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IMMISSION AUDIT REPORT – **Project: 16227.06**

Niagara Region Wind Farm
Acoustic Immission Audit – Phase 4
Receptor O0085

Prepared for:

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Revision History

Version	Description	Author	Reviewed	Date
1	Initial Report	HF, AM	PA	February 3, 2021

Important Notice and Disclaimer

Executive Summary

Aercoustics Engineering Limited ("Aercoustics") has been retained by 1021702 B.C. Ltd as general partner for and on behalf of FWRN L.P. to complete the acoustic immission audit outlined in the Renewable Energy Approval ("REA") for the Niagara Region Wind Farm ("NRWF"). NRWF operates under REA #4353-9HMP2R, issued on November 6, 2014.

During the Phase 2 audit the measured levels were found to be non-compliant with the applicable sound level limits at receptor O0085. Boralex in partnership with the turbine manufacturer Enercon has undertaken a noise abatement action plan dated June 4, 2019 which has been approved by the Ministry of Environment Conservation and Parks ("MECP"). Subsequent verification off the noise abatement action plan was done in the Phase 3 audit and was found to be effective with the exception of the Mode II (3.0MW) mode of operation. The noise abatement action plan has been updated to remove the Mode II mode of operation and is replaced with the 1500kW mode of operation.

The updated noise abatement action plan included the following mitigation details:

- Curtailment of the closest turbine, T08 to 1500kW mode of operation
- The curtailment applies during the night-time from 10pm – 5am and to the wind direction range of 150° – 240° only, referencing North with 0°.

Details of the noise abatement action plan and mitigation details are provided in Appendix D.

Measurements have recently been concluded at the site to verify compliance after the implementation of the noise abatement action plan. This report details the 4th measurement campaign of the NRWF immission audit near to receptor O0085 after mitigation. Monitoring near receptor O0085 spanned the following dates:

Location	Monitoring Start Date	Monitoring End Date
O0085	October 30th, 2020	December 15th, 2020

The audit has been completed as per the methodology outlined in Parts D and E5.5 RAM-I (Revised Assessment Methodology) of the "*MECP Compliance Protocol for Wind Turbine Noise*" (Updated: April 21, 2017).

The measured turbine-only noise impact for the curtailment mode at the audit location was compared to the Ministry of Environment Conservation and Parks ("MECP") sound level limits. The measured turbine-only levels were found to be in compliance with the applicable sound level limits.

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1 Introduction

Aercoustics Engineering Limited (“Aercoustics”) has been retained by 1021702 B.C. Ltd as general partner for and on behalf of FWRN L.P to complete an Immission Audit (“I-audit”) of the Niagara Region Wind Farm (“Niagara Region Wind Farm”). Niagara Region Wind Farm operates under Renewable Energy Approval ("REA") #4353-9HMP2R.

During the Phase 2 audit the measured levels were found to be non-compliant with the applicable sound level limits at receptor O0085. Boralex in partnership with the turbine manufacturer Enercon has undertaken a noise abatement action plan dated June 4, 2019 which has been approved by the Ministry of Environment Conservation and Parks (“MECP”). Subsequent verification off the noise abatement action plan was done in the Phase 3 audit and was found to be effective with the exception of the Mode II (3.0MW) mode of operation. The noise abatement action plan has been updated to remove the Mode II (3.0MW) mode of operation and is replaced with the 1500kW mode of operation.

The updated noise abatement action plan included the following mitigation details:

- Curtailment of the closest turbine, T08 to 1500kW mode of operation
- The curtailment applies during the night-time from 10pm – 5am and to the wind direction range of 150^{o} – 240^{o} only, referencing North with 0^{o}.
- The curtailment applies for hub-height wind speeds from 7.5m/s to 22.9m/s

Details of the updated implemented noise abatement action plan and mitigation details are provided in Appendix D.

Measurements have recently been concluded at the site to verify compliance after the implementation of the noise abatement action plan. This report details the 4th measurement campaign of the NRWF immission audit near to receptor O0085 after mitigation.

This I-audit has been conducted per the methodology outlined in Part D and Part E of the 2017 Compliance Protocol for Wind Turbine Noise (“Compliance Protocol”). The Compliance Protocol is an Ontario Ministry of the Environment, Conservation and Parks (“MECP”) document used to evaluate noise from a wind facility at nearby receptors.

2 Audit Location

The monitoring equipment, and details regarding the monitoring locations are provided in this section.

2.1 Monitoring Location

Receptor O0085 was originally chosen to be representative of the worst-case impact of the facility. The location was one of five locations that were chosen based on the MECP selection requirements communicated in the NRWF REA. The receptor is located in the predominant downwind direction of the facility. O0085 has a predicted impact of 39.5 dBA as per the sound pressure level predicted from an "As Built" noise model based on the original CadnaA noise prediction model. The following describes the measurement location M0085 in relation to the receptor:

- M0085: Measurement equipment was placed in an open field to the west of O0085, 540 m to the closest turbine (T08), on the south side of Concession Road Three. The predicted level based on the acoustic model at M0085 is 39.7 dBA.

The following table provides a summary of the receptor location.

Table 1: Receptor Measurement Locations

	Audit Receptor ID Nearest Turbine ID	O0085 T08
Receptor	UTM Coordinates (X,Y)	17T 614752mE 4765425mN
	Distance to Nearest Turbine	554m
	Predicted Level dBA*	39.5
Monitor	UTM Coordinates (X,Y)	17T 614682mE 4765434mN
	Distance to Nearest Turbine	540m
	Predicted Level dBA**	39.7

* Predicted level from Sound Level Prediction Results, [Modified Model for As-built] 77 WTGs – Stantec [3]
** Predicted level from Aercoustics' acoustic model

Site plans and photographs of the monitoring equipment are provided in Appendix A. Details regarding the monitoring equipment are provided in Section 3.1.

2.2 Ambient Environment

Niagara Region Wind Farm is located in a rural (Class III) area. Ambient noise in rural areas is typically driven by a mixture of flora, fauna, traffic, and nearby industry. Each of these sources and their impacts on the ambient environment are discussed in this section. If the ambient noise is extraneous – such as a short-duration event, or noise concentrated at specific frequencies – then filtering is employed to reduce or remove it (see Section 3.3.2). If the ambient noise is not extraneous, then efforts are made to ensure that the

noise is equally represented in both *Total Noise* and *Background* periods (see Section 3.3.4).

In addition to ambient noise sources, self-generated noise from the monitoring equipment will typically be present in the measurement data at high wind speeds. This noise is minimized by the usage of a primary and secondary wind screen installed around the microphone. The larger secondary wind screen meets the requirements of Section D2.1.4 of the Compliance Protocol and the insertion loss of the wind screen is tested and accounted for in the analysis. Self-generated noise is assumed to be equally present in *Total Noise* and *Background* periods for a given wind speed.

2.2.1 Flora

Noise from flora was found to be insignificant during the I-audit. The area surrounding Niagara Region Wind Farm is a mix of shelter belts surrounding fields. The noise generated from these features is proportional to wind speed – both ground level and hub-height – with higher wind speeds generating increased amounts of noise.

2.2.2 Fauna

Noise from flora was found to be insignificant during the I-audit. Occasional activity from animals introduced extraneous noise in a small number of intervals, which were removed from the dataset.

2.2.3 Traffic

Noise from traffic was found to be an occasional source of extraneous noise during the I-audit. Roadways near the project include Concession Road 3. Intervals influenced by car passbys were removed from the dataset whenever possible (see Section 3.3.2).

2.2.4 Industry

Noise from other industrial sources was found to be insignificant during the I-audit.

2.2.5 Other Sources

No significant contamination from other sources was found in the measurement dataset.

3 Audit Methodology

For the duration of the I-audit, acoustic and weather data are logged simultaneously in one-minute intervals at the monitoring location. Analysis and filtering are conducted per Section D5.2 and E5.5 of the Compliance Protocol with additional filters applied as needed – following the guidance of the Compliance Protocol – to remove or reduce extraneous ambient noise (see Section 3.3.2) and ensure representative ambient conditions (see Section 3.3.4).

Intervals that pass the filtering criteria are sorted into integer wind bins[1] depending on the measured wind speed and classified as either *Total Noise* or *Background* depending on the operation of the nearby Niagara Region Wind Farm turbines (see Section 3.3.1). The *Turbine-Only* sound level at each wind bin is then determined by logarithmically subtracting the average *Background* level from the *Total Noise* level in wind bins having sufficient data for assessment. Minimum thresholds for sufficient data are discussed in Section 3.4.1.

3.1 Monitoring Equipment

The following acoustic and non-acoustic monitoring equipment was installed at the monitoring location.

- One (1) Type 1 sound level meter with microphone and pre-amplifier, installed at receptor height
- One (1) primary and one (1) secondary[2] windscreen for the microphone.
- One (1) anemometer installed 10 metres above ground level (“10m-AGL”).

The monitoring equipment was configured to log one-minute equivalent sound levels (L_{eq}) in A-weighted broadband and 1/3rd octave band frequencies. The microphone was installed at least 5 meters away from any large reflecting surfaces, as far away as practically possible from trees and other foliage, and in direct line of sight to the nearest Niagara Region Wind Farm turbines.

[1] An integer wind bin spans 1 m/s, centred on each integer wind speed, open at the low end and closed at the high end.
[2] The 1/3 octave band insertion loss of the secondary windscreen has been tested and has been accounted for in the data analysis.

Table 2 lists the specific make, model, and serial number for the monitoring equipment used at the audit receptor.

Table 2: Monitoring Equipment Details

Audit Receptor	Equipment	Make/Model	Serial Number	Date of Last Calibration
O0085	Sound Level Meter	NI 9234	1C009CC	August 21, 2020
	Microphone	PCB 377B02	166229	August 4, 2020
	Pre-amplifier	PCB 426E01	044002	August 4, 2020
	Signal Conditioner	PCB 480E09	34423	May 6, 2020
	Weather Station	Vaisala WXT520	R3250319	August 9, 2019

The measurement chain was calibrated before, during, and after the measurement period using a type 4231 Brüel & Kjær acoustic calibrator. The monitoring equipment is also verified by laboratory calibration per the requirements in Section D2.3 of the Compliance Protocol; calibration certificates are provided in Appendix B.

3.2 Measurement Parameters

The monitoring equipment is configured to run nightly from approximately 9pm to 6am, local time. The measurement parameters acquired and used in the audit are listed in Table 3.

Table 3: Measurement parameters used for the I-audit

Parameter Group	Measurement Parameters	Notes
Acoustic (microphone height)	L_{Aeq}	dBA
	L_{90}	dBA
	1/3rd Octave Band	dBA (20 Hz–10 kHz)
	Signal Recording	Uncompressed raw files
Weather (10m height)	Wind Speed	m/s
	Wind Direction	0-360˚
	Temperature	˚C
	Humidity	0-100%
	Precipitation	mm
Turbine (hub height)	Wind Speed	Provided by operator
	Yaw Angle	Provided by operator
	Power Output	Provided by operator
	Rotational Speed	Provided by operator

Turbine operational information was obtained from the facility SCADA system and provided to Aercoustics by NRWF.

3.3 Filtering Criteria

Analyses and filtering of the intervals in the measurement dataset are conducted per the requirements outlined in Section D5.2 and E5.5 of the Compliance Protocol. Intervals are included or excluded from analysis depending on several filtering criteria. Some of these criteria apply to all intervals and some apply only for *Total Noise* or *Background* intervals. Measurement intervals are first passed through the *All Intervals* filters, after which they are sorted into either *Total Noise* or *Background* categories based on the operation of the nearby turbines. Intervals that fail to meet the applicable filtering criteria are excluded from analysis.

All Intervals

- Have occurred between 10pm – 5am
- Have no precipitation within one hour before or after
- Have an ambient temperature above -20˚C
- Have minimal influence from extraneous ambient noise (see Section 3.3.2)

Total Noise Intervals

- Have all nearby turbines operating (see Section 3.3.1)
- Have primary turbine generating at least 85% of its maximum rated power output
    - Threshold reduced to 45% as the turbine is curtailed in accordance with the NAAP (see Section 3.3.2)
- Have a downwind wind direction (primary turbine to monitor, +/- 45°)

Background Intervals

- Have all nearby turbines parked (see Section 3.3.1)
- Have ambient conditions representative of Total Noise periods (Section 3.3.4)

Measurement intervals that pass the filtering criteria above form the assessment dataset for the I-audit.

3.3.1 Turbines in Study Area

As noted above, several filtering criteria are applied based on the operation of the primary turbine or the turbines in the surrounding area. To verify the operation of these turbines, information from the facility SCADA system is examined.

In order for a measurement interval to be considered for the *Total Noise* or *Background* periods, all the turbines in the study area must be operating or parked, respectively. The minimum number of turbines included in the study area for the receptor is selected based on the guidance of Section D3.5.2 of the Compliance Protocol:

D3.5.2 Acoustic measurements with wind turbines parked

"Ambient noise measurements shall be carried out at a point of reception with all turbines in the vicinity of the point of reception parked. The prediction model will be used to determine the number of turbines that require parking in order for the predicted noise contribution of the wind facility to fall to 30 dBA or 10 dB less than the applicable criterion."

The Niagara Region Wind Farm turbines in the audit study area for the receptor is listed in Table 4 and conform to the Compliance Protocol requirements listed above. All turbines were confirmed to be operating for Total Noise periods and parked for Background periods.

Table 4: Turbines included in the study area

Audit Receptor	Turbines verified for Total Noise Measurements	Turbines verified for Background Measurements
O0085	T08, T52, T53	T08, T52, T53

Parked turbines do not rotate or generate power. There is some idling of the blades (~1 rpm or less), but the acoustic impact of the turbines in this condition is negligible at the receptor. The turbines in the study area were confirmed to be running in their normal operating mode for the duration of the monitoring campaign, see Appendix C for a statement from the operator.

3.3.2 Turbine Power Threshold

The 85% minimum power threshold for Total Noise data points has been reduced to 45%. This was implemented as Turbine T08 has been curtailed in accordance with the Noise Abatement Action Plan to produce a maximum electrical power output of 1500kW in the curtailed mode.

3.3.3 Removal of Extraneous Noise

'Extraneous noise' is noise unrelated to the operation of the wind facility that is not part of the typical ambient environment in the area. It is typically noise that is short-duration (i.e. transient) or noise that is limited to specific frequencies. Extraneous noise is considered acoustic contamination and should be removed from the measurement dataset wherever possible. The Compliance Protocol provides the following guidance regarding extraneous noise:

C2.4.7 Extraneous noise sources[3]

"Measurements are to be inhibited when the sound level is affected by noise from extraneous sources such as vehicle noise, dogs barking and wind gusts (i.e. other than wind turbine sound)."

The same result can also be achieved by digitally recording the sound level time history and later editing out the extraneous events and recalculating the descriptors such as Leq. This should address measurement situations where extraneous sounds were not inhibited.

D3.5 Acoustic measurements

"[…] In addition, if the background sound levels are greater than the applicable exclusion limits then the applicable limits are the background sound levels without extraneous noise sources."

D5.3 Effects of insects and fauna

"The analysis shall identify the influence of any insects, fauna, or other extraneous but constant sources of noise and verify them through sound recordings. Noise from insects can be removed from the 1/3rd octave spectra of each measurement. It has to be shown, however, that the contribution of the wind turbine noise in those frequencies is minimal."

D6 Assessment of compliance

"[…] However, if the background sound levels are greater than the applicable exclusion limits then the applicable limits are now the background sound levels without extraneous noise sources."

Extraneous noise can be steady or transient. Steady extraneous noise, such as the noise from crickets or other insects, may be removed via filtering of specific 1/3rd octave bands affected by the contamination (see Protocol section D5.3).

Transient extraneous noise, such as the noise from car passes, dogs, or wind gusts, may be removed via a combination of automatic and manual filtering techniques. Automatic filtering of transient extraneous noise is achieved by removing points where the measured L_{Aeq} is significantly greater than the measured L_{90} for the same interval. Manual filtering of extraneous noise is conducted via listening tests to identify intervals having audible contamination.

[3] It is acknowledged that the measurements in this report follow Part D and Part E of the Compliance Protocol and this guidance is from Part C. Nevertheless, the guidance regarding the removal of extraneous noise in Part C is applicable here as the requirement to remove contamination from the measurement dataset follows good engineering principles for noise measurements.

3.3.4 Representative Ambient Conditions

The ambient conditions present in the *Total Noise* and *Background* periods should be similar. Section D3.8.2 of the Compliance Protocol specifically states that weather and wind shear conditions should be similar:

> ***D3.8.2 Overall equivalent sound level – wind turbines parked***
>
> *"Ambient noise measurements should be performed with the turbines parked and conducted within the same general measurement period and with the same weather and wind shear conditions. Measurements of ambient noise obtained during other periods are not recommended and should only be used with great caution to ensure that they represent the "current" ambient noise."*

Note: turbine shutdowns were conducted periodically throughout the I-audit to ensure similar weather conditions between Total Noise and Background periods.

3.4 Compliance Criteria

The criteria for an assessment of compliance per the Compliance Protocol are detailed in this section.

3.4.1 Sample Size Requirements

This audit follows the requirements of the Revised Assessment Methodology – Immission ("RAM-I"). Analysis parameters for RAM-I are detailed in Section E5.5 of the Compliance Protocol. Relevant sections regarding sample size requirements as they pertain to this I-audit are also copied below:

> *E5.5(1): "The objective of the RAM I-Audit is to assess the acoustic immission at the measurement location at wind speeds between 1 and 7 m/s (inclusive). At a minimum, data must be acquired to satisfy the requirements of at least one of the following:*
>
> *a. three (3) of the wind speed bins between 1 and 7 m/s (inclusive), or*
> *b. two (2) of the wind speed bins between 1 and 4 m/s (inclusive)."*
>
> *E5.5(5): "The Ministry may accept a reduced number of data points for each wind speed bin with appropriate justification (i.e. 60 data points in place of 120 for turbine operational measurements and 30 data points in place of 60 data points for ambient measurements). The acceptable number of data points will be influenced by the quality of the data (standard deviation)."*

In this study, a wind bin is considered complete if there are at least 60 valid *Total Noise* and 30 valid *Background* intervals.

3.4.2 Sound Level Limits

The area surrounding Niagara Region Wind Farm has been designated as Class III. Exclusion limits for a Class III area are summarized in Table 5 below.

Table 5: MECP Exclusion Limits (Class III)

Wind speed at 10m height (m/s)	Sound Level Exclusion Limit (dBA)
≤ 6	40
7	43

Sections D3.5 and D6 of the Compliance Protocol state that where the measured *Background* sound level exceeds the exclusion limits, the sound level limit for that wind bin is the *Background* sound level without extraneous noise sources.

3.4.3 Tonality

A tonality assessment of the measurement data has been conducted due to prominent tones being observed in the measurement data. The calculation of the mean tonal audibility attributable to the Niagara Region Wind Farm turbines is determined in accordance the IEC 61400-11:2012 standard. Frequencies of interest were identified from the available previous immission audit reports to be 116 Hz. Calculations were conducted using narrowband spectra calculated using the measurement intervals from the assessment dataset. Tonal audibility penalties, if applicable, for each wind bin are calculated according to Annex C of ISO 1996-2:2007 and Section E5.5.2 of the Compliance Protocol.

Applicable tonal penalties are determined using the mean tonal audibility, the calculation method of the tonal penalty is summarized in Table 6. Tonal penalties are applied to the turbine-only sound level.

Table 6: Calculation of Applicable Tonal Penalty

Mean Audibility, ΔL	Tonal Adjustment, K_T
$\Delta L \leq 4$ dB	0 dB
4 dB < $\Delta L \leq 10$ dB	ΔL – 4 dB
10 dB < ΔL	6 dB

3.5 Deviations

Any deviations from the methods prescribed in the Compliance Protocol are discussed in this section.

3.5.1 Turbine Power Threshold

As noted in section 3.3.2, the 85% minimum power threshold for Total Noise data points has been reduced to 45%. This was implemented as Turbine T08 has been curtailed in accordance with the Noise Abatement Action Plan to produce a maximum electrical power output of 1500kW in the curtailed mode reduced from a 3MW nominal maximum power output.

4 Audit Results

Measurement results of the I-audit are summarized in the following sections. Sound levels presented here are rounded to the nearest integer, whereas all calculations are conducted using un-rounded values.

4.1 Audit Duration

The length of monitoring time is summarized below in Table 7.

Table 7: Length of monitoring campaign

Audit Receptor	Audit Start Date	Audit End Date	Monitoring Duration (weeks)
O0085	October 30, 2020	December 15, 2020	6

4.2 Weather Conditions

The range of weather parameters measured during the I-audit are summarized in Table 8. These values show the range in weather conditions measured in the assessment dataset.

Table 8: Range of weather conditions in assessment dataset

Audit Receptor	Atmospheric Pressure (hPa)	10m-AGL Wind Speed (m/s)	Relative Humidity (%)	Temperature (°C)	Hub-Height Wind Speed (m/s)
O0085	983 - 1006	0 - 10	51 - 90	-1.4 – 18.5	0 - 14

A wind rose showing the measured wind directions are provided in Figure 1. This data represents the range of wind directions for all measurement data collected during the audit, not just the assessment dataset. Note that wind directions shown on the wind roses indicate the direction the wind is coming from, and the purple shaded area represent the downwind angle for the receptor.

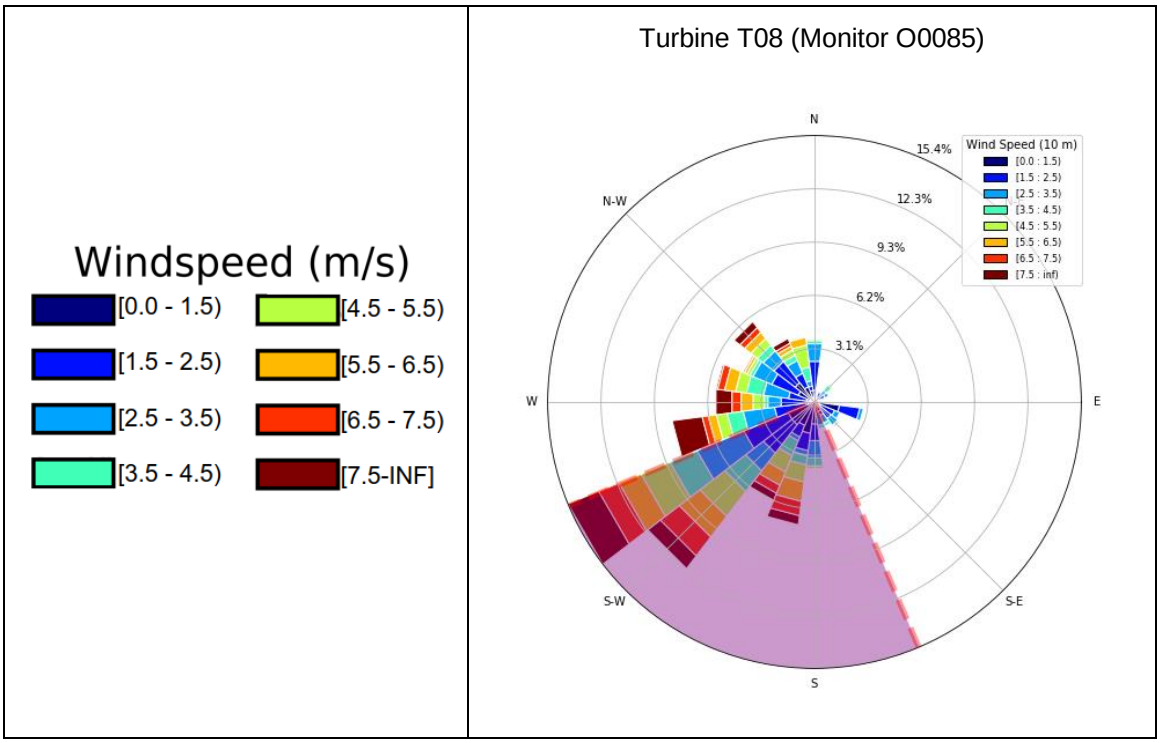


Figure 1: Wind Rose – all measured data.

From Figure 1, the distribution of wind directions observed during the I-audit is similar to what was expected based on the historical wind patterns.

4.3 Data Excluded due to Filtering Criteria

A range of wind and weather conditions were measured over the course of the I-audit. The Compliance Protocol requires that assessment data be counted only during downwind and high-power conditions, both of which vary independently with time. As a measure of how often the minimum suitable conditions materialized during the audit, the total proportion of measurement time where these two conditions were satisfied is presented in Table 9. This data shows how often during the I-audit the minimum assessment requirements in the Compliance Protocol were met at the audit receptor.

Table 9: Prevalence of Occurrence of Suitable Turbine Conditions

Audit Receptor	Primary Turbine	Prevalence of Downwind	Prevalence of High Output, >45% power	Prevalence of Downwind and High Output
O0085	T08	46%	19%	4%

Note: reduced power threshold applied as per Section 3.3.2.

It should be noted that the proportion of measurement data indicated above in Table 9 represents the maximum available data for assessment. Additional filters applied to remove contaminated or otherwise unsuitable measurement data (as discussed in Section 3.3) will further reduce the assessment dataset.

4.4 Measured Sound Levels

Valid measurement intervals that pass the filtering criteria are logarithmically averaged and sorted by wind bin into *Total Noise* and *Background* datasets. These average sound levels are presented below in Table 10.

Table 10: Average measured sound levels at the monitoring Location

Audit Receptor	Period	Measurement Parameter	Wind Bin (m/s)						
			1	2	3	4	5	6	7
O0085	Total Noise	Number of Samples	83	105	101	118	185	129	106
		Average L_{Aeq} [dBA]	39.0	39.1	39.7	39.6	40.8	43.6	47.8
		Standard Deviation [dB]	0.8	0.8	0.7	0.8	0.9	1.7	1.8
	Background	Number of Samples	111	386	132	69	76	14	16
		Average L_{Aeq} [dBA]	29.9	29.9	29.9	34.3	36.5	-	-
		Standard Deviation [dB]	3.5	2.1	2.0	1.9	1.9	-	-

- Minimum sample size not met in this wind bin, sound levels not reported except as noted by (*).

Measurement data points from Table 10 are also plotted in the following figures.

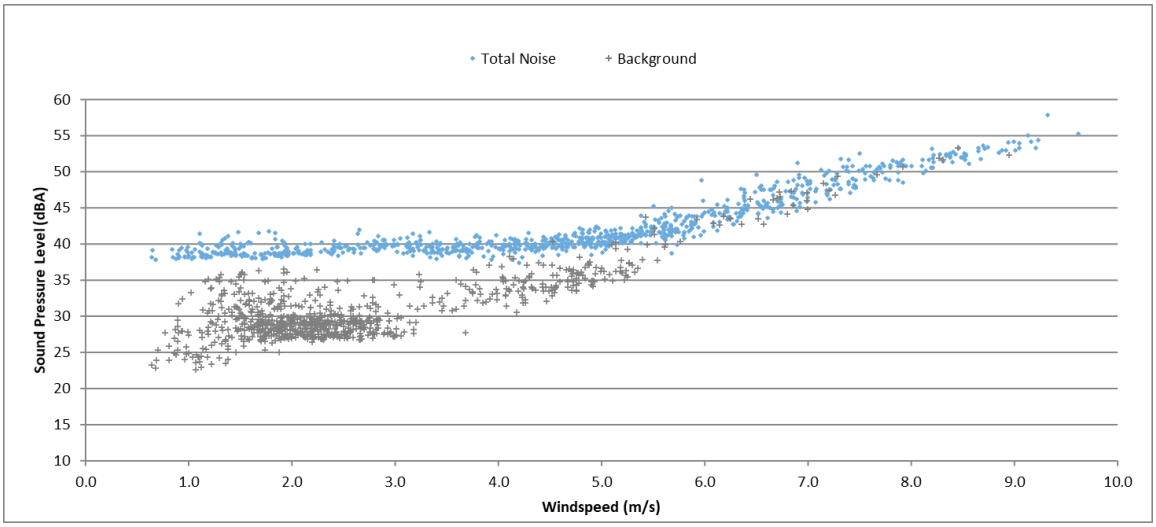


Figure 2: All valid Total Noise and Background intervals measured at O0085 Monitor

4.5 Sound Level Adjustments

The following sections detail any adjustments made to the sound levels presented in Section 4.4.

4.5.1 Tonal Adjustment

No penalties were found to be applicable.

Table 11: Tonality Assessment Table – 116 Hz

Audit Receptor	Tonality Parameter	Wind Bin (m/s)						
		1	2	3	4	5	6	7
O0085	Data Points in Wind Bin	83	105	101	118	185	129	106
	Data Points with Tone	77	93	96	114	156	86	20
	Tonal Presence	93%	89%	95%	97%	84%	67%	19%
	Tonal Audibility, ΔL [dB]	-1.4	-2.6	-2.6	-3.0	-4.0	-5.7	-6.5
	Tonal Adjustment, K_T [dB]	0	0	0	0	0	0	0

From the results in Table 11, no tones were detected that exceeded the threshold for tonal penalties.

4.6 Turbine-Only Sound Levels

The average *Total Noise* and *Background* sound levels by wind bin at the monitoring location are presented in Table 12. Any sound level adjustments used to determine the Turbine-Only sound level at the audit receptor (Point of Reception) are also presented.

Table 12: Calculated Turbine-Only Sound Levels

Audit Receptor	Measurement Period	Wind Bin (m/s)						
		1	2	3	4	5	6	7
O0085	Total Noise (dBA)	39.0	39.1	39.7	39.6	40.8	43.6	47.8
	Background (dBA)	29.9	29.9	29.9	34.3	36.5	-	-
	Signal to Noise (dBA)	9.0	9.2	9.9	5.4	4.3	-	-
	Turbine-Only (dBA) [monitor location]	38	39	39	38	39	-	-
	Tonal Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Turbine-Only (dBA) [Point of Reception]	38	39	39	38	39	-	-

- Minimum sample size not met in this wind bin, sound levels not reported except as noted by (*).

An assessment compliance of the Turbine-Only sound levels at the Point of Reception is provided in Table 13.

5 Assessment of Compliance

This section provides the results of the measurements and calculations as they pertain to the determination of compliance of the facility. Section 3.4 details the criteria used to evaluate compliance.

5.1 Assessment Table

Final Turbine-Only sound levels at the audit receptor (Point of Reception) are compared to the exclusion limits and Background sound levels in Table 13. Turbine-Only sound levels at the audit receptor are calculated by taking the Turbine-Only sound level at the monitoring location and applying any applicable adjustments as indicated in Table 12.

Table 13: Assessment Table

Audited Receptor	Wind speed at 10m-AGL [m/s]	1	2	3	4	5	6	7
O0085	Turbine-Only Sound Level (Point of Reception) [dBA]	38	39	39	38	39	-	-
	Background Sound Level [dBA]	*30*	*30*	*30*	*34*	*37*	-	-
MECP Exclusion Limit [dBA]		40	40	40	40	40	40	43
Compliance? (Y/N)		Y	Y	Y	Y	Y	-	-

- Minimum sample size not met in this wind bin, sound levels not reported except as noted by (*).

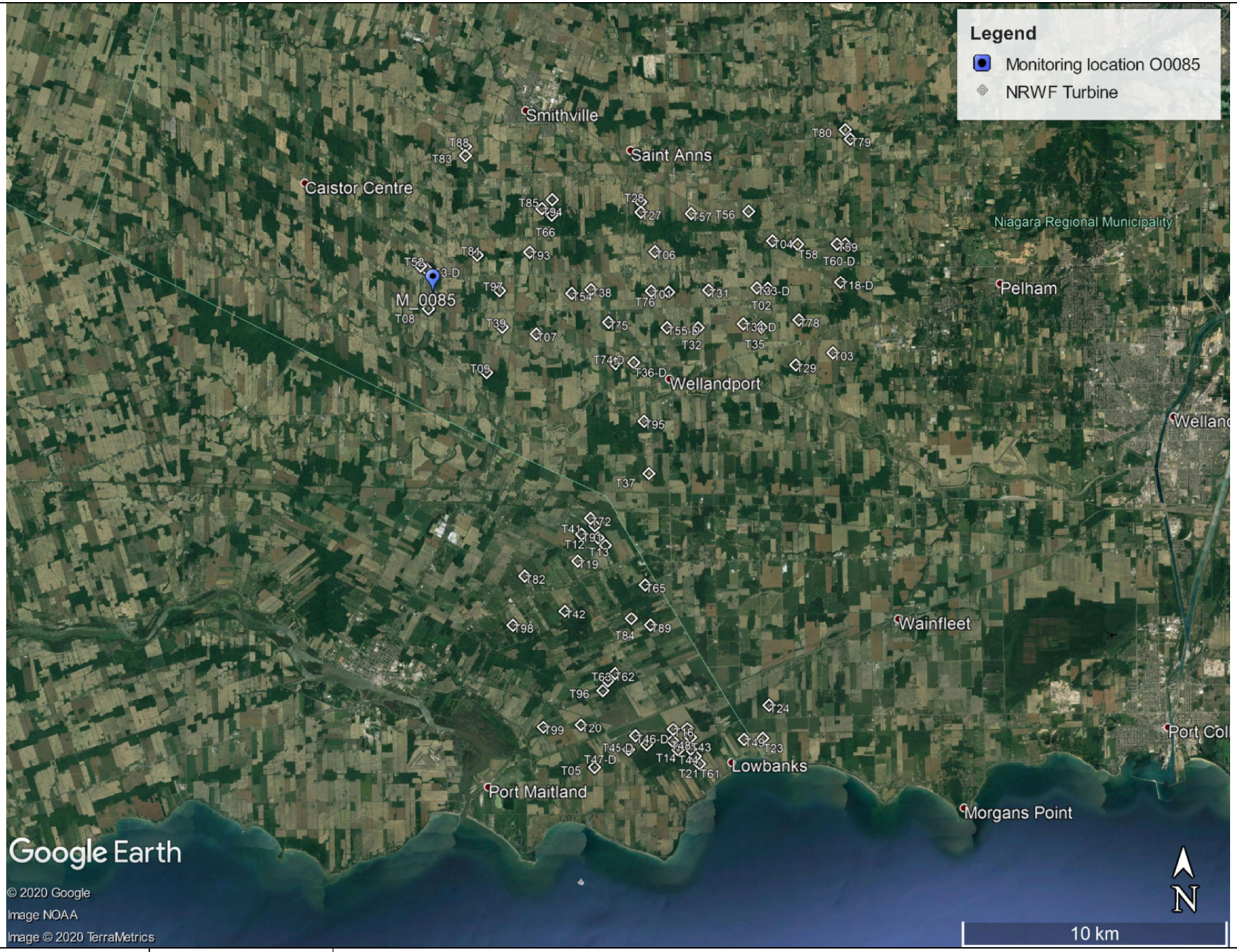
5.2 Statement of Compliance

Based on the results presented in Table 13, the Turbine-Only sound levels at the audit receptor for Niagara Region Wind Farm are in compliance with the applicable sound level limits.

6 Conclusion

An acoustic immission audit per the requirements of the MECP Compliance Protocol for Wind Turbine Noise was conducted at Niagara Region Wind Farm receptor O0085 per the results presented in this report and summarized in Table 13, the noise impacts at the receptor was found to be in in compliance with the applicable sound level limits.

Appendix A
Site Details



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16227.06

Scale: NTS
Drawn by: HF
Reviewed by: AM
Date: Jan 6, 2021
Revision: 1

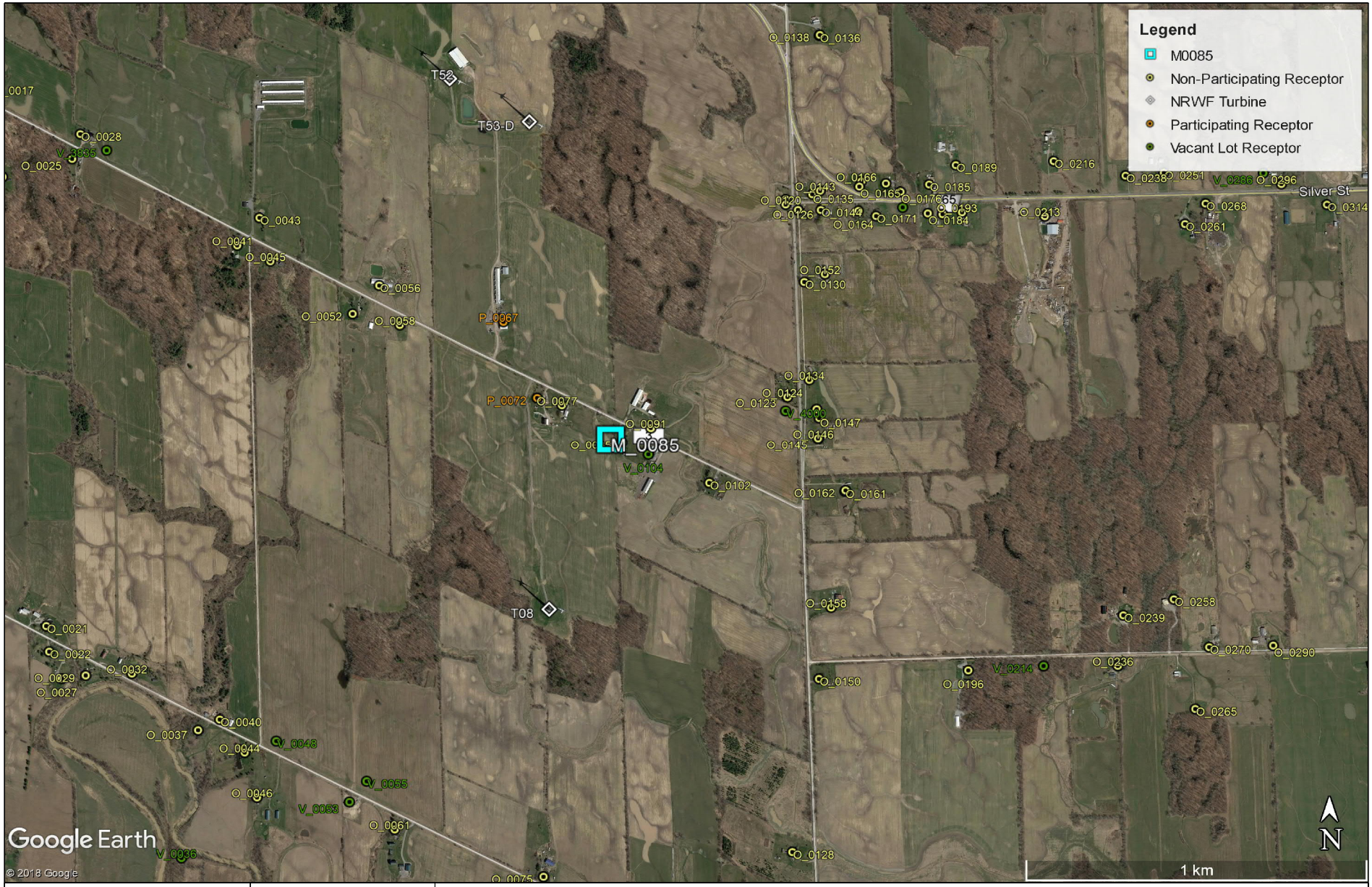
Project Name

Niagara Region Wind Farm Project - 2nd Acoustic Immission Audit

Figure Title

Site Plan

Figure A.01



aercoustics	16227.06 Scale: NTS Drawn by: HF Reviewed by: AM Date: Jan 6, 2021 Revision: 1	**Project Name** Niagara Region Wind Farm Project - 3rd Acoustic Immission Audit **Figure Title** M0085 - Monitor and Receptor Location Details **Figure A.02**

aercoustics	16227.06 Scale: NTS Drawn by: HF Reviewed by: AM Date: Jan 6, 2021 Revision: 1	**Project Name** Niagara Region Wind Farm Project - 2nd Acoustic Immission Audit	
		Figure Title Site Photos - M0085	**Figure A.03**

Appendix B
Calibration Certificates

Monitoring Equipment Details

Table B.01: Monitoring Equipment Details

Audit Receptor	Equipment	Make/Model	Serial Number	Date of Last Calibration
O0085	Sound Level Meter	NI 9234	1C009CC	August 21, 2020
	Microphone	PCB 377B02	166229	August 4, 2020
	Pre-amplifier	PCB 426E01	044002	August 4, 2020
	Signal Conditioner	PCB 480E09	34423	May 6, 2020
	Weather Station	Vaisala WXT520	R3250319	August 9, 2019

Compliant Calibration Certificate

NI CALIBRATED
SN/ID: 1C009CC
DATE: 21-AUG-2020
DUE: 21-AUG-2021
ni.com/calibration

Certificate Number:	6490398.1	**OE Number:**	21970516
Date Printed:	24-AUG-2020	**Page:**	1 of 14
Customer:	Aercoustics Engineering Ltd (CA) 5335 Lucas Court ONTARIO Mississauga, L4Z 4A9 CANADA		
Manufacturer:	National Instruments	**Model:**	NI 9234
Serial Number:	1C009CC		
Part Number:	195551C-01L	**Description:**	MODULE ASSY,NI 9234, 4 AI CONFIGURABLE
Calibration Date:	21-AUG-2020	**Issued Date:**	24-AUG-2020
Procedure Name:	NI 9234	**Recommended Calibration Due:**	21-AUG-2021
Procedure Version:	3.6.1.0	**Verification Results:**	As Found: Passed As Left: Passed
Lab Technician:	Rogelio Gaytan	**Calibration Executive Version:**	5.2.0.0
		Driver Info:	NI-DAQmx:19.0.0
Temperature:	23.0° C	**Humidity:**	44.2% RH

The data found in this certificate must be interpreted as:

As Found The calibration data of the unit as received by National Instruments, if the unit is functional.

As Left The calibration data of the unit when returned from National Instruments.

The As Found and As Left readings are identical for units not adjusted or repaired.

This calibration conforms to ANSI/NCSL Z540.1 requirement.

The TUR (Test Uncertainty Ratio) of this calibration is maintained at a ratio of 4:1 or greater, unless otherwise indicated in the measurements. A TUR determination is not possible for singled sided specification limits and therefore the absence of a value should not be interpreted as a TUR of 4:1 or greater, but rather undetermined. When provided, the expanded measurement uncertainty is calculated according to the Guide to the Expression of Uncertainty in Measurement (GUM) for a confidence level of approximately 95%.

Measured values greater than the Manufacturer's specification limits are marked as 'Failed', measured values within the Manufacturer's specifications are marked as 'Passed'. NI Service Labs do not consider uncertainties when making statements of compliance to a specification.

This certificate applies exclusively to the item identified above and shall not be reproduced except in full, without National Instruments written authorization. Calibration certificates without signatures are not valid.

The Calibration Certificate can be viewed or downloaded online at www.ni.com/calibration/. To request a hard copy, contact NI Customer Service at Tel:(800) 531-5066 or Email orders@ni.com.

Ted Talley
Technical Manager

NI Calibration Services Austin
Building A
11500 N MoPac Expwy
AUSTIN, TX 78759-3504
USA
Tel: (800) 531-5066

Calibration Notes

Type	Note
Asset	Verification and adjustment were performed.

Standards Used

Manufacturer	Model	Type	Tracking Number	Calibration Due	Notes
FLUKE	5700A	Calibrator	2554	19-SEP-2020	
National Instruments	PXI-4461	Function generator	9383	05-MAY-2021	
National Instruments	PXI-4071	Digital multimeter	9433	28-AUG-2020	
National Instruments	PXI-4132	SMU	9166	19-MAY-2021	

The standards used in this calibration are traceable to NIST and/or other National Measurement Institutes (NMI's) that are signatories of the International Committee of Weights and Measures (CIPM) mutual recognition agreement (MRA).

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Calibration Results

As Found

Verify Accuracy

Lower Range	Upper Range	Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
-5 V	5 V	0	4.00000 V	3.99520 V	4.00000 V	4.00480 V	Passed	
-5 V	5 V	0	0.00000 V	-0.00120 V	-0.00001 V	0.00120 V	Passed	
-5 V	5 V	0	-4.00000 V	-4.00480 V	-4.00001 V	-3.99520 V	Passed	
-5 V	5 V	1	4.00000 V	3.99520 V	3.99984 V	4.00480 V	Passed	
-5 V	5 V	1	0.00000 V	-0.00120 V	-0.00019 V	0.00120 V	Passed	
-5 V	5 V	1	-4.00000 V	-4.00480 V	-4.00019 V	-3.99520 V	Passed	
-5 V	5 V	2	4.00000 V	3.99520 V	3.99999 V	4.00480 V	Passed	
-5 V	5 V	2	0.00000 V	-0.00120 V	-0.00001 V	0.00120 V	Passed	
-5 V	5 V	2	-4.00000 V	-4.00480 V	-3.99999 V	-3.99520 V	Passed	
-5 V	5 V	3	4.00000 V	3.99520 V	3.99998 V	4.00480 V	Passed	
-5 V	5 V	3	0.00000 V	-0.00120 V	0.00000 V	0.00120 V	Passed	
-5 V	5 V	3	-4.00000 V	-4.00480 V	-3.99996 V	-3.99520 V	Passed	

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As Found

Verify Gain Matching

Max Gain Difference for Channel	Rate	Samples per Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	10240	10240	4 V	-0.040 dB	0.000 dB	0.040 dB	Passed	
1	10240	10240	4 V	-0.040 dB	0.000 dB	0.040 dB	Passed	
2	10240	10240	4 V	-0.040 dB	-0.000 dB	0.040 dB	Passed	
3	10240	10240	4 V	-0.040 dB	-0.000 dB	0.040 dB	Passed	

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As Found

Verify Phase Matching

Max Phase Difference for Channel	Rate	Samples per Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	16384	1000 Hz	-0.085 Degrees	-0.014 Degrees	0.085 Degrees	Passed	
1	51200	16384	1000 Hz	-0.085 Degrees	-0.011 Degrees	0.085 Degrees	Passed	
2	51200	16384	1000 Hz	-0.085 Degrees	-0.012 Degrees	0.085 Degrees	Passed	
3	51200	16384	1000 Hz	-0.085 Degrees	0.014 Degrees	0.085 Degrees	Passed	
0	51200	16384	10000 Hz	-0.490 Degrees	-0.134 Degrees	0.490 Degrees	Passed	
1	51200	16384	10000 Hz	-0.490 Degrees	-0.105 Degrees	0.490 Degrees	Passed	
2	51200	16384	10000 Hz	-0.490 Degrees	-0.116 Degrees	0.490 Degrees	Passed	
3	51200	16384	10000 Hz	-0.490 Degrees	0.134 Degrees	0.490 Degrees	Passed	

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As Found

Verify Common Mode Rejection Ratio

Channel	Rate	Samples per Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	16384	1000 Hz	40.000 dB	51.393 dB	100.000 dB	Passed	
1	51200	16384	1000 Hz	40.000 dB	52.056 dB	100.000 dB	Passed	
2	51200	16384	1000 Hz	40.000 dB	52.569 dB	100.000 dB	Passed	
3	51200	16384	1000 Hz	40.000 dB	50.481 dB	100.000 dB	Passed	

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As Found

Verify IEPE Current

Channel	Rate	DMM Range	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	0.01 A	2.000 mA	2.000 mA	2.093 mA	2.200 mA	Passed	
1	51200	0.01 A	2.000 mA	2.000 mA	2.080 mA	2.200 mA	Passed	
2	51200	0.01 A	2.000 mA	2.000 mA	2.074 mA	2.200 mA	Passed	
3	51200	0.01 A	2.000 mA	2.000 mA	2.076 mA	2.200 mA	Passed	

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As Found

Verify IEPE Compliance Voltage

Channel	Rate	SMU Voltage Limit	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	24 V	2 mA	19.000 V	20.912 V	24.000 V	Passed	
1	51200	24 V	2 mA	19.000 V	20.918 V	24.000 V	Passed	
2	51200	24 V	2 mA	19.000 V	20.919 V	24.000 V	Passed	
3	51200	24 V	2 mA	19.000 V	20.922 V	24.000 V	Passed	

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As Left

Verify Accuracy

Lower Range	Upper Range	Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
-5 V	5 V	0	4.00000 V	3.99520 V	4.00000 V	4.00480 V	Passed	
-5 V	5 V	0	0.00000 V	-0.00120 V	-0.00000 V	0.00120 V	Passed	
-5 V	5 V	0	-4.00000 V	-4.00480 V	-3.99998 V	-3.99520 V	Passed	
-5 V	5 V	1	4.00000 V	3.99520 V	3.99999 V	4.00480 V	Passed	
-5 V	5 V	1	0.00000 V	-0.00120 V	-0.00001 V	0.00120 V	Passed	
-5 V	5 V	1	-4.00000 V	-4.00480 V	-3.99999 V	-3.99520 V	Passed	
-5 V	5 V	2	4.00000 V	3.99520 V	4.00000 V	4.00480 V	Passed	
-5 V	5 V	2	0.00000 V	-0.00120 V	-0.00000 V	0.00120 V	Passed	
-5 V	5 V	2	-4.00000 V	-4.00480 V	-3.99999 V	-3.99520 V	Passed	
-5 V	5 V	3	4.00000 V	3.99520 V	3.99999 V	4.00480 V	Passed	
-5 V	5 V	3	0.00000 V	-0.00120 V	-0.00001 V	0.00120 V	Passed	
-5 V	5 V	3	-4.00000 V	-4.00480 V	-3.99999 V	-3.99520 V	Passed	

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Verify Gain Matching

Max Gain Difference for Channel	Rate	Samples per Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	10240	10240	4 V	-0.040 dB	-0.000 dB	0.040 dB	Passed	
1	10240	10240	4 V	-0.040 dB	0.000 dB	0.040 dB	Passed	
2	10240	10240	4 V	-0.040 dB	0.000 dB	0.040 dB	Passed	
3	10240	10240	4 V	-0.040 dB	-0.000 dB	0.040 dB	Passed	

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Verify Phase Matching

Max Phase Difference for Channel	Rate	Samples per Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	16384	1000 Hz	-0.085 Degrees	-0.014 Degrees	0.085 Degrees	Passed	
1	51200	16384	1000 Hz	-0.085 Degrees	-0.011 Degrees	0.085 Degrees	Passed	
2	51200	16384	1000 Hz	-0.085 Degrees	-0.013 Degrees	0.085 Degrees	Passed	
3	51200	16384	1000 Hz	-0.085 Degrees	0.014 Degrees	0.085 Degrees	Passed	
0	51200	16384	10000 Hz	-0.490 Degrees	-0.134 Degrees	0.490 Degrees	Passed	
1	51200	16384	10000 Hz	-0.490 Degrees	-0.105 Degrees	0.490 Degrees	Passed	
2	51200	16384	10000 Hz	-0.490 Degrees	-0.116 Degrees	0.490 Degrees	Passed	
3	51200	16384	10000 Hz	-0.490 Degrees	0.134 Degrees	0.490 Degrees	Passed	

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Verify Common Mode Rejection Ratio

Channel	Rate	Samples per Channel	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	16384	1000 Hz	40.000 dB	51.120 dB	100.000 dB	Passed	
1	51200	16384	1000 Hz	40.000 dB	53.358 dB	100.000 dB	Passed	
2	51200	16384	1000 Hz	40.000 dB	50.623 dB	100.000 dB	Passed	
3	51200	16384	1000 Hz	40.000 dB	49.617 dB	100.000 dB	Passed	

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As Left

Verify IEPE Current

Channel	Rate	DMM Range	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	0.01 A	2.000 mA	2.000 mA	2.081 mA	2.200 mA	Passed	
1	51200	0.01 A	2.000 mA	2.000 mA	2.080 mA	2.200 mA	Passed	
2	51200	0.01 A	2.000 mA	2.000 mA	2.074 mA	2.200 mA	Passed	
3	51200	0.01 A	2.000 mA	2.000 mA	2.076 mA	2.200 mA	Passed	

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As Left

Verify IEPE Compliance Voltage

Channel	Rate	SMU Voltage Limit	Test Value	Low Limit	Reading	High Limit	Status	Notes
0	51200	24 V	2 mA	19.000 V	20.914 V	24.000 V	Passed	
1	51200	24 V	2 mA	19.000 V	20.917 V	24.000 V	Passed	
2	51200	24 V	2 mA	19.000 V	20.919 V	24.000 V	Passed	
3	51200	24 V	2 mA	19.000 V	20.922 V	24.000 V	Passed	

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CERTIFICATE of CALIBRATION

Make :	PCB Piezotronics	Reference # :	162360
Model :	378B02	Customer :	Aercoustics Engineering Ltd Mississauga, ON
Descr. :	Microphone System 1/2" Free Field		
Serial # :	125631	P. Order :	2020.07.29C
Asset # :	00921		

Cal. status : Received in spec's, no adjustment made.
Preamp System with Mic 377B02 s/n 166229

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our Quality System system complies with the requirements of ISO-9001-2015 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

Calibrated : Aug 04, 2020 By : Petro Onasko

Cal. Due : Aug 04, 2022

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-324 J-333 J-420 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 800-668-7440 Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

NAVAIR TECHNOLOGIES

6375 Dixie Rd Unit # 7
Mississauga ON L5T 2E7
Tel: (905) 565-1583
Fax: (905) 565-8325

Form: 378B02	Approved by: J.R.	Feb-16	Ver 1.0

Calibration Report for Certificate : 162360

Make			Model	Serial	Asset		
PCB Piezotronics			378B02	**125631**	00921		
PCB Piezotronics			426E01	**044002**	00921		
PCB Piezotronics			377B02	**166229**	00921		

Sensitivity at 250 Hz

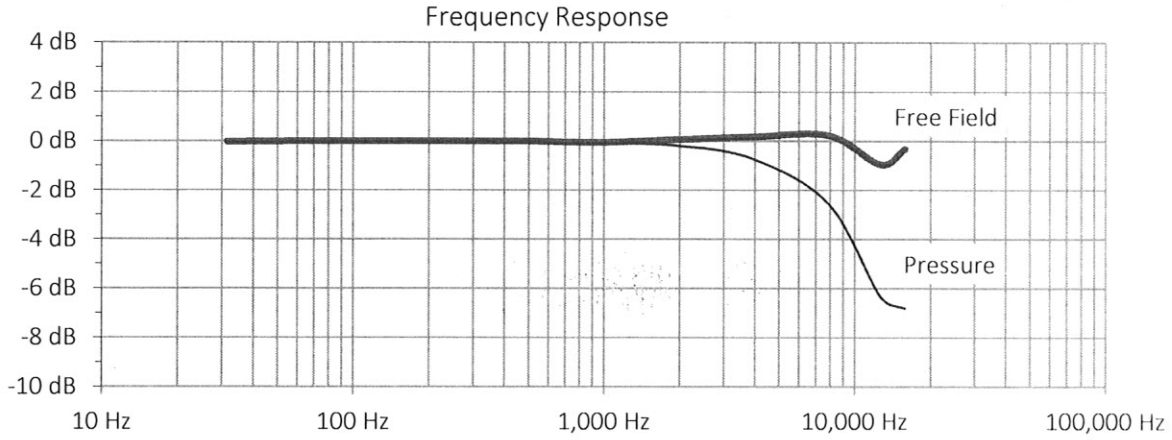
Specs Nom	Unit		Min	Reading	Max		In/Out
50.0 mV/Pa			39.72	**53.74**	62.94		In
−26.02 dB	re 1 V/Pa		-28.02	**-25.39**	-24.02		In
0 dB	re 50 mV/Pa		-2	**0.63**	2		In

Ambient Conditions:

Static Pressure	99.1 kPa
Temperature	24.7°C
Rel.Humidity	54%

Frequency response

	Lower	Upper	
Freq	Pressure	Free Field	
Hz	dB	dB	
31.5	−0.03	−0.03	
63.1	−0.01	−0.01	
125.9	0.00	0.00	
251.3	**0.00**	**0.00**	ref
502.5	−0.01	−0.01	
1005.1	−0.07	−0.05	
1978.7	−0.19	+0.06	
3957.5	−0.73	+0.18	
7914.9	−2.58	+0.22	
12663	−6.34	−0.95	
15830	−6.82	−0.33	



CERTIFICATE of CALIBRATION

Make :	PCB Piezotronics	Reference # :	161534
Model :	480E09	Customer :	Aercoustics Engineering Ltd Mississauga, ON
Descr. :	Conditioning Amplifier		
Serial # :	00034423	P. Order :	2020.05.04C
Asset # :	00980		

Cal. status : Received in spec's, no adjustment made.

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our Quality System system complies with the requirements of ISO-9001-2015 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

Calibrated : May 06, 2020 By : Petro Onasko

Cal. Due : May 06, 2022

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-255 J-367 J-512

Navair Technologies

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Phone : 800-668-7440 Fax: 905 565 8325
http: // www.navair.com
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6375 Dixie Rd Unit # 7
Mississauga ON L5T 2E7
Tel: (905) 565-1583
Fax: (905) 565-8325

Form: 480E09	Approved by: J. Raposo	Jun-19	Ver 2.0

Calibration Report for Certificate : 161534

Make	Model	Serial №	Asset	Cal by
PCB Piezotronics	480E09	00034423	00980	P.O.

Test	Setting	Input	Min	Reading	Max	In/Out

Excitation Voltage

• 1			25 Vdc	26.9 Vdc	29 Vdc		In

Constant Current Excitation

• 1			2.0 mA	3.01 mA	3.2 mA		In

Voltage Gain Accuracy at 1 kHz

• 1	1.000 V		0.98	1.000	1.02		In
• 10	0.100 V		9.80	10.00	10.20		In
• 100	0.010 V		98.0	99.9	102.0		In

VAISALA

#1427

Test report no. H31-19320119

TEST REPORT

Product family	WXT530 series
Product type	WXT536
Order code	6B1B2A4B1A1B
Serial number	R3250319
Manufacturer	Vaisala Oyj, Finland
Test date	9 August 2019

This test report certifies that the product was thoroughly tested and inspected, and found to meet its published test limits when it was shipped from Vaisala.

Test results

Test	Result	Lower limit	Upper limit	Unit
Rain response	381	345	575	mV
Zero wind speed	0	0	0.4	m/s
Pressure difference	-0.2	-1	1	hPa
Temperature difference	0.59	-2	2	°C
Humidity difference	-1.11	-10	10	%RH
Heating current	0.75	0.6	0.8	A
Current (service port)	1.22	0.5	2	mA
Communication (service port)	pass	PASS	PASS	-
Current (main port)	0.87	0.5	2	mA
Communication (main port)	pass	PASS	PASS	-

Ambient conditions / Humidity 47.33 ±5 %RH, Temperature 24.31 ±1 °C, Pressure 1001.7 ±1 hPa.

Signature

Technician

 DOC233154-A.doc

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Phone +358 9 894 91 | Fax +358 9 8949 2227
Email firstname.lastname@vaisala.com | www.vaisala.com
Domicile Vantaa, Finland | VAT FI01244162 | Business ID 0124416-2

VAISALA

Calibration sheet no. H31-19320120

CALIBRATION SHEET

Instrument	WXTPTU
Serial number	R2530005
Manufacturer	Vaisala Oyj, Finland
Test date	11 July 2019

This test report certifies that the instrument was thoroughly tested and inspected, and found to meet its published test limits when it was shipped from Vaisala.

Calibration results

Test phase of calibration process	Reference value	Observed value	Difference*	Uncertainty**
Pressure	1076.5	1076.4	-0.1	± 0.4 hPa
Pressure	898	898	0	± 0.4 hPa
Pressure	796.6	796.6	0	± 0.4 hPa
Pressure	599.3	599.3	0	± 0.4 hPa
Temperature	59.7	59.7	0	± 0.2 °C
Temperature	-5.9	-5.9	0	± 0.2 °C
Temperature	-32.5	-32.5	0	± 0.2 °C
Temperature	25	25	0	± 0.2 °C
Temperature	-52.3	-52.3	0	± 0.2 °C
Relative humidity	29.2	29.2	0	± 2 %RH
Relative humidity	58.7	58.7	0	± 2 %RH
Relative humidity	92.3	92.3	0	± 3 %RH

*The test points for error values are polynomial fitting curve fitting points.
**The calibration uncertainty given at 95 % confidence level, k = 2

Traceability
The working standards for pressure and temperature are calibrated at Vaisala Measurement Standards Laboratory (MSL) by using MSL working standards traceable to National Institute of Standards and Technology (NIST, USA). The relative humidity values are calculated from measured temperature and dew-point temperature values. The dew-point working standards are traceable to the Finnish National Humidity Laboratory (MIKES).

Signature

Technician

Doc218938-A

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Phone +358 9 894 91 | Fax +358 9 8949 2227
Email firstname.lastname@vaisala.com | www.vaisala.com
Domicile Vantaa, Finland | VAT FI01244162 | Business ID 0124416-2

Appendix C
Statement from the Operator

Niagara Region Wind Farm
2659 Industrial park road
Smithville, Ontario L0R 2A0
Canada

T. 1.844.363.6491
boralex.com

BORALEX

January 19, 2021

Mr. Denton Miller, Senior Review Engineer
Environmental Assessment and Permissions Branch
Ministry of Environment, Conservation and Parks
Floor 1, 135 St. Clair Ave W
Toronto (Ontario) M4V 1P5

Dear Sir,

Re: Operator Letter for Immission Audit at the Niagara Region Wind Farm – Receptor O_0085

Please accept this letter as confirmation that all turbines surrounding receptor O_0085 at the Niagara Region Wind Farm were operating as per specifications during the acoustic Immission Audit, Phase 3 conducted by Aercoustics Engineering Ltd, except during ambient noise measurements.

During ambient noise measurements, all turbines in the vicinity of receptor O_0085 were parked (the turbine rotors were not rotating).

There were no modifications to the blades of the wind turbines surrounding receptor O_0085 during the Audit.

The Immission Audit was specifically conducted from October 30 to December 15, 2021.

Your sincerely,

Jason Weir

Jason Weir,
Wind Site Manager,
Niagara Region Wind Farm

Appendix D
Supplemental Information

Appendix F7: I-Audit checklist

Wind Energy Project – Screening Document – Acoustic Audit Report – Immission

Information Required in the Acoustic Audit Report – Immission

Item	Description	Complete?	Comment
1	Did the Sound level Meter meet the Type 1 Sound level meter requirements according to the IEC standard 61672-1 Sound level Meters, Part 1: Specifications? Section D2.1.1	✓	
2	Was the complete sound measurement system, including any recording, data logging or computing systems calibrated immediately before and after the measurement session at one or more frequencies using an acoustic calibrator on the microphone (must not exceed ±0.5dB)? Section D2.1.3	✓	
3	Are valid calibration certificate(s) of the noise monitoring equipment and calibration traceable to a qualified laboratory? Is the validity duration of the calibration stated for each item of equipment? Section D2.3	✓	
4	Was the predictable worst case parameters such as high wind shear and wind direction toward the Receptor considered? Section D3.2	✓	
5	Is there a Wind Rose showing the wind directions at the site? Section D7 (1e)	✓	
6	Did the results cover a wind speed range of at least 4-7 m/s as outlined in section D 3.8.?	✓	RAM-I Audit sample size utilized
7	Was the weather report during the measurement campaign included in the report? Section D7 (1c)	✓	
8	Did the audit state there was compliance with the limits at each wind speed category? Section D6	✓	RAM-I Audit sample size utilized
9	Are pictures of the noise measurement setup near Point of reception provided? Section D3.3.2 & D3.4	✓	
10	Was there justification of the Receptor location choice(s) prior to commencement of the I-Audit? Section D4.1	✓	
11	Was there sufficient valid data for different wind speeds? Section D5.2 # 3	✓	RAM-I Audit sample size utilized
12	Was the turbine (operational) specific information during the measurement campaign in tabular form (i.e. wind speed at hub height, anemometer wind speed at 10 m height, air temperature and pressure and relative humidity) Section D3.7	✓	
13	Were all the calculated standard deviations at all relevant integer wind speeds provided? Section D7 (2d)	✓	
14	Compliance statement	✓	
15	All data included in an Excel spreadsheet	✓	
16	If deviations from standard; was justification of the deviations provided	✓	As noted in section 3.3.2, the 85% minimum power threshold for Total Noise data points has been reduced to 45%. This was implemented as Turbine T08 has been curtailed in accordance with the Noise Abatement Action Plan to produce a maximum electrical power output of 1500kW in the curtailed mode.

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Manufacturer's declaration on sound emissions of wind energy converters

Reference number.: SM-06795-008-A

Hereby we declare that the following wind energy converter:

Type:	ENERCON E-101 with a hub height of 124 m
Serial number:	1011169
Source ID in Approval:	T08
Wind farm operator:	FWRN LP 36, rue Lajeunesse J0A 1B0 Kingsey Falls, Québec Canada
Location:	L0S 1E0 Pelham, Ontario, Canada
Approval authority:	Ministry of the Environment Ontario, Canada
Number of Approval:	4353-9HMP2R
Date of Approval:	November 06, 2014 - and Amendment from April 8, 2016

has a maximum power production capacity of 3.0 MW and operates continuously in *Operating Mode I* with a maximum rotational speed of 14.3 rpm when the below listed restrictions do not apply.

According to the customer's request from June 14, 2019, a noise curtailment has been set up with the following mitigation plan:

	From	To	From	To	From	To	From	To	From	To
Hub height wind speed [m/s]	7.5	10.9	11	13.9	14	16.9	17	19.9	20	22.9
Operating Mode	*Mode 1500kW*		*Mode II (3.0 MW)*		*Mode 1500kW*		*Mode 1000kW*		*Mode 1500kW*	

This curtailment applies during the night time from 10pm - 5am and to the wind direction range of 150° - 240° only, referencing North with 0°.

The described restrictions have been active since June 17, 2019.

Author

Aurich, June 28, 2019
Place / Date

This document was created by the author on behalf of ENERCON GmbH. The handwritten signature confirms the accuracy of the above-mentioned data. If you have any questions, please get in touch stating the above reference number.

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Checked/Date:	D. Eschen / June 28, 2019	Note:	Original document
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End of Report