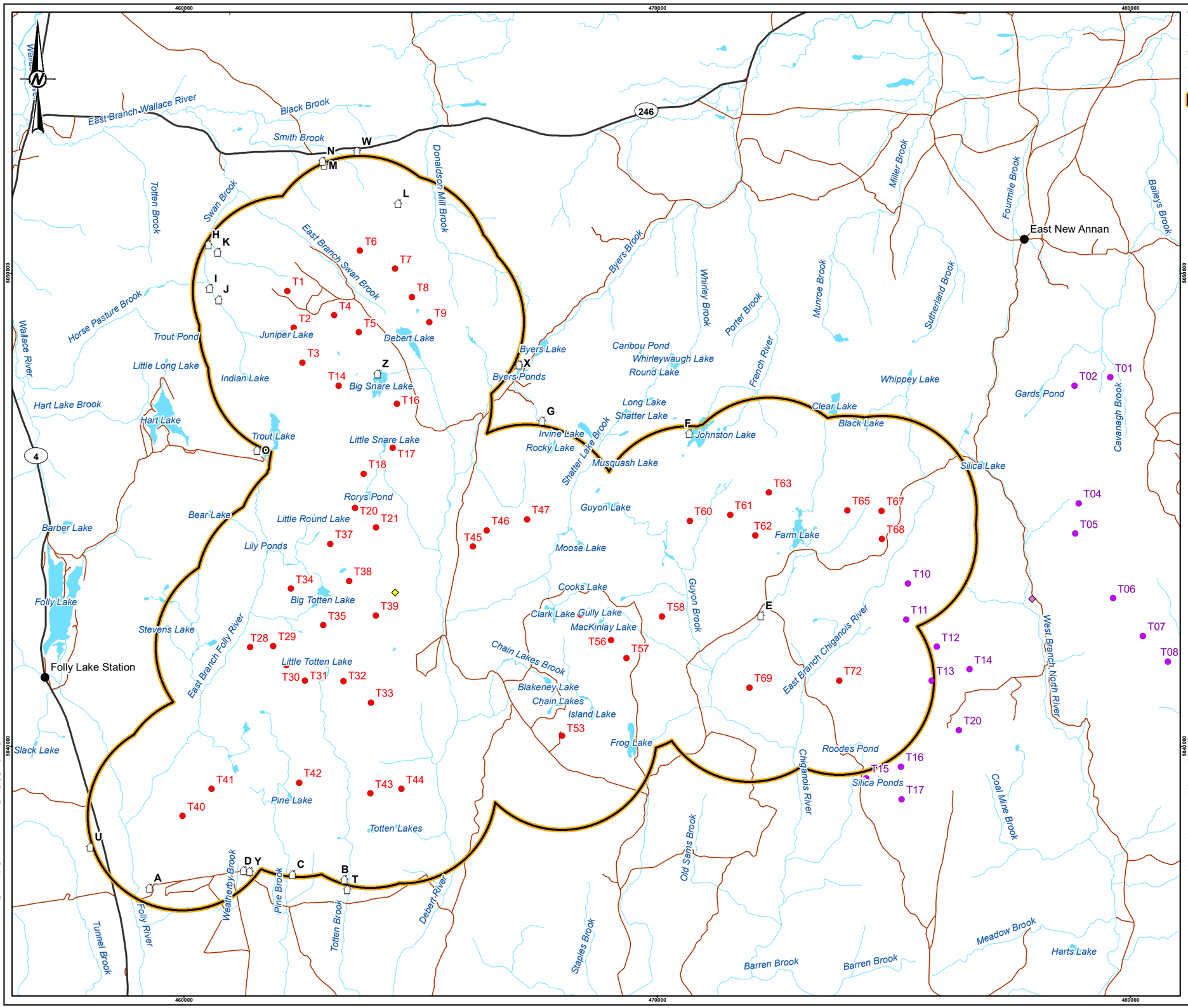
Receptor Identification Code[a]	Universal Transverse Mercator Coordinates [Zone 20]		Closest Project Noise Source	Distance to Closest Project Noise Source [m]
	Easting [m]	Northing [m]		
A	459270	5037006	T40	1,678
B	463393	5037186	T43	1,904
C	462292	5037292	T42	1,953
D	461264	5037373	T40	1,739
E	472190	5042763	T69	1,530
F	470681	5046616	T60	1,845
G	467567	5046876	T47	2,093[b]
H	460521	5050606	T01	1,929
I	460547	5049680	T01	1,639
J	460739	5049446	T01	1,458
K	460716	5050449	T01	1,681
L	464529	5051474	T06	1,284
M	462962	5052291	T06	1,962
N	462928	5052373	T06	2,050[b]
O	461549	5046260	T03	2,086[b]
T	463449	5036979	T43	2,090[b]
U	458019	5037877	T40	2,056[b]
W	463660	5052579	T06	2,100[b]
X	467085	5048074	T09	2,100[b]
Y	461393	5037358	T40	1,846
Z[c]	464092	5047877	T16	748

(a) The receptor identification codes are not sequential because some locations were removed during the planning process.

(b) This receptor is located more than 2 km from the nearest Project noise source but was maintained in the assessment in the interest of fully capturing all noise effects.

(c) The owner of this camp has an agreement with Windy Ridge waiving the requirement to comply with noise limits.

Figure 1 presents a map showing the locations of receptors and Project noise sources. For context, Figure 1 also shows the locations of the wind turbines and substation associated with the Kmtnuk Wind Power Project (Kmtnuk), which is being proposed for development east of the Project. As discussed in Section 5.0 and Section 6.0 of this report, noise from the Kmtnuk turbines and substation was considered when assessing potential cumulative effects in accordance with the EA Guide (Nova Scotia 2021) and Noise Guidelines (Nova Scotia 2023).



LEGEND

- HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- NOISE STUDY AREA
- NOISE RECEPTOR

PROJECT NOISE SOURCES

- TURBINE LOCATION
- SUBSTATION

KMTNUK NOISE SOURCES

- TURBINE LOCATION
- SUBSTATION

0 2,000 4,000

1:80,000 METRES

REFERENCE(S)

DIGITAL BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED
DATUM: NAD83 PROJECTION: UTM ZONE 20

CLIENT
EVERWIND FUELS (EWF)

PROJECT
WINDY RIDGE WIND PROJECT

TITLE
STUDY AREA

CONSULTANT
wsp

YYYY-MM-DD	2024-04-11
DESIGNED	VY
PREPARED	PT
REVIEWED	VY
APPROVED	TC

PROJECT NO.	CONTROL	REV.	FIGURE
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It should be noted that the Higgins Mountain Wind Power Project (Higgins Mountain) is being proposed for development west of the Project. WSP reviewed information posted to the Nova Scotia Environment and Climate Change website to determine the location of Higgins Mountain wind turbines. Based on this information, the smallest distance between a Higgins Mountain wind turbine and a receptor from Table 2 is approximately 4 km. At this distance, there is no potential for cumulative noise effects per the EA Guide (Nova Scotia 2021), and so the Higgins Mountain wind turbines were not considered in the Project noise assessment.

4.2 Baseline Noise Levels

As discussed in Section 3.0 of this report, thresholds from the EA Guide (Nova Scotia 2021) apply to noise from wind turbines in isolation from other sources. In contrast, thresholds from the Noise Guidelines apply to comprehensive sound levels, which include the noise contribution from existing natural and anthropogenic sources (often called baseline noise levels), as well as the noise contribution from proposed wind turbines (Nova Scotia 2023).

The Noise Guidelines indicate that measured baseline noise levels may sometimes be required in response to specific direction from Nova Scotia Environment and Climate Change (Nova Scotia 2023). However, in quiet rural environments (like the Project study area) where natural noise sources tend to dominate, environmental assessments often establish representative baseline noise levels using a desktop method from Health Canada's *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise* (Health Canada 2017), which will hereafter be referred to as the Health Canada Guidance.

The Health Canada Guidance indicates that a baseline noise level of 35 dBA is generally representative of a quiet rural environment during the nighttime period (Health Canada 2017). The Health Canada Guidance does not provide comparable baseline noise levels in dBC. However, research has shown that a baseline noise level of 42 dBC is generally representative of the nighttime period for cottages and camps in a quiet rural environment (Young et al. 2015). Representative baseline noise levels for each receptor are presented in Table 3. The Project noise assessment made use of these representative baseline noise levels when assessing potential effects in accordance with the Noise Guidelines (Nova Scotia 2023).

Table 3: Representative Baseline Noise Levels

Receptor Identification Code	Representative Baseline Noise Level for Use with Noise Guidelines (Nova Scotia 2023)	
	[dBA][(a)]	[dBC][(b)]
A	35	42
B	35	42
C	35	42
D	35	42
E	35	42
F	35	42
G	35	42
H	35	42
I	35	42
J	35	42
K	35	42
L	35	42
M	35	42
N	35	42
O	35	42
T	35	42
U	35	42
W	35	42
X	35	42
Y	35	42
Z	35	42

(a) A-weighted noise levels taken from Health Canada (2017).

(b) C-weighted noise levels taken from Young et al. (2015).

4.3 Noise Prediction Methodology

Computer models for the Project noise assessment were developed using the CadnaA® software package. In accordance with the Noise Guidelines (Nova Scotia 2023), CadnaA® implements the noise propagation algorithm described in the International Organization for Standardization (ISO) 9613-2 technical standard (ISO 1996).

The computer models were used to predict noise levels from operation of the Project and operation of Kmtnuk at the receptors listed in Table 2. Inputs to the computer noise models consisted of source emissions in the form of octave band sound power levels and environmental conditions that are known to influence noise propagation (e.g., ground cover, temperature, humidity, wind conditions).

Noise source emissions for the Project and Kmtnuk are discussed in detail in Section 5.0. A summary of environmental inputs to the computer models is provided in Table 4.

Table 4: Noise Model Inputs

Parameter	Model Setting	Description / Notes
Standard	ISO 9613-2 (ISO 1996)	Models treated noise sources and noise propagation in accordance with this standard.
Source Type	Point	Point sources were used to model noise emissions from the Project and from Kmtnuk.
Ground Factor	0.5	This value represents the acoustic properties of the ground in accordance with ISO 9613-2.
Temperate	10 degrees Celsius	This is the typical default value for ISO 9613-2 modelling intended to represent nighttime summer conditions.
Relative Humidity	70%	This is the typical default value for ISO 9613-2 modelling intended to represent nighttime summer conditions.
Wind Conditions	1 to 5 metres per second (m/s) from source to receptor	These represent default ISO 9613-2 wind conditions – moderate temperature inversion, wind from source to receptor 100% of the time.
Terrain	Included based on lidar data.	High-resolution lidar data was used to represent terrain elevation in the study area.

When calculating noise levels at receptors, the ISO 9613-2 algorithm used the environmental inputs listed in Table 4 to account for four noise attenuation mechanisms:

- geometric divergence
- atmospheric absorption
- ground absorption
- screening by barriers

Geometric divergence accounts for the fact that a given noise source radiates a finite amount of acoustic energy and as this finite amount of energy propagates into the environment it is spread out over a larger and larger area (i.e., the surface of an ever-expanding sphere). This geometric spreading means that the farther away a receptor is located from a source, the less energy will be received (i.e., the lower the observed noise level).

Atmospheric absorption accounts for the fact that the acoustic energy associated with a given noise source is absorbed via interaction with molecules in the air through which it propagates. Attenuation effects associated with atmospheric absorption are most substantial at high frequencies but can be important at lower frequencies when propagation distances are large.

Ground absorption accounts for the fact that each time the acoustic energy emitted by a noise source interacts with the ground some of it is absorbed. The amount of energy absorbed depends on the type of ground surface. During interactions with hard ground very little energy is absorbed but during interactions with porous ground a substantial amount of energy is absorbed. As a result, if all other factors are held constant, observed noise levels associated with sources operating in an area of hard ground will be higher than observed noise levels associated with sources operating in an area of porous ground.

Screening by barriers accounts for the fact that a physical object (either terrain-based or anthropogenic) placed between a noise source and receptor can block acoustic energy and reduce observed noise levels at the receptor.

According to the ISO 9613-2 standard, the overall accuracy of the propagation algorithm used in the Project noise assessment computer models is ±3 dBA for distances between source and receptor up to 1 km. The accuracy for propagation distances greater than 1 km is not stated in the standard. Model accuracy also depends on the accuracy of the noise emissions inputs, which is often ±2 dBA. Accounting for both these independent sources of uncertainty, the overall accuracy of the noise levels predictions presented in the Project noise assessment is expected to be ±3.6 dBA. Several conservative assumptions regarding propagation conditions, Project operations, and Project noise emissions were made to account for this level of uncertainty.

Each receptor was assumed to be downwind from each source 100% of the time. Because downwind conditions tend to enhance noise propagation, this assumption is conservative and likely overestimates noise effects from the Project.

Ground conditions in most of the study area meet the definition of porous ground provided in ISO 9613-2: *"…ground covered by grass, trees or other vegetation…"* (ISO 1996). Visual review of satellite imagery suggest that roads and other reflective surfaces make up a very small fraction of the study area. As such, for consistency with ISO 9613-2, a ground factor very close to 1.0 should be used in the computer models. Instead, the computer models used a substantially more reflective ground factor of 0.5 to represent conditions in the study area. Because reflective ground tends to enhance noise propagation, this approach is conservative and likely overestimates noise effects from the Project.

The Project wind turbines and substation were modelled with maximum noise emissions 100% of the time. Because Project noise sources will often operate with less than maximum noise emissions (e.g., during periods of relatively low wind), this approach is conservative and likely overestimates noise effects from the Project.

Terrain features were the only acoustical screening elements considered in the computer models. Acoustical screening from anthropogenic features (e.g., buildings) and vegetation (e.g., the dense forest that covers most of the study area) was not considered in the computer models. This is a conservative approach that will tend to overestimate noise effects from the Project.

5.0 NOISE EMISSIONS

As discussed in Section 2.0, Project noise sources consist of 49 Nordex N163 7.0-MW wind turbines and one substation consisting of two 190 MVA electrical transformers. All Project sources were modelled with maximum planned noise emissions.

Noise emissions for the Project wind turbines were provided by Nordex (the manufacturer) in the form of one-third octave band sound power levels for integer wind speeds from 3 m/s to 12 m/s. According to the Nordex data, noise emissions from the Project turbines increase with wind speed until reaching maximum emissions for a wind speed of 7 m/s. For wind speeds ≥7 m/s, noise emissions from the Project wind turbines do not change.

As discussed in Section 3.2 of this report, the Noise Guidelines provide a test for identifying low frequency tonal components in one-third octave band data (Nova Scotia 2023). WSP applied this test to the emissions data provided by Nordex and found no tonal components associated with the Project wind turbines. Therefore, Project wind turbines cannot produce low frequency noise issues as defined in Noise Guidelines (Nova Scotia 2023).

As discussed in Section 4.3, computer modelling in accordance with ISO 9613-2 (ISO 1996) requires that noise emissions be specified in the form of octave band sound power levels. To facilitate computer modelling, WSP processed the one-third octave band data provided by Nordex to obtain octave band sound power levels for frequency bands from 31.5 Hertz (Hz) to 8 kilohertz (kHz). Noise emissions for the Project substation were calculated based on a technical standard from the National Electrical Manufacturers Association (NEMA 2000). To facilitate computer modelling, substation emissions were established as octave band sound power levels from 31.5 Hz to 8 kHz.

Noise sources associated with the proposed Kmtnuk facility consist of 16 Nordex N163 5.9-MW wind turbines, each with a hub height of 125 m, and a substation consisting of one 115 MVA electric transformer. All Kmtnuk sources were modelled with maximum planned noise emissions.

Similar to the Project noise sources, emissions from the Kmtnuk wind turbines were established using data provided by Nordex (the manufacturer) and emissions from the Kmtnuk substation were calculated based on a NEMA technical standard (NEMA 2000). According to the Nordex data, noise emissions from the Kmtnuk turbines increase with wind speed until reaching maximum emissions for a wind speed of 7 m/s. For wind speeds ≥7 m/s, total noise emissions from the Project wind turbines do not change; however, the way that noise emissions are distributed across frequency is different for a wind speed of 7 m/s and for wind speeds ≥8 m/s. As such, the Project noise assessment modelled Kmtnuk turbines for a wind speed of 7 m/s and for wind speeds ≥8 m/s and used the maximum predicted noise level when assessing potential cumulative effects.

Table 5 presents noise emissions values used to model Project sources. Table 6 presents noise emissions values used to model Kmtnuk noise sources. All noise emissions values are presented in the form of octave band sound power levels, expressed in unweighted decibels (dBZ), and total sound power levels expressed in dBA.

Table 5: Project Noise Emissions

Source	Operating Mode	Octave Band Sound Power Level [dBZ]									Total Sound Power Level [dBA]
		31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Nordex N163 7.0-MW wind turbine	Mode 0; wind speed ≥7 m/s	123.9	118.7	113.4	109.0	105.1	103.5	100.5	89.2	71.1	108.6
Substation (two 190 MVA transformers)	ONAF2	105.3	111.3	113.3	108.3	108.3	102.3	97.3	92.3	85.3	108.7

Table 6: Kmtnuk Noise Emissions

Source	Operating Mode	Octave Band Sound Power Level [dBZ]									Total Sound Power Level [dBA]
		31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Nordex N163 5.9-MW wind turbine	Mode 0; wind speed 7 m/s	118.4	115.2	112.4	109.8	106.9	104.3	100.0	90.2	84.3	109.2
Nordex N163 5.9-MW wind turbine	Mode 0; wind speed ≥8 m/s	118.9	115.7	111.8	108.5	106.4	104.6	101.0	92.4	85.7	109.2
Substation (one 115 MVA transformer)	ONAF2	99.8	105.8	107.8	102.8	102.8	96.8	91.8	86.8	79.8	103.2

6.0 ASSESSMENT RESULTS

6.1 Broadband Noise – Operations

For each receptor, Table 7 presents predicted noise levels from operation of the Project, predicted noise levels from operation of Kmtnuk, and predicted noise levels from combined operation of the Project and Kmtnuk. Figure 2 presents a contour map showing predicted noise levels from operation of the Project in isolation from all other noise sources. The contour map covers the entire noise study area.

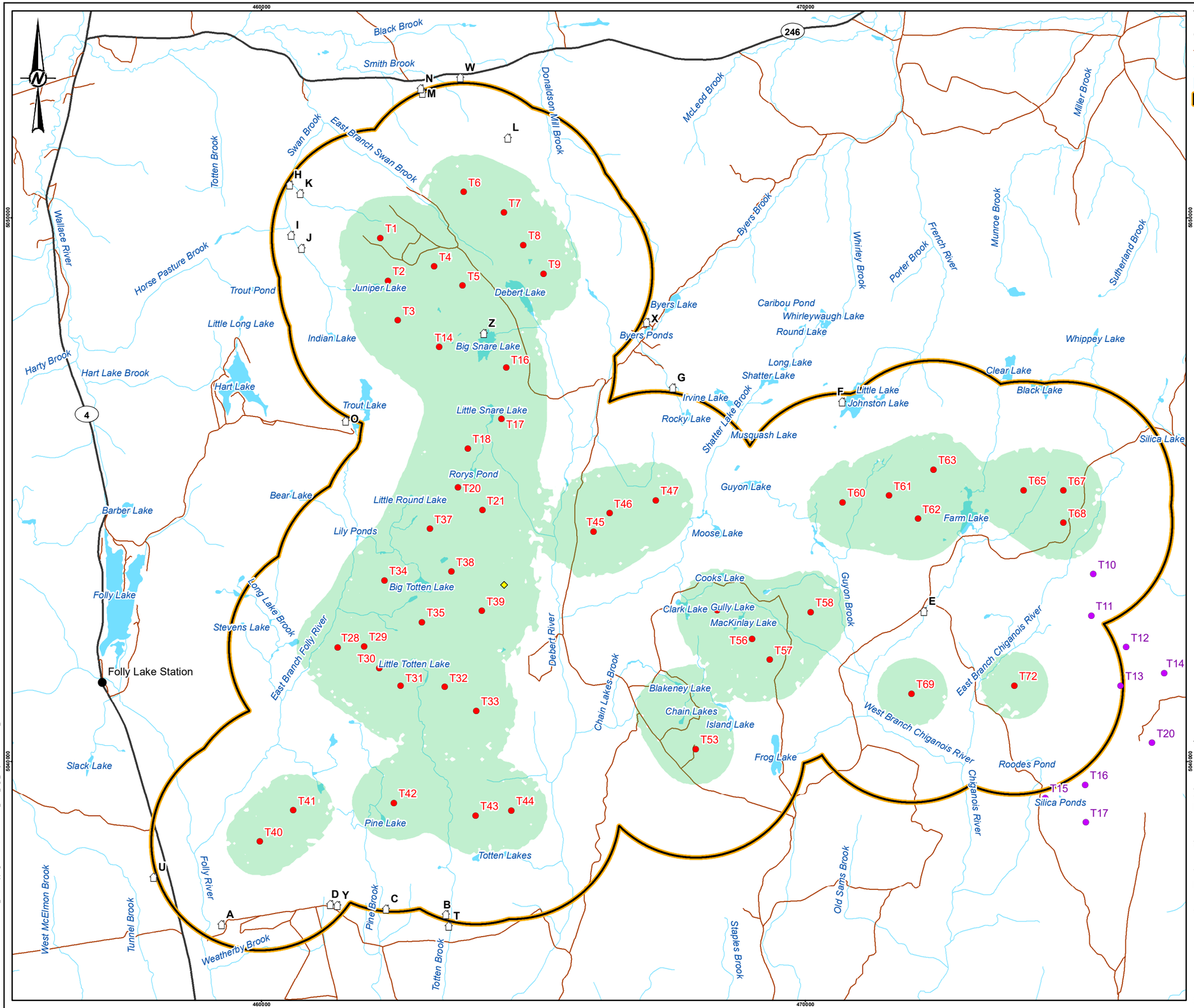
Table 7: Project and Kmtnuk Noise Levels

Receptor Identification Code	Project Noise Level [dBA]	Kmtnuk Noise Level [dBA]			Total Noise Level: Project + Kmtnuk[a] [dBA]
		Wind Speed 7 m/s	Wind Speed ≥8 m/s	Maximum	
A	29.8	nil[b]	nil[b]	nil[b]	29.8
B	31.2	nil[b]	nil[b]	nil[b]	31.2
C	32.2	nil[b]	nil[b]	nil[b]	32.2
D	33.6	nil[b]	nil[b]	nil[b]	33.6
E	35.9	27.3	26.8	27.3	36.5
F	34.0	nil[b]	nil[b]	nil[b]	34.0
G	30.5	nil[b]	nil[b]	nil[b]	30.5
H	26.8	nil[b]	nil[b]	nil[b]	26.8
I	30.0	nil[b]	nil[b]	nil[b]	30.0
J	30.1	nil[b]	nil[b]	nil[b]	30.1
K	28.1	nil[b]	nil[b]	nil[b]	28.1
L	37.5	nil[b]	nil[b]	nil[b]	37.5
M	14.9	nil[b]	nil[b]	nil[b]	14.9
N	26.1	nil[b]	nil[b]	nil[b]	26.1
O	35.1	nil[b]	nil[b]	nil[b]	35.1
T	30.4	nil[b]	nil[b]	nil[b]	30.4
U	29.3	nil[b]	nil[b]	nil[b]	29.3
W	20.3	nil[b]	nil[b]	nil[b]	20.3
X	31.0	nil[b]	nil[b]	nil[b]	31.0
Y	31.6	nil[b]	nil[b]	nil[b]	31.6
Z[c]	43.0	nil[b]	nil[b]	nil[b]	43.0

(a) Total noise level calculated by summing predicted Project noise level with predicted maximum Kmtnuk noise level.

(b) Noise contribution too small to be meaningfully quantified.

(c) The owner of this camp has an agreement with Windy Ridge waiving the requirement to comply with noise limits.



LEGEND

- HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- NOISE STUDY AREA
- NOISE RECEPTOR

PROJECT NOISE SOURCES

- TURBINE LOCATION
- SUBSTATION

KMTNUK NOISE SOURCES

- TURBINE LOCATION

PREDICTED WINDY RIDGE NOISE LEVEL [DBA]

- 40 DBA

0 2,000 4,000

1:70,000 METRES

REFERENCE(S)

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DATUM: NAD83 PROJECTION: UTM ZONE 20

CLIENT
EVERWIND FUELS (EWF)

PROJECT
WINDY RIDGE WIND PROJECT

TITLE
PROJECT NOISE LEVELS

CONSULTANT

YYYY-MM-DD	2024-04-11
DESIGNED	VY
PREPARED	PT
REVIEWED	VY
APPROVED	TC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0020489.7754	2001	2	2

Table 8 assesses Project compliance with the EA Guide (Nova Scotia 2021) by comparing the total noise level from combined operation of the Project and Kmtnuk to the 40 dBA noise threshold. The results presented in Table 8 demonstrates that noise levels from combined operation of the Project and Kmtnuk are predicted to comply with the EA Guide (Nova Scotia 2021) at all receptors where compliance is required.

Table 8: Compliance Assessment for EA Guide

Receptor Identification Code	Total Noise Level: Project + Kmtnuk [dBA]	EA Guide Noise Threshold[a] [dBA]	Margin of Compliance[b] [dBA]	Assessment
A	29.8	40	10.2	compliant
B	31.2	40	8.8	compliant
C	32.2	40	7.8	compliant
D	33.6	40	6.4	compliant
E	36.5	40	3.5	compliant
F	34.0	40	6.0	compliant
G	30.5	40	9.5	compliant
H	26.8	40	13.2	compliant
I	30.0	40	10.0	compliant
J	30.1	40	9.9	compliant
K	28.1	40	11.9	compliant
L	37.5	40	2.5	compliant
M	14.9	40	25.1	compliant
N	26.1	40	13.9	compliant
O	35.1	40	4.9	compliant
T	30.4	40	19.7	compliant
U	29.3	40	9.0	compliant
W	20.3	40	10.2	compliant
X	31.0	40	8.8	compliant
Y	31.6	40	7.8	compliant
Z	43.0	n/a[c]	n/a[c]	n/a[c]

(a) Noise threshold taken from EA Guide (Nova Scotia 2021).

(b) Margin of compliance is the difference between the noise threshold and the total noise level from combined operation of the Project and Kmtnuk. A margin of compliance ≥0 dBA indicates compliance with the EA Guide (Nova Scotia 2021).

(c) The owner of this camp has an agreement with Windy Ridge waiving the requirement to comply with noise limits.

For each receptor, Table 9 presents comprehensive sound levels calculated in accordance with the Noise Guidelines (Nova Scotia 2023). As discussed in Section 3.2 of this report, comprehensive sound levels consist of the combined noise contribution from existing natural and anthropogenic sources (i.e., baseline noise levels) and new industrial sources being proposed for development (i.e., Kmtnuk and the Project).

Table 9: Comprehensive Sound Levels

Receptor Identification Code	Baseline Noise Level[(a)] [dBA]	Kmtnuk Noise Level [dBA]	Project Noise Level [dBA]	Comprehensive Sound Level [dBA]
A	35	nil[(b)]	29.8	36.1
B	35	nil[(b)]	31.2	36.5
C	35	nil[(b)]	32.2	36.8
D	35	nil[(b)]	33.6	37.4
E	35	27.3	35.9	38.8
F	35	nil[(b)]	34.0	37.5
G	35	nil[(b)]	30.5	36.3
H	35	nil[(b)]	26.8	35.6
I	35	nil[(b)]	30.0	36.2
J	35	nil[(b)]	30.1	36.2
K	35	nil[(b)]	28.1	35.8
L	35	nil[(b)]	37.5	39.4
M	35	nil[(b)]	14.9	35.0
N	35	nil[(b)]	26.1	35.5
O	35	nil[(b)]	35.1	38.1
T	35	nil[(b)]	30.4	36.3
U	35	nil[(b)]	29.3	36.0
W	35	nil[(b)]	20.3	35.1
X	35	nil[(b)]	31.0	36.5
Y	35	nil[(b)]	31.6	36.6
Z[(c)]	35	nil[(b)]	43.0	43.6

(a) Baseline noise levels established based on Health Canada (2017).

(b) Noise contribution too small to be meaningfully quantified.

(c) The owner of this camp has an agreement with Windy Ridge waiving the requirement to comply with noise limits.

Table 10 assesses Project compliance with the Noise Guidelines (Nova Scotia 2023) by comparing the comprehensive sound level to the 40 dBA PSL limit. The results presented in Table 10 demonstrates that comprehensive sound levels during Project operation are predicted to comply with the Noise Guidelines (Nova Scotia 2023) at all receptors where compliance is required.

Table 10: Compliance Assessment for Noise Guidelines

Receptor Identification Code	Comprehensive Sound Level [dBA]	Permissible Sound Level[(a)] [dBA]	Margin of Compliance[(b)] [dBA]	Assessment
A	36.1	40	3.9	compliant
B	36.5	40	3.5	compliant
C	36.8	40	3.2	compliant
D	37.4	40	2.6	compliant
E	38.8	40	1.2	compliant
F	37.5	40	2.5	compliant
G	36.3	40	3.7	compliant
H	35.6	40	4.4	compliant
I	36.2	40	3.8	compliant
J	36.2	40	3.8	compliant
K	35.8	40	4.2	compliant
L	39.4	40	0.6	compliant
M	35.0	40	5.0	compliant
N	35.5	40	4.5	compliant
O	38.1	40	1.9	compliant
T	36.3	40	3.7	compliant
U	36.0	40	4.0	compliant
W	35.1	40	4.9	compliant
X	36.5	40	3.5	compliant
Y	36.6	40	3.4	compliant
Z	43.6	n/a[(c)]	n/a[(c)]	n/a[(c)]

(a) PSL limit taken from Noise Guidelines (Nova Scotia 2023).

(b) Margin of compliance is the difference between the PSL limit and the comprehensive sound level. A margin of compliance ≥0 dBA indicates compliance with the Noise Guidelines (Nova Scotia 2023).

(c) The owner of this camp has an agreement with Windy Ridge waiving the requirement to comply with noise limits.

6.2 Low Frequency Noise – Operations

As discussed in Section 3.1 of this report, the EA Guide requires a discussion of potential effects from low frequency noise or infrasound during Project operations but does not provide quantitative thresholds or limits for assessing such effects (Nova Scotia 2021). In contrast, as discussed in Section 3.2 of this report, the Noise Guidelines provide a two-part quantitative test for identifying and accounting for low frequency noise issues (Nova Scotia 2023). The Project noise assessment made use of the two-part test from the Noise Guidelines to assess potential low frequency noise effects from the Project.

The first part of the low frequency noise test requires a comparison of comprehensive sounds levels expressed in dBA and dBC. Comprehensive sound levels expressed in dBA are presented in Table 9 (see Section 6.1), and comprehensive sound levels expressed in dBC are presented in Table 11.

Table 11: Comprehensive Sound Levels (C-Weighted)

Receptor Identification Code	Baseline Noise Level[(a)] [dBC]	Kmtnuk Noise Level [dBC]	Project Noise Level [dBC]	Comprehensive Sound Level [dBC]
A	42	nil[(b)]	51.9	52.3
B	42	nil[(b)]	53.7	54.0
C	42	nil[(b)]	53.8	54.1
D	42	nil[(b)]	54.3	54.5
E	42	47.3	58.5	58.9
F	42	nil[(b)]	55.1	55.3
G	42	nil[(b)]	52.7	53.1
H	42	nil[(b)]	47.2	48.3
I	42	nil[(b)]	50.5	51.1
J	42	nil[(b)]	49.8	50.5
K	42	nil[(b)]	48.2	49.1
L	42	nil[(b)]	58.2	58.3
M	42	nil[(b)]	40.8	44.5
N	42	nil[(b)]	47.0	48.2
O	42	nil[(b)]	58.7	58.8
T	42	nil[(b)]	53.4	53.7
U	42	nil[(b)]	50.9	51.4
W	42	nil[(b)]	44.5	46.4
X	42	nil[(b)]	53.2	53.5
Y	42	nil[(b)]	52.6	53.0
Z	42	nil[(b)]	62.3	62.3

(a) Baseline noise levels established based on Young et al. (2015).

(b) Noise contribution too small to be meaningfully quantified.

According to the Noise Guidelines, a low frequency noise issue exists if the difference between dBA and dBC comprehensive sound levels is ≥20 **and** there is a low frequency tonal component in at least one of the one-third octave bands. Both parts of the two-part test must be satisfied for a low frequency noise issue to exist.

As discussed in Section 5.0 of this report, the second part of the low frequency noise test was applied to the one-third octave band emissions spectrum from the Project wind turbines. No tonal components were identified. As such, the Project cannot cause low frequency noise issues as defined in the Noise Guidelines (Nova Scotia 2023). Nevertheless, Table 12 compares comprehensive sound levels expressed in dBA to comprehensive sound levels expressed in dBC and compares the difference between dBC and dBA levels to the threshold value from the first part of the low frequency noise test.

Table 12: Low Frequency Noise Assessment for Noise Guidelines

Receptor Identification Code	First Part of Low Frequency Noise Test				Second Part of Low Frequency Noise Test	Assessment[b]
	Comprehensive Sound Level			Threshold Value[a]	Presence of Tonal Component	
	[dBA]	[dBC]	Difference: dBC minus dBA			
A	36.1	52.3	16.2	20	no	no low frequency noise issue
B	36.5	54.0	17.5	20	no	no low frequency noise issue
C	36.8	54.1	17.3	20	no	no low frequency noise issue
D	37.4	54.5	17.1	20	no	no low frequency noise issue
E	38.8	58.9	20.1	20	no	no low frequency noise issue
F	37.5	55.3	17.8	20	no	no low frequency noise issue
G	36.3	53.1	16.8	20	no	no low frequency noise issue
H	35.6	48.3	12.7	20	no	no low frequency noise issue
I	36.2	51.1	14.9	20	no	no low frequency noise issue
J	36.2	50.5	14.3	20	no	no low frequency noise issue
K	35.8	49.1	13.3	20	no	no low frequency noise issue
L	39.4	58.3	18.9	20	no	no low frequency noise issue
M	35.0	44.5	9.5	20	no	no low frequency noise issue
N	35.5	48.2	12.7	20	no	no low frequency noise issue
O	38.1	58.8	20.7	20	no	no low frequency noise issue
T	36.3	53.7	17.4	20	no	no low frequency noise issue
U	36.0	51.4	15.4	20	no	no low frequency noise issue
W	35.1	46.4	11.3	20	no	no low frequency noise issue
X	36.5	53.5	17.0	20	no	no low frequency noise issue
Y	36.6	53.0	16.4	20	no	no low frequency noise issue
Z	43.6	62.3	18.7	n/a[c]	no	n/a[c]

(a) Threshold value taken from Noise Guidelines (Nova Scotia 2023).

(b) Both the first part and second part of the two-part test must be satisfied for a low frequency noise issue to be present (Nova Scotia 2023).

(c) The owner of this camp has an agreement with Windy Ridge waiving the requirement to comply with noise limits.

Table 12 indicates there are two receptors (E and O) where the difference between dBA and dBC comprehensive sound levels is predicted to be ≥20. However, because no Project-related tonal component can exist at these receptors, there is no potential for a low frequency noise issue at any receptor considered in the Project noise assessment.

6.3 Construction Noise

As discussed in Section 3.1 of this report, the EA Guide requires a discussion of potential noise effects during construction of the Project but does not provide quantitative thresholds or limits for assessing such effects (Nova Scotia 2021). The Noise Guidelines (Nova Scotia 2023) do not require an assessment of construction noise or provide thresholds/limits for evaluating potential construction noise effects. In the absence of quantitative thresholds or detailed assessment methodology, the Project noise assessment considered construction noise qualitatively.

Potential noise effects during Project construction will vary based on the type of construction activities. The primary noise sources associated with construction will include trucks and other vehicles (used to transport workers and materials to the site), backhoes and graders (for site preparation), blasting, cranes, and smaller equipment such as welding units. Due to their tonal character, back-up alarms installed on mobile equipment are also an important source when assessing potential effects from construction noise. Noise levels at receptors during construction activities will depend primarily on the number, type, and proximity of noise sources. Construction noise levels will decrease as the distance between the receptors and construction activities increases.

Where practical, Windy Ridge will implement the following measures to mitigate potential noise effects during Project construction.

- Conduct construction activities during the daytime period (7 am to 7 pm).
- Advise nearby residents of noisy activities (e.g., blasting) and schedule these activities to reduce disruption.
- Install appropriate and well-maintained muffler systems on engine-driven equipment.
- Design work areas and travel paths to reduce the amount of time that equipment must operate in reverse and thereby reduce the use of back-up alarms.
- Respond expeditiously to noise complaints and take appropriate action to address such complaints.

Implementation of the measures listed above should be sufficient to mitigate potential noise effects from Project construction to an acceptable level.

7.0 SUMMARY AND DISCUSSION

A noise assessment was prepared for the Project in accordance with provincial requirements. In particular, the Project noise assessment took guidance from the EA Guide (Nova Scotia 2021) and the Noise Guidelines (Nova Scotia 2023). The noise assessment considered potential effects to receptors (i.e., cottages and camps) located within approximately 2 km of the Project. The noise assessment considered potential effects associated with Project operations and Project construction. The noise assessment also considered potential cumulative effects associated with operation of the Kmtnuk Wind Power Project, which is being proposed for development east of the Project.

The Project noise assessment concluded:

- Noise levels from operation of the Project and Kmtnuk will comply with the noise threshold from the EA Guide (Nova Scotia 2021).
- Noise levels from operation of the Project and Kmtnuk, in combination with natural and non-industrial anthropogenic sources, will comply with the permissible sound level from the Noise Guidelines (Nova Scotia 2023).
- Operation of the Project will not result in low frequency noise issues as defined in the Noise Guidelines (Nova Scotia 2023).
- Implementation of noise mitigation measures should be sufficient to reduce potential effects from Project construction to acceptable levels.

In summary, the noise assessment predicts that Project construction and operation will comply with all provincial requirements. As such, the Project is not expected to result in unacceptable noise effects.

Signature Page

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https://wsponlinecan.sharepoint.com/sites/ca-ca00204897754/shared documents/05. technical/noise and shadow - windy ridge/noise assessment report/rev2 - 15 april 2024/ca0020489.7754_2001 windyridge noiseassessment_15april2024.docx

8.0 REFERENCES

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