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PHASE 2 ACOUSTIC AUDIT – IMMISSION REPORT

Amherst Island Wind Project

Amherst Island, Ontario

Version 5

Project Number: 01800287

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May 14, 2020

VERSION CONTROL

Amherst Island Wind Project
Second Acoustic Audit – Immission Report

Version	Date	Version Description
1	December 13, 2019	Original Report
2	February 18, 2020	Updated report title and corrected typographical errors in Table 9a and Table A1.
3	March 20, 2020	Updated report title. Updated report to include detailed tonality assessment for all receptor locations and an updated analysis for measurement location M670.
4	March 24, 2020	Added a Report Checklist.
5	May 14, 2020	Updated tonality analysis.

EXECUTIVE SUMMARY

Howe Gastmeier Chapnik Limited ("HGC Engineering") was retained by Windlectric Inc. to complete an Immission Audit of the Amherst Island Wind Project ("Wind Project") in Loyalist Township, Ontario. The project includes 26 Siemens wind turbine generators, each rated at either 2772 kW or 2942 kW. The Immission Audit is required as a condition of Renewable Energy Approval number 7123-9W9NH2 issued to Windlectric Inc. by the Ontario Ministry of the Environment, Conservation and Parks ("MECP"). HGC Engineering has assessed the acoustic impact against the acoustic criteria of the MECP and in accordance with the requirements of the MECP's *Compliance Protocol for Wind Turbine Noise*. This report presents the results from the second of two measurement campaigns, completed between March 20 and November 25, 2019. The sound level measurements and analysis, as performed in accordance with the MECP's *Compliance Protocol for Wind Turbine Noise*, indicate that the Wind Project meets the applicable sound level criteria at the five selected monitoring locations. Details of the measurements and analysis are provided herein.

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1 INTRODUCTION

Howe Gastmeier Chapnik Limited ("HGC Engineering") was retained by Windlectric Inc. to complete an Acoustic Audit – Immission of the Amherst Island Wind Project ("Wind Project"). The Wind Project is located in Loyalist Township, Ontario and consists of 26 Siemens SWT-xx-113 Wind Turbine Generators ("WTG"), each rated at either 2772 kW or 2942 kW. All wind turbine generators have a hub height of 99.5 m.

The Audit is required as part of the Renewable Energy Approval ("REA") number 7123-9W9NH2 [1] issued to Windlectric Inc. by the Ontario Ministry of the Environment, Conservation and Parks ("MECP"). Specifically, this report summarizes the second of two measurement campaigns that were conducted in order to satisfy the requirements of Condition E of the REA. The audit was completed in accordance with the MECP's *Compliance Protocol for Wind Turbine Noise* ("Compliance Protocol") [2].

2 MONITORING LOCATIONS

The Noise Assessment Report ("NAR") [3] prepared by Hatch provided sound level predictions for receptors within 1500 m of the project WTGs. The receptor locations selected for the Immission Audit (R008, R316, R493, R537, R670) satisfy the two requirements of the REA:

- The receptors should represent the location of the greatest predicted noise impact.
- The receptors should be in the direction of prevailing winds from the facility.

A summary of the monitoring location selection process and the historical wind rose for the area can be found in Appendix A. Data from a 6-year period, between 2012 and 2018, were analyzed from a 100 m meteorological tower operated by the Wind Project and are presented as wind roses in Appendix A. The local wind roses were compared to the previously referenced historical wind rose from a publicly available data source. The meteorological tower data generally trends well with the historical wind rose.

Predicted sound levels for the receptors surrounding the Wind Project were taken from the NAR and were used in the receptor selection process. The receptor locations were selected based on

their predicted sound level and downwind location with respect to the historical wind direction. The monitoring locations were selected based on consultation with the landowners. Aerial images of the selected monitoring locations are provided in Figures 1 through 1d and photos of the installations are provided in Appendix B.

HGC Engineering developed an acoustic predictive model of the site to determine the sound levels at the five selected monitoring locations without the contribution of alternate turbine S12, which was not constructed. The predicted sound levels at the receptor and monitoring locations, along with their respective UTM coordinates and distances to their respective nearest wind turbine generator can be found in Table 1.

Table 1: Predicted Sound Levels and UTM Coordinates of Selected Locations

Location		UTM Coordinates		Nearest Wind Turbine		Predicted Sound Level [dBA]
		Easting	Northing	ID	Distance	
R008 / M008	Receptor	363457	4888709	S20	780	39.1 ±
	Monitoring Location	363474	4888697		801	38.9*
R316 / M316	Receptor	358861	4890030	S01	571	38.6 ±
	Monitoring Location	358813	4889962		546	38.7*
R493 / M493	Receptor	363947	4889535	S34	722	38.9 ±
	Monitoring Location	363913	4889495		715	39.0*
R537 / M537	Receptor	366953	4893452	S30	519	38.9 ±
	Monitoring Location	366918	4893452		525	38.7*
R670 / M670	Receptor	361834	4891347	S31	600	38.9 ±
	Monitoring Location	361788	4891384		659	38.1*

± Sound level taken from NAR [3]
* Sound level predicted by acoustic model created by HGC Engineering

Receptor R008 is a vacant lot receptor located near the middle of the Wind Project, with the closest wind turbine, S20, located 780 m to the northwest. Receptor R008 is represented by monitoring location M008, 801 m to the southeast of WTG S20. Receptor R316 is a single-storey home with the closest wind turbine, S01, located 571 m to the south. Receptor R316 is represented by monitoring location M316, which is 546 m from WTG S01, in the southwest corner of the property. Receptor R493 is a two-storey home located 722 m southeast of WTG

S34. Monitoring location M493 was selected to represent receptor R493, and is located to the west of the residence, approximately 715 m from WTG S34. Receptor R537 is a participating vacant lot receptor selected to represent non-participating receptors R401 and R470. R537 is represented by monitoring location M537. WTG S30 is located approximately 519 m south of receptor R537 and 525 m south of monitoring location M537. Receptor R670 is a vacant lot receptor located 600 m northwest of turbine S31. Receptor R670 is represented by monitoring location M670, which is located 659 m northwest of WTG S31.

The Wind Project area is generally rural in nature with infrequently travelled gravel and paved roads.

3 INSTRUMENTATION

The instrumentation used for this acoustic audit satisfies the instrumentation requirements of the Compliance Protocol.

Audio frequency sound levels were measured using Svantek 977 and Norsonic N140 sound level meters, each connected to ½" microphones. The microphones were set at a height of approximately 4.5 m and equipped with 175 mm diameter windscreens to minimize wind-induced microphone self-noise.

The energy-equivalent average sound level, denoted L_{EQ}, was recorded by the instrumentation. The audio-frequency measurements are presented as A-weighted sound levels as they are intended to represent the loudness of sounds as perceived by the human ear. The overall audio-frequency sound level monitoring results are summarized in this report.

In addition to the acoustic instrumentation, meteorological instruments were used. A weather station was deployed at monitoring location M537 to collect ground weather conditions including temperature, humidity, and precipitation. NRG anemometers and wind vanes were used at each receptor location to collect 10 m height wind speed and direction.

The various instruments deployed by HGC Engineering are summarized in Table 2, and their respective locations are shown in Figures 1 through 1d.

Table 2: Measurement Instrumentation

Location	Instrumentation Make and Model	Serial Number
M008 (R008)	Svantek 977 sound level meter	36426
	Norsonic N140 sound level meter	1403362
	NRG #40C anemometer connected to a Campbell Scientific datalogger	179500262946
M316 (R316)	Svantek 977 sound level meter	36816
	Norsonic N140 sound level meter	1404511
	NRG #40C anemometer connected to a Campbell Scientific datalogger	179500245122
M493 (R493)	Svantek 977 sound level meter	45419
	NRG #40C anemometer connected to a Campbell Scientific datalogger	179500266979
M537 (R537)	Svantek 977 sound level meter	36827
	NRG #40C anemometer connected to a Campbell Scientific datalogger	179500265230
M670 (R670)	Svantek 977 sound level meter	36439
	NRG #40C anemometer connected to a Campbell Scientific datalogger	179500262926

The sound level meters were configured to measure and record spectral (frequency-dependent) one-minute L_{EQ} sound levels. For identification of dominant sources, the sound level meters also recorded audio files.

Correct calibration of the acoustic instrumentation was verified using an acoustic calibrator manufactured by Brüel & Kjær. Calibration verification was carried out periodically throughout the measurement period.

Windscreens were used on the microphones, consistent with the requirements of MECP technical publication *NPC-103*, *Procedures* [4]. A large wind screen, 175 mm in diameter, was used on each sound level meter to minimize wind-induced microphone self-noise at higher wind speeds. Sound level data included herein has not been adjusted for the sound insertion loss of the large wind screen.

In accordance with Section D2.3 of the Compliance Protocol, all the equipment was within its annual or bi-annual calibration, confirmed by the calibration certificates found in Appendix C.

4 ASSESSMENT CRITERIA

The MECP publication *Noise Guidelines for Wind Farms – Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities* [5] indicates the exclusionary minimum sound level limit for wind energy projects in a Class 3 environment. Additionally, the Compliance Protocol includes the same exclusionary minimum sound level limits which are shown in Table 3.

Table 3: Wind Turbine Noise Criteria [dBA]

10 m Height Wind Speed [m/s]	4	5	6	7	8	9	10
Wind Turbine Sound Level Exclusionary Minimum Sound Level Limits - Class 3 Area [dBA]	40.0	40.0	40.0	43.0	45.0	49.0	51.0

If the ambient sound levels (OFF condition) are greater than the exclusionary minimum sound level limits identified in Table 3, then the applicable limits are the ambient sound (OFF condition) level in each of the integer wind speed bins. Both the exclusionary minimum and the applicable sounds level limits for each receptor location are shown in Tables 5b, 6b, 7b, 8b, and 9b.

It should be noted that the sound level limits of the MECP apply only to the sound level contribution of the sound source under assessment, in this case the sound from the wind turbine generators. Thus, where a sound level measured at a receptor location includes significant sound due to the relevant sound source and unrelated background sound sources (i.e., road vehicles, trains, air traffic, farming machinery, wind, etc.), some form of evaluation must be made to determine the sound level contribution of the source under assessment in the absence of the background sounds. Methodology prescribed by the MECP to complete an assessment of a wind energy project is discussed in the following section.

5 METHODOLOGY

The REA requires the acoustic audit be completed in accordance with Part D of the Compliance Protocol. Part D includes requirements for instrumentation, measurement, and data reduction procedures to assist with determining compliance.

A series of one-minute energy-equivalent sound level measurements are collected with ("ON") and without ("OFF") the wind turbines operating. The ON condition is defined as any period where all wind turbine generators within 3 km of the measurement location are operational. The OFF condition is defined as any period where sufficient nearby wind turbines generators are parked (i.e. 0 rpm) to reduce the total sound level contribution of the facility at the measurement location to less than 30 dBA.

Simultaneously, wind speed and direction at 10 m height are measured and collected in one-minute intervals. The measured sound level data is separated into integer wind speed "bins" where the sound levels corresponding to each integer wind speed are logarithmically averaged to determine the L_{EQ} sound level when the wind turbines are operational and when they are parked. The ambient L_{EQ} (turbines parked) is logarithmically subtracted from the overall L_{EQ} (turbines operational) to determine the sound level contribution of the wind turbines alone. Supplementary data including wind speed at turbine hub height, wind speed at noise measurement height, turbine electrical power output, turbine yaw position, temperature, humidity, and statistical noise indices (Ln) can also be measured during the monitoring campaign to aid in the analysis.

Part D of the Compliance Protocol requires at least 120 one-minute intervals be measured for each 10 m height wind speed between 4 and 7 m/s when the turbines are operating and at least 60 one-minute intervals be measured for each 10 m height wind speed between 4 and 7 m/s when the turbines are parked. Prior to determining the number of data points measured in each wind speed bin, the data is filtered to only include night-time hours (between 22:00 and 05:00) and data outside of rainfall (no rain within one hour of the measurement interval). In accordance with the environmental specifications of the instrumentation, data measured during periods with temperatures below -10°C or relative humidity greater than 90% were omitted from the analysis. Data is also filtered to only include periods where the closest turbine is operating at greater or

equal to 85% of its rated electrical power output and at least 90% of its maximum sound power, and the turbine yaw position is ± 45° from the line of sight between the closest turbine and the measurement location (measurement location is downwind).

In the case of monitoring locations M008, M316, M537, and M670, a modified electrical power filter was used to increase the number of valid data points. It was determined through analysis that the turbine operational (ON) sound levels at monitoring locations M008, M316, M537, and M670 remained relatively unchanged (within one standard deviation) between the modified power filter rating (between 65% and 80%) and 85% of the rated electrical output of the respective closest wind turbine. The analysis supporting the use of the modified power filter is shown in Appendix D. Furthermore, a recent Acoustic Test Report for WTG S30, completed by HGC Engineering, dated October 29, 2019 [6], supports the use of a modified power filter. The Acoustic Test Report indicates the maximum sound power of the wind turbine is reached at 65% of the rated electrical power output.

The specific yaw position and power filters used at each location are summarized in Table 4.

Table 4: Downwind Direction and Power Filters

Location	Nearest Wind Turbine(s)			Filters Used in Analysis	
	ID	Downwind Direction	Rated Electrical Power [kW]	Acceptable Yaw Position	Electrical Power [kW]
R008 / M008	S20 and S05	310° and 285°	2942	240° to 355°[Δ]	2354 (80%)[^]
R316 / M316	S01	140°	2772	95° to 185°	1940 (70%)[^]
R493 / M493	S34	300°	2772	255° to 345°	2356 (85%)
R537 / M537	S30	170°	2772	125° to 215°	1801 (65%)[^]
R670 / M670	S31	123°	2772	78° to 168°	1801 (65%)[^]

[Δ] The acceptable downwind direction considers the location of both S20 and S05, as per Section E5.5.2(10) and Appendix F11 of the Compliance Protocol.
[^] See Appendix D for analysis supporting the use of the modified power filters.

If the measurement campaign does not yield enough data to satisfy the minimum requirements of Part D of the Compliance Protocol, a Revised Assessment Methodology Immission Audit can be

completed. As described in Part E5.5 of the Compliance Protocol, three wind speed bins between 1 and 7 m/s or two wind speed bins between 1 and 4 m/s are required. With appropriate justification, the number of one-minute intervals required in each bin may be reduced to 60 for turbine operational measurements (ON) and 30 for ambient measurements (OFF). Additionally, the MECP has recently indicated that the number of one-minute intervals required in each bin may be reduced to 30 turbine operational measurements (ON). Appropriate justification for a reduced amount of data is determined on a case-by-case basis and may include the length of the monitoring campaign (greater than 6 weeks) and lower standard deviation of the sound levels. If there is insufficient ambient sound level data (OFF), a value of 30 dBA or data from a lower wind speed bin may be used to represent the ambient sound level at higher wind speed bins.

The Compliance Protocol allows for the removal of individual events to improve the signal to noise ratio. An additional filter to remove gusty wind events that cause low frequency buffeting on the microphone was included in the data analysis. This filter included removing data where the sound level in the 20 Hz octave band was greater than 70 dB. A review of the audio recordings allows for the identification of the dominant noise source within a given one-minute interval, and the subsequent removal of data points that contain interference (birds, car passbys, voices, dogs, wind gusts, etc.).

Adjustments to the measured sound levels may be required based on wind turbine tonality, if any. If during the acoustic measurement campaign, the project wind turbines exhibit tonal characteristics (a whine, screech, buzz or hum), then an assessment of the tonal audibility is required according to the publication CAN/CSA-C61400-11:13, *Wind Turbine Generator Systems – Part 11: Acoustical Measurement Techniques* [7] or at the MECP Director's discretion another equivalent standard/procedure (such as ISO 20065). The average tonal audibility correction must be determined for each integer wind speed and the correction added to the final noise contribution of the Wind Project at those wind speeds, in accordance with International Standards Organization *1996-2* [8].

6 TONALITY ASSESSMENT

Based on our site observations up close to the wind turbine generators and review of the audio recordings there were no tones identified/observed at the turbines or the monitoring locations.

As requested by the MECP, a detailed tonality analysis was completed following methods from CAN/CSA-C61400-11:13. The audio recordings collected during the monitoring campaign were utilized to generate one-minute narrow-band spectra, from approximately 20 Hz to 3000 Hz. The tonal audibility results for each one-minute data point were binned into integer wind speeds and logarithmically averaged in accordance with the standard to determine the tonal audibility value for each wind speed bin. Where tonal audibility greater than 4 dB is determined, adjustments are made to the wind project only sound levels based on the procedure described in ISO 1996-2.

The detailed tonality analysis found no tonal audibility greater than 1.4 dB and no penalties are applicable for this measurement campaign. Summary results of the tonality analysis are found in Appendix E. Detailed tonality analysis results are available electronically, upon request.

7 MEASUREMENTS AND RESULTS

Sound level measurements were conducted between March 20 and November 25, 2019 at monitoring locations R008, R316, R537, and R670, and between March 20 and June 4, 2019 at monitoring location R493. The weather during the monitoring period varied, including several days with rain and snow. Temperatures ranged from -15°C to 26°C. Wind speeds at 10 m height ranged from calm up to 18 m/s. The prevailing wind direction during the measurement campaign was from the north and northwest, inconsistent with the historical wind rose, which shows wind predominantly from the west and southwest. Figures 2a through 6d show the wind roses for the monitoring locations during the ON and OFF conditions.

The sound level summary for data collected at Monitoring Location M008 is shown in Tables 5a and 5b. Data were collected between March 20 and November 25, 2019.

Table 5a: Monitoring Location M008 - Summary of Valid Data Points

Wind Project Condition	10 m Height Wind Speed [m/s]		
	3	4	5
Operating (ON)	81	124	84
Ambient (OFF)	134	162	122

Table 5b: Monitoring Location M008 - Sound Level Summary

L_{EQ} Sound Level [dBA]	10 m Height Wind Speed [m/s]					
	3		4		5	
Average Operating (ON) / Std Dev.	40*	1.5	41*	1.6	42*	1.5
Average Ambient (OFF) / Std Dev.	35	2.2	38	2.9	40	2.4
Wind Project Only	**39**		**38**		**36**	
Exclusionary Minimum Criteria	40		40		40	
Applicable Criteria	40		40		40	
Excess	**0**		**0**		**0**	

*Data was filtered using a modified turbine electrical power filter, as described in Table 4 and Appendix D.

The results presented were obtained using a modified electrical power filter as described in Table 4. The detailed analysis supporting the use of the modified electrical power filter is found in Appendix D.

Sound levels during operating (ON) conditions increase as wind speeds increase, which follows a similar increase in the ambient (OFF) sound levels. Ambient OFF sound levels are dominated by foliage noise in neighbouring trees and large woodlots. Based on the data presented above, and in Figures 7a and 7b, the Wind Project is compliant with the applicable criteria and the MECP's exclusionary minimum sound level criteria at monitoring location M008.

The sound level summary for data collected at monitoring location M316 is shown in Tables 6a and 6b. Data were collected between March 20 and November 25, 2019.

Table 6a: Monitoring Location M316 - Summary of Valid Data Points

Wind Project Condition	10 m Height Wind Speed [m/s]		
	5	6	7
Operating (ON)	86	107	64
Ambient (OFF)	139	107	63

Table 6b: Monitoring Location M316 - Sound Level Summary

L_{EQ} Sound Level [dBA]	10 m Height Wind Speed [m/s]					
	5		6		7	
Average Operating (ON) / Std Dev.	42*	1.3	43*	1.9	45*	1.5
Average Ambient (OFF) / Std Dev.	41	1.6	42	1.2	43	0.9
Wind Project Only	**31**		**37**		**39**	
Exclusionary Minimum Criteria	40		40		43	
Applicable Criteria	41±		42±		43	
Excess	**0**		**0**		**0**	

*Data was filtered using a modified turbine electrical power filter, as described in Table 4 and Appendix D.
±Ambient (OFF) sound levels are greater than the exclusion limit. As a result, the applicable limit is the ambient (OFF) sound level.

The results presented above were obtained using a modified electrical power filter as described in Table 4. The detailed analysis supporting the use of the modified electrical power filter is found in Appendix D.

A similar trend of increasing sound levels with increasing wind speeds is seen at monitoring location M316. Ambient (OFF) conditions were dominated by foliage noise and distant lake noise. Based on the data presented above, and in Figures 8a and 8b, the Wind Project is compliant with the applicable criteria and the MECP's exclusionary minimum sound level criteria at monitoring location M316.

The sound level summary for data collected at monitoring location M493 is shown in Tables 7a and 7b. Data were collected between March 20 and June 4, 2019.

Table 7a: Monitoring Location M493 - Summary of Valid Data Points

Wind Project Condition	10 m Height Wind Speed [m/s]		
	5	6	7
Operating (ON)	101	132	91
Ambient (OFF)	91	110	35

Table 7b: Monitoring Location M493 - Sound Level Summary

L_{EQ} Sound Level [dBA]	10 m Height Wind Speed [m/s]					
	5		6		7	
Average Operating (ON) / Std Dev.	42	1.3	44	1.8	47	1.7
Average Ambient (OFF) / Std Dev.	37	2.6	41	1.8	45	1.2
Wind Project Only	**40**		**40**		**43**	
Exclusionary Minimum Criteria	40		40		43	
Criteria	40		41[±]		45[±]	
Excess	**0**		**0**		**0**	

[±]Ambient (OFF) sound levels are greater than the exclusion limit. As a result, the applicable limit is the ambient (OFF) sound level.

The operating (ON) and ambient (OFF) sound levels increase with increasing wind speeds at monitoring location M493. Ambient (OFF) conditions are dominated by foliage noise from several large trees surrounding the monitoring location. Based on the data presented above, and in Figures 9a and 9b, the Wind Project is compliant with the applicable criteria and the MECP's exclusionary minimum sound level criteria at monitoring location M493.

The sound level summary for data collected at monitoring location M537 is shown in Tables 8a and 8b. Data were collected between March 20 and November 25, 2019.

Table 8a: Monitoring Location M537 - Summary of Valid Data Points

Wind Project Condition	10 m Height Wind Speed [m/s]		
	4	5	6
Operating (ON)	68	77	96
Ambient (OFF)	254	79	50

Table 8b: Monitoring Location M537 - Sound Level Summary

L_{EQ} Sound Level [dBA]	10 m Height Wind Speed [m/s]					
	4		5		6	
Average Operating (ON) / Std Dev.	40*	1.3	41*	1.1	42*	1.0
Average Ambient (OFF) / Std Dev.	34	2.7	35	2.6	38	1.6
Wind Project Only	**39**		**40**		**40**	
Exclusionary Minimum Criteria	40		40		40	
Applicable Criteria	40		40		40	
Excess	**0**		**0**		**0**	

*Data was filtered using a modified turbine electrical power filter, as described in Table 4 and Appendix D.

The results presented above were obtained using a modified electrical power filter as described in Table 4. The detailed analysis supporting the use of the modified electrical power filter is found in Appendix D.

Based on the data presented above, and in Figures 10a and 10b, the Wind Project is compliant with the applicable criteria and the MECP's exclusionary minimum sound level criteria at monitoring location M537.

The sound level summary for data collected at monitoring location M670 is shown in Tables 9a and 9b. Data were collected between March 20 and November 25, 2019.

Table 9a: Monitoring Location M670 - Summary of Valid Data Points

Wind Project Condition	10 m Height Wind Speed [m/s]		
	2	4	5
Operating (ON)	32	53	79
Ambient (OFF)	265	194	143

Table 9b: Monitoring Location M670 - Sound Level Summary

L_{EQ} Sound Level [dBA]	10 m Height Wind Speed [m/s]					
	2		4		5	
Average Operating (ON) / Std Dev.	39*	0.8	39*	1.5	41*	1.4
Average Ambient (OFF) / Std Dev.	33	3.1	37	2.0	38	1.7
Wind Project Only	**38**		**34**		**38**	
Exclusionary Minimum Criteria	40		40		40	
Applicable Criteria	40		40		40	
Excess	**0**		**0**		**0**	

*Data was filtered using a modified turbine electrical power filter, as described in Table 4 and Appendix D.

The results presented above were obtained using a modified power filter as described in Table 4. The detailed analysis supporting the use of the modified power filter is found in Appendix D.

Based on the data presented above, and in Figures 11a and 11b, the Wind Project is compliant with the applicable criteria and the MECP's exclusionary minimum sound level criteria at monitoring location M670.

Appendix F includes a statement from the Wind Project indicating the wind turbine generators were operating normally from March 20 to November 25, 2019.

8 CONCLUSIONS

The measurements and analysis, performed in accordance with the methods prescribed by the Ontario Ministry of the Environment, Conservation and Parks' 2017 publication *Compliance Protocol for Wind Turbine Noise* indicate that the Amherst Island Wind Project is operating in compliance with the applicable criteria and the MECP's exclusionary minimum sound level criteria at monitoring locations M008, M316, M493, M537, and M670.

REFERENCES

1. Ontario Ministry of the Environment, Conservation and Parks, Renewable Energy Approval Number 7123-9W9NH2, August 24, 2015.
2. Ontario Ministry of the Environment, Conservation and Parks, *Compliance Protocol for Wind Turbine Noise Guideline for Acoustic Assessment and Measurement*, April 2017.
3. Hatch, *Amherst Island Wind Project Noise Assessment Report*, May 3, 2013.
4. Ontario Ministry of the Environment, Conservation and Parks Publication, NPC-103, *Procedures.*
5. Ontario Ministry of the Environment, Conservation and Parks Publication, *Noise Guidelines for Wind Farms*, May 2016.
6. HGC Engineering, *Acoustic Test Report, WTG 30, Amherst Island Wind Project, Version 01*, October 29, 2019.
7. CAN/CSA-C61400-11:13, *Wind Turbine Generator Systems – Part 11: Acoustical Measurement Techniques*, 2018
8. International Standards Organization 1996-2, *Acoustics – Description, assessment and measurement of environmental noise – Part 2: Determination of environmental noise levels*, 2007.
9. WindAtlas.ca Wind Statistics, Retrieved from http://www.windatlas.ca/rose-en.php?field=E1&height=50&season=ANU&no=17&ni=1001&nj=233 on December 4, 2019.

Figure 1 - Location of Sound Level Monitors - Overview

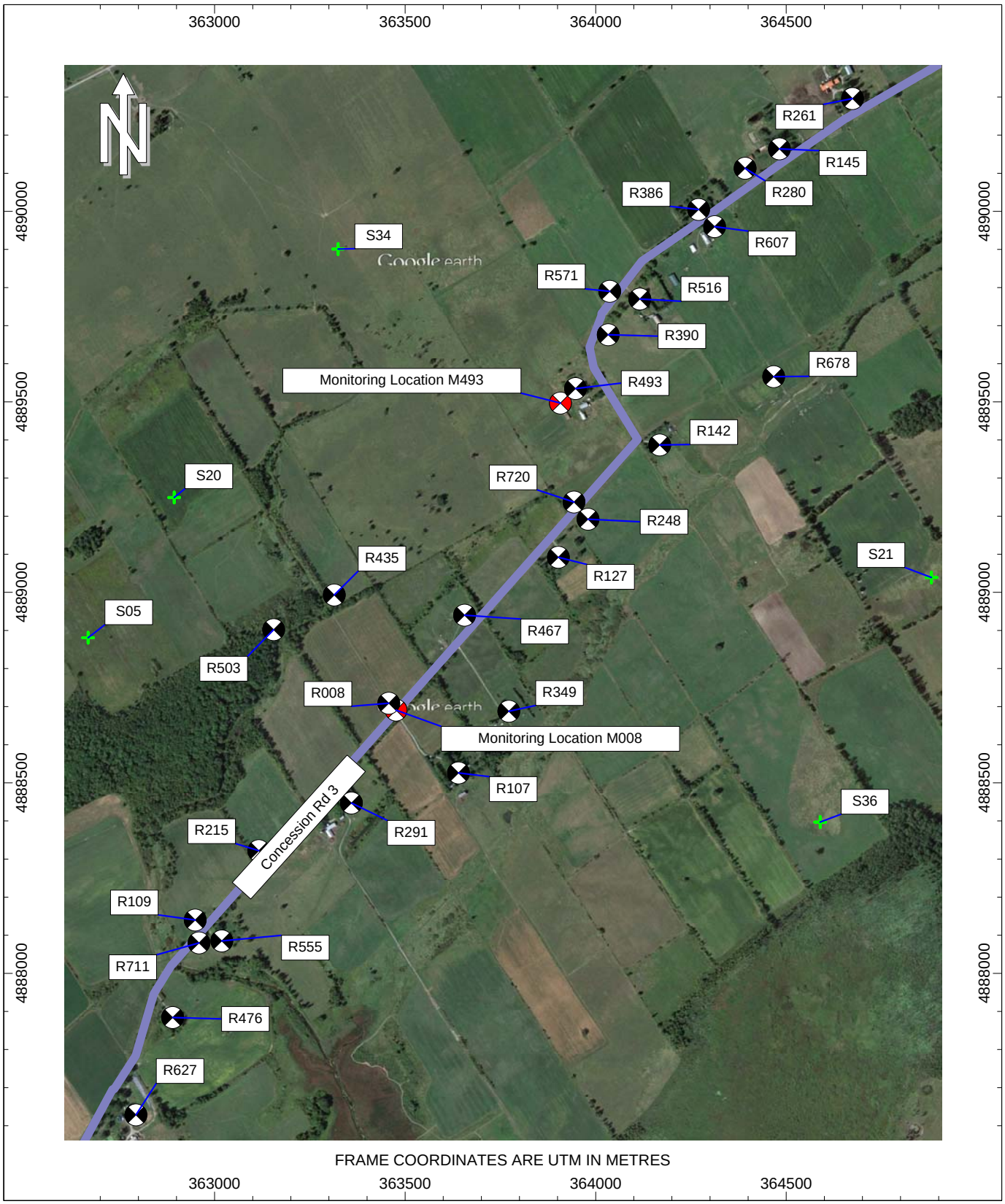


Figure 1a - Location of Receptors R008 and R493 and Monitoring Locations M008 and M493
Amherst Island Wind Project - Spring 2019

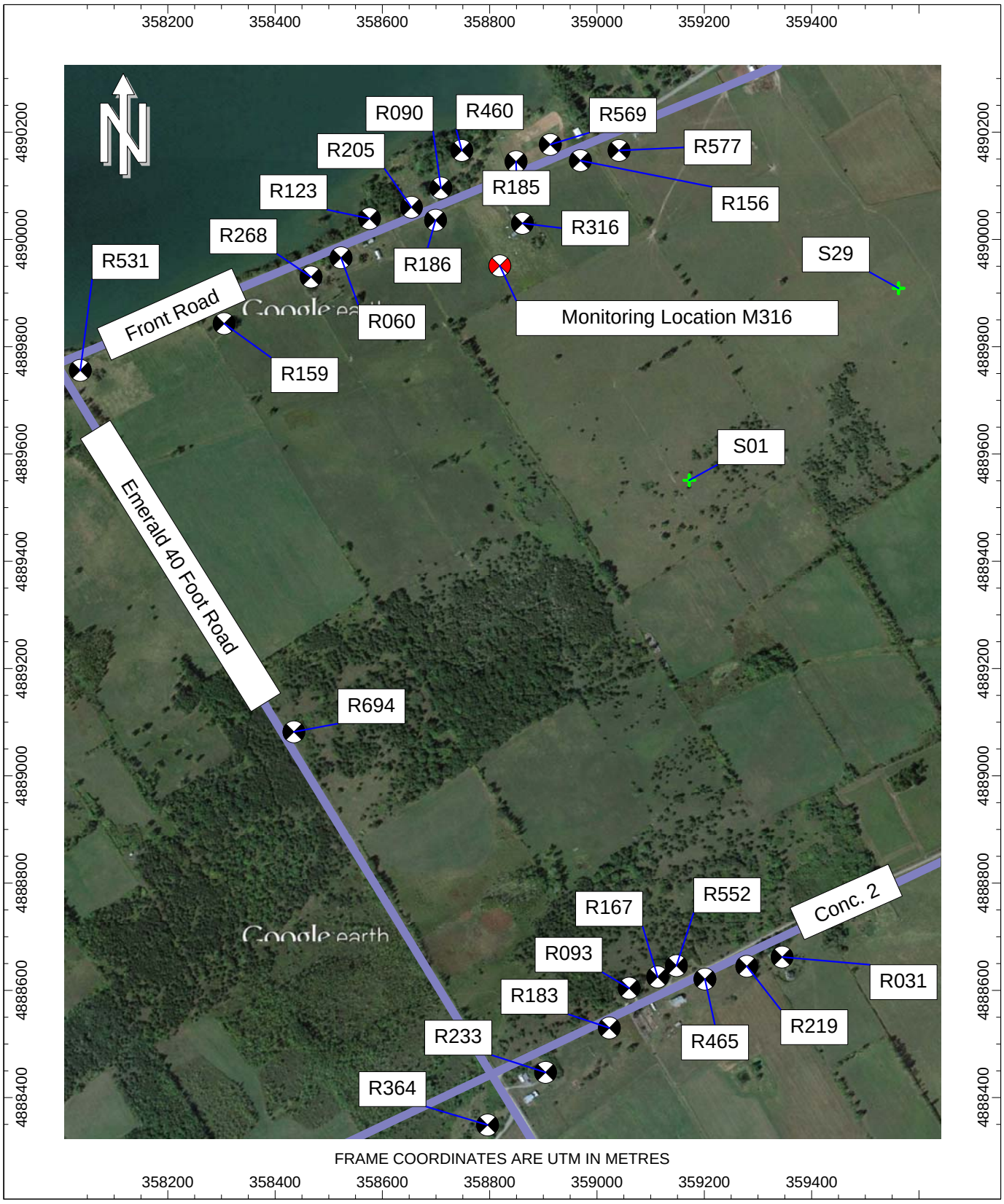


Figure 1b - Location of Receptor R316 and Monitoring Location M316
Amherst Island Wind Project - Spring 2019

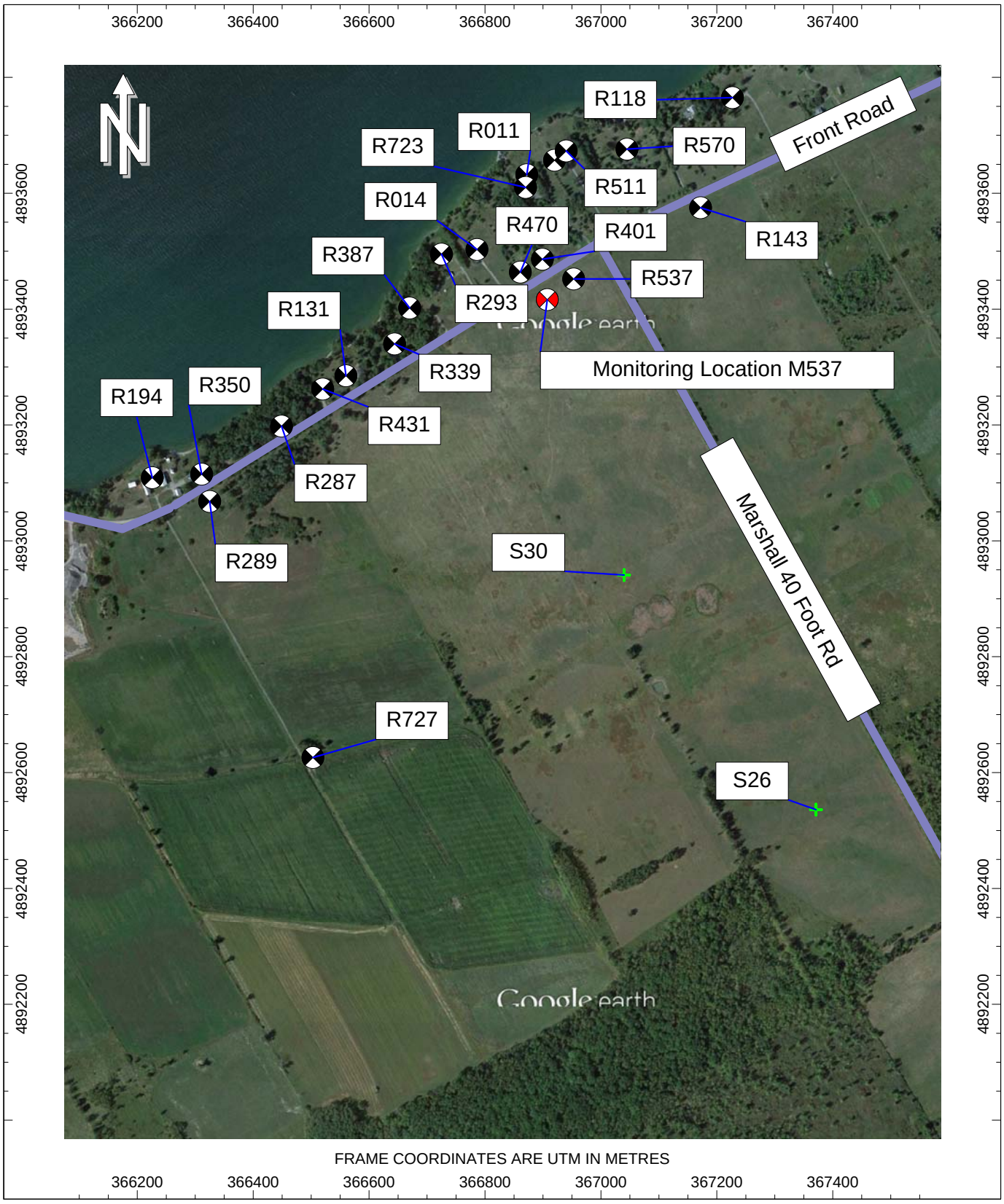


Figure 1c - Location of Receptor R537 and Monitoring Location M537
Amherst Island Wind Project - Spring 2019

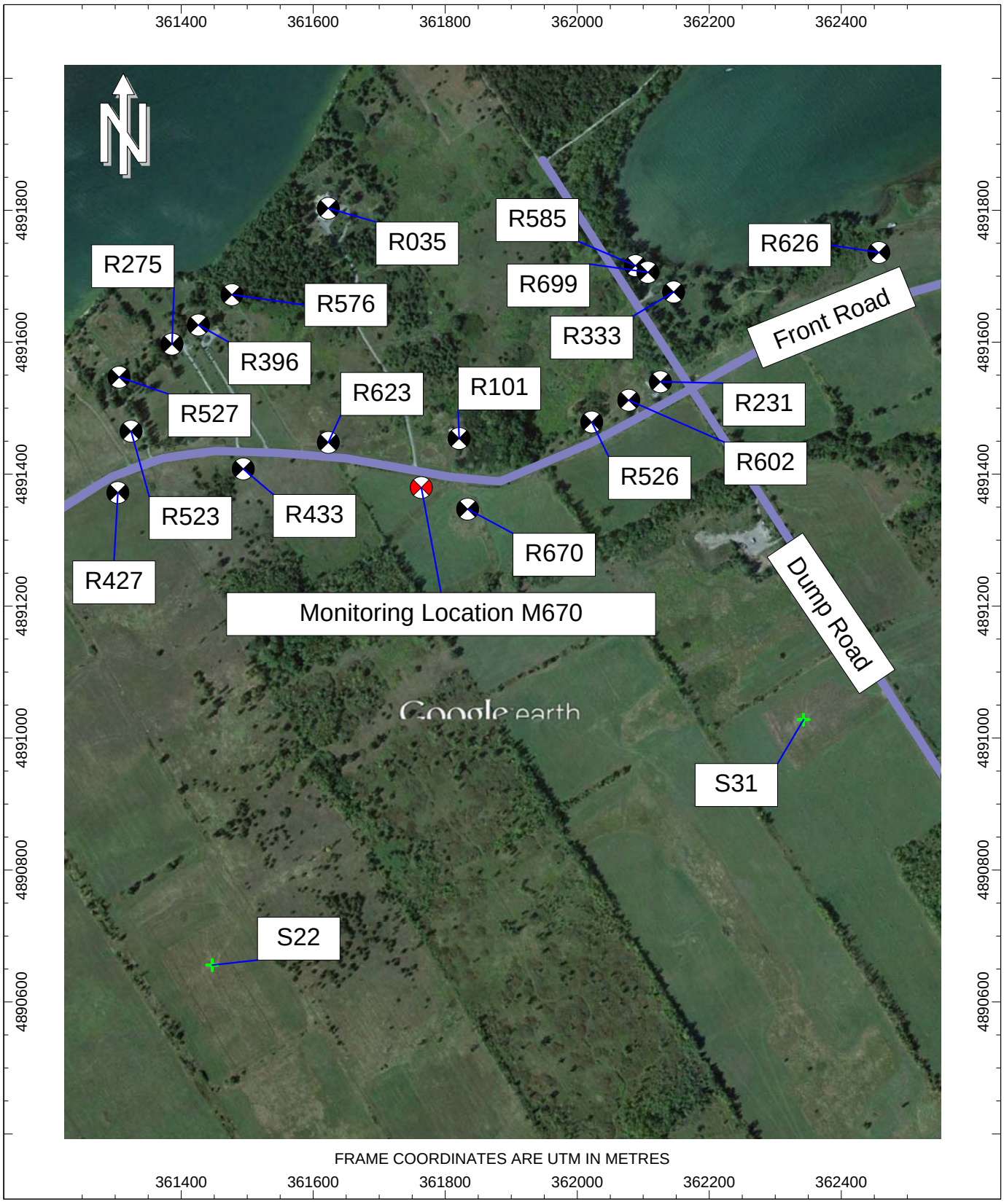


Figure 1d - Location of Receptor R670 and Monitoring Location M670
Amherst Island Wind Project - Spring 2019

Figure 2a: Wind Direction, Amherst Island Wind Project
Monitoring Location M008, ON Conditions, March 20 to November 25, 2019

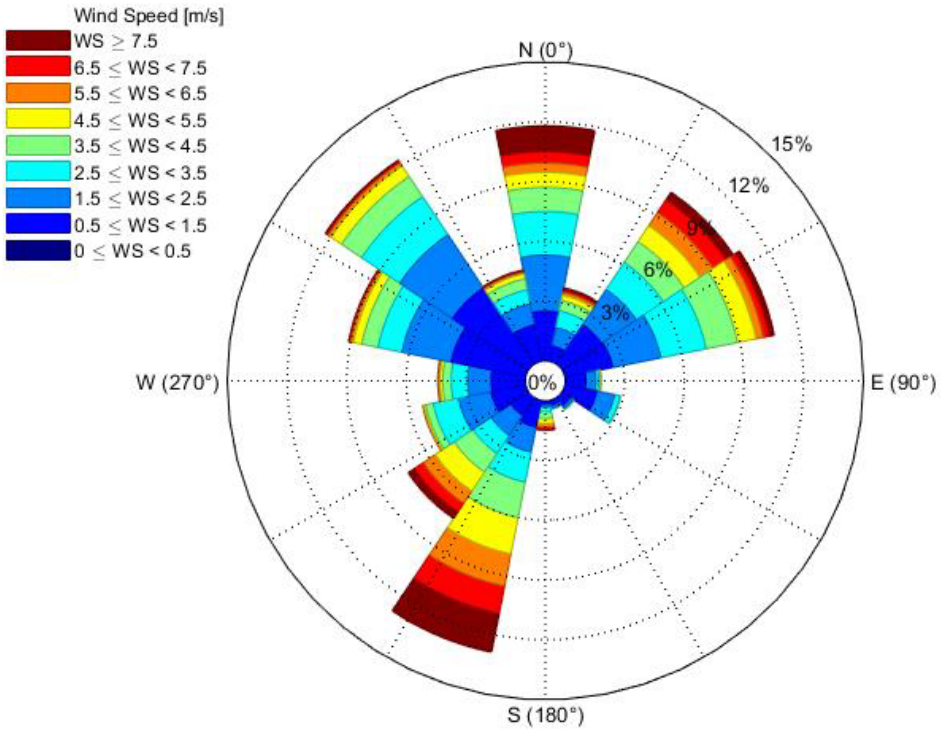


Figure 2b: Wind Direction, Amherst Island Wind Project
Monitoring Location M008, OFF Conditions, March 20 to November 25, 2019

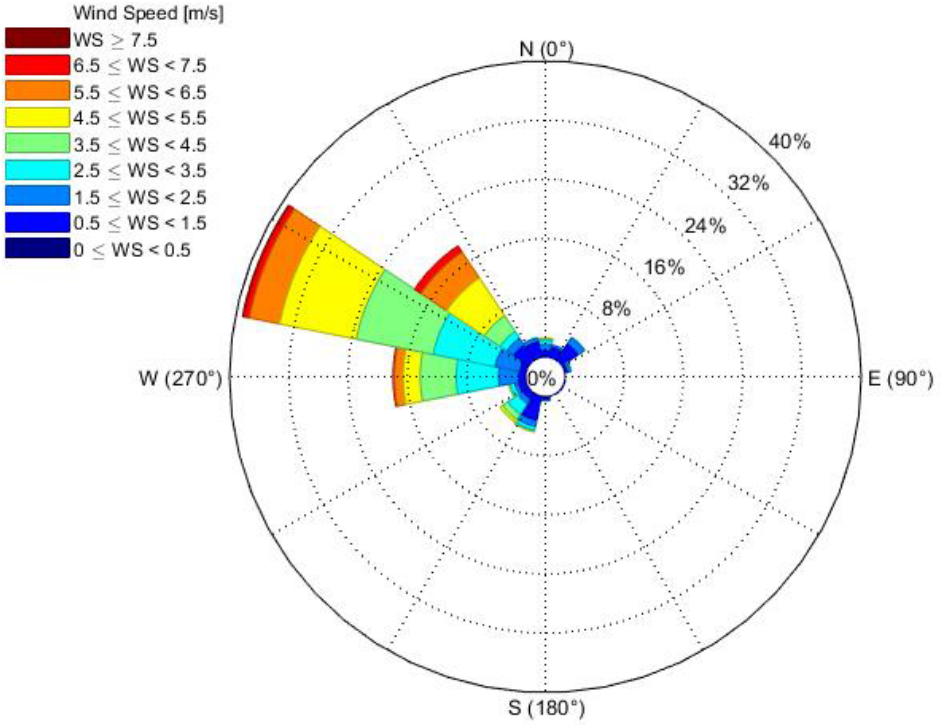


Figure 2c: Wind Direction, Amherst Island Wind Project
Monitoring Location M008, ON Data Used in Analysis, March 20 to November 25, 2019

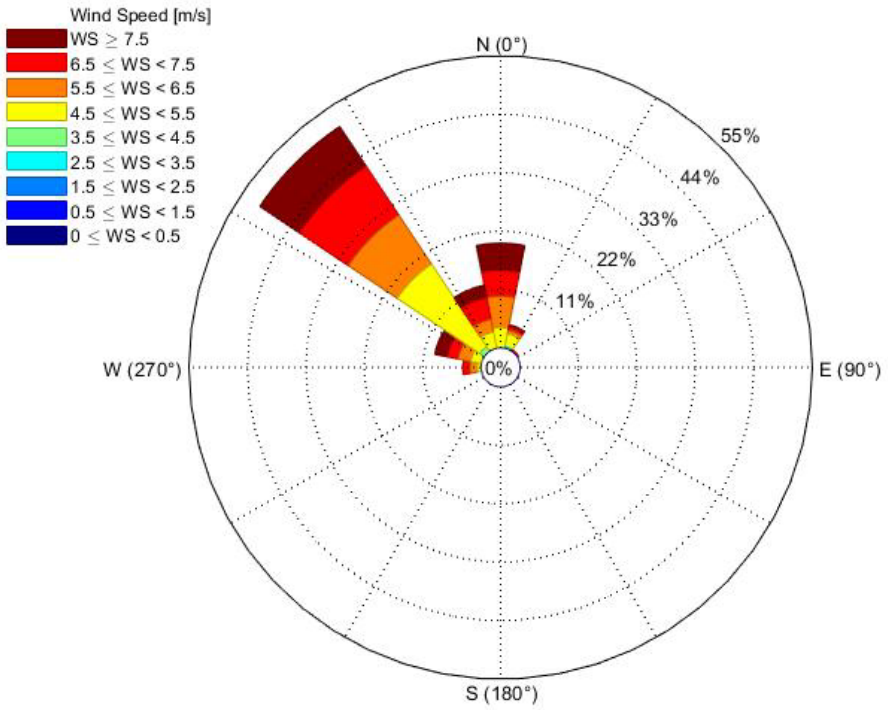


Figure 2d: Wind Direction, Amherst Island Wind Project
Monitoring Location M008, OFF Data Used in Analysis, March 20 to November 25, 2019

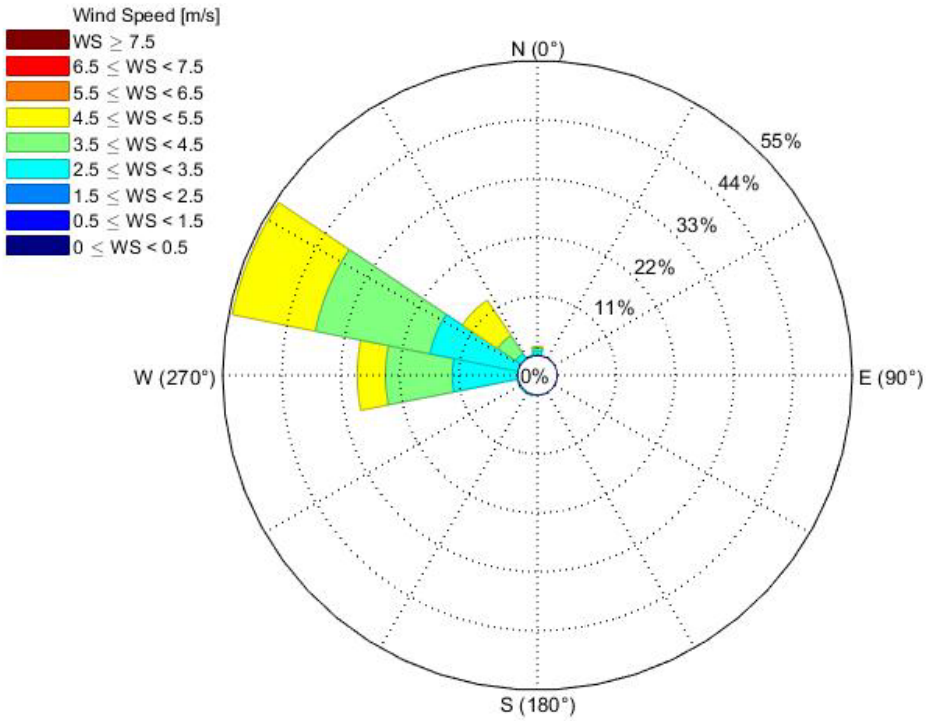


Figure 3a: Wind Direction, Amherst Island Wind Project
Monitoring Location M316, ON Conditions, March 20 to November 25, 2019

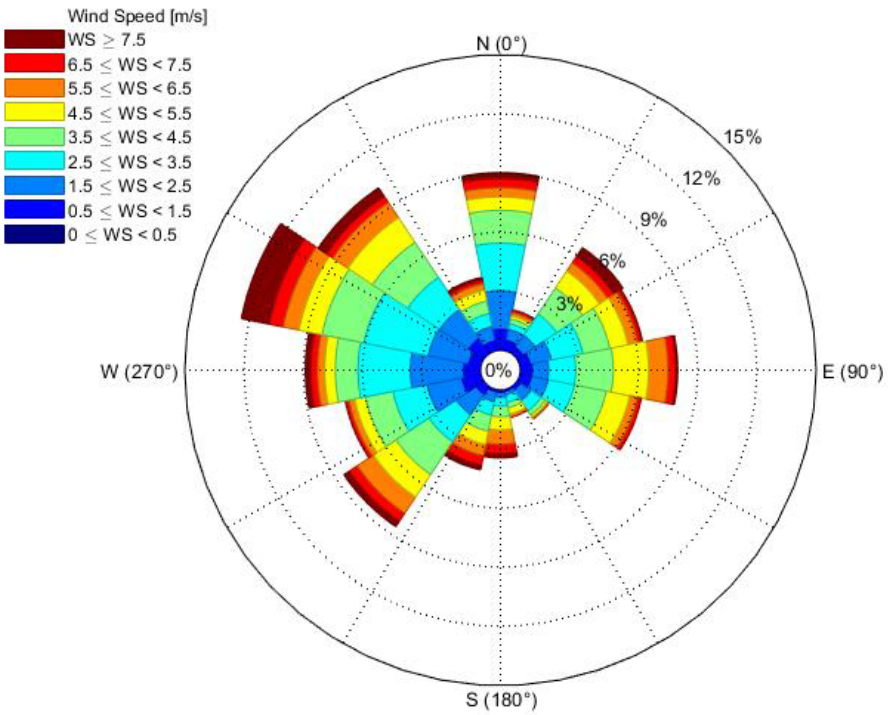


Figure 3b: Wind Direction, Amherst Island Wind Project
Monitoring Location M316, OFF Conditions, March 20 to November 25, 2019

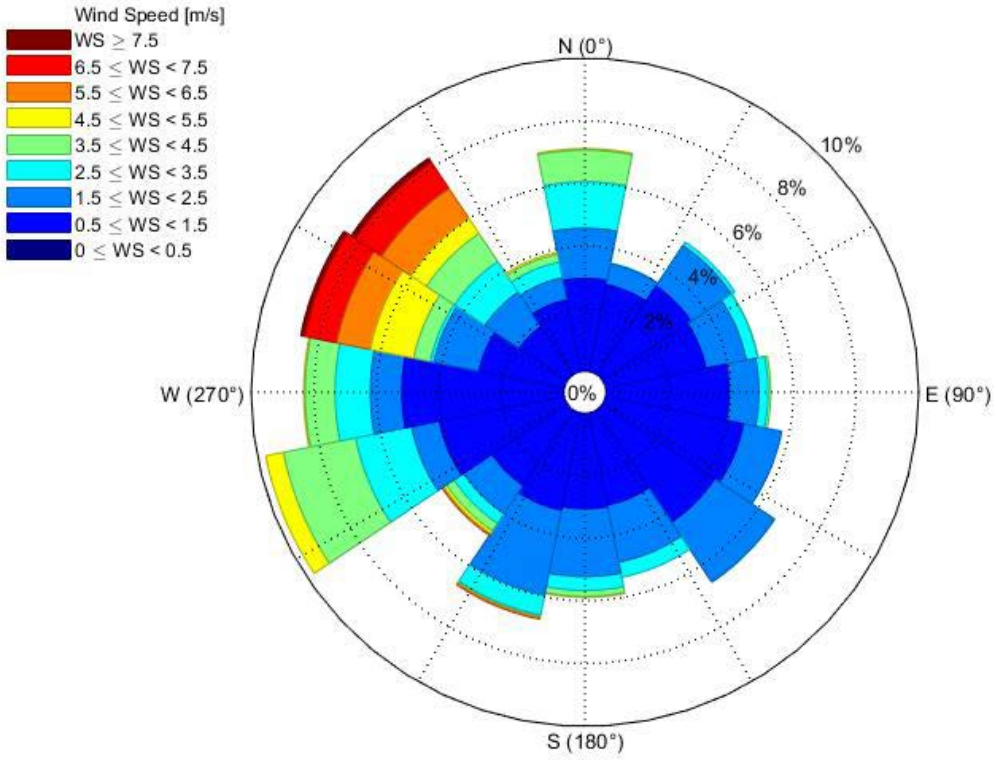


Figure 3c: Wind Direction, Amherst Island Wind Project
Monitoring Location M316, ON Data Used in Analysis, March 20 to November 25, 2019

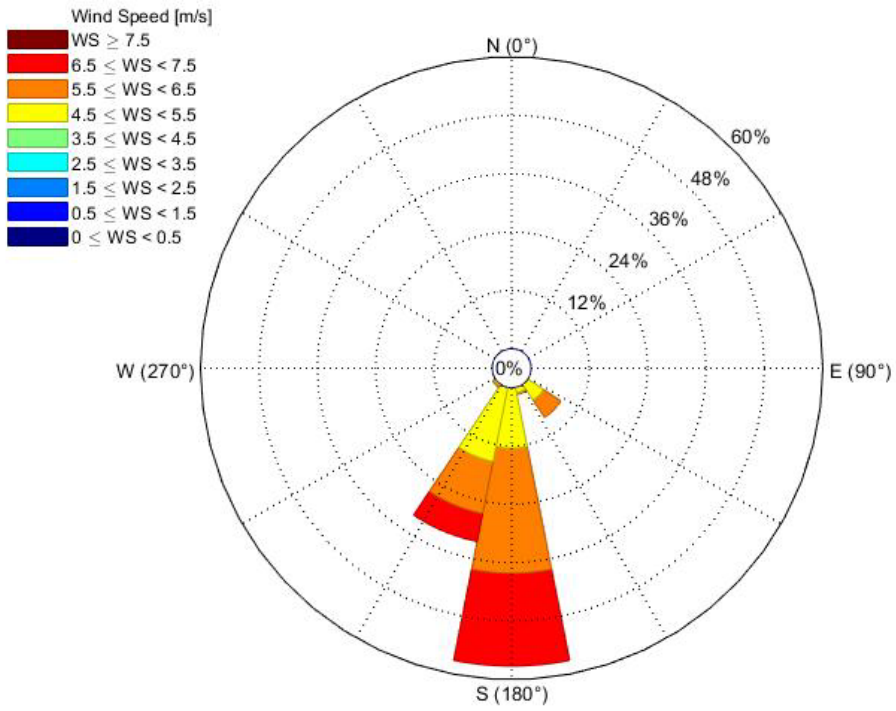


Figure 3d: Wind Direction, Amherst Island Wind Project
Monitoring Location M316, OFF Data Used in Analysis, March 20 to November 25, 2019

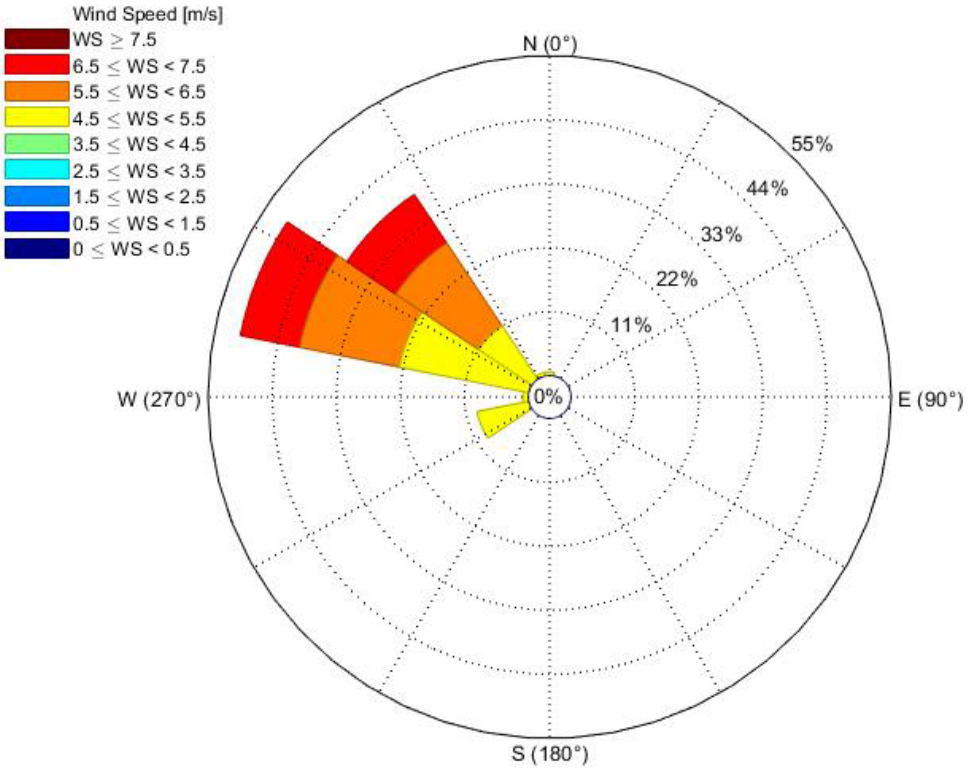


Figure 4a: Wind Direction, Amherst Island Wind Project
Monitoring Location M493, ON Conditions, March 20 to June 4, 2019

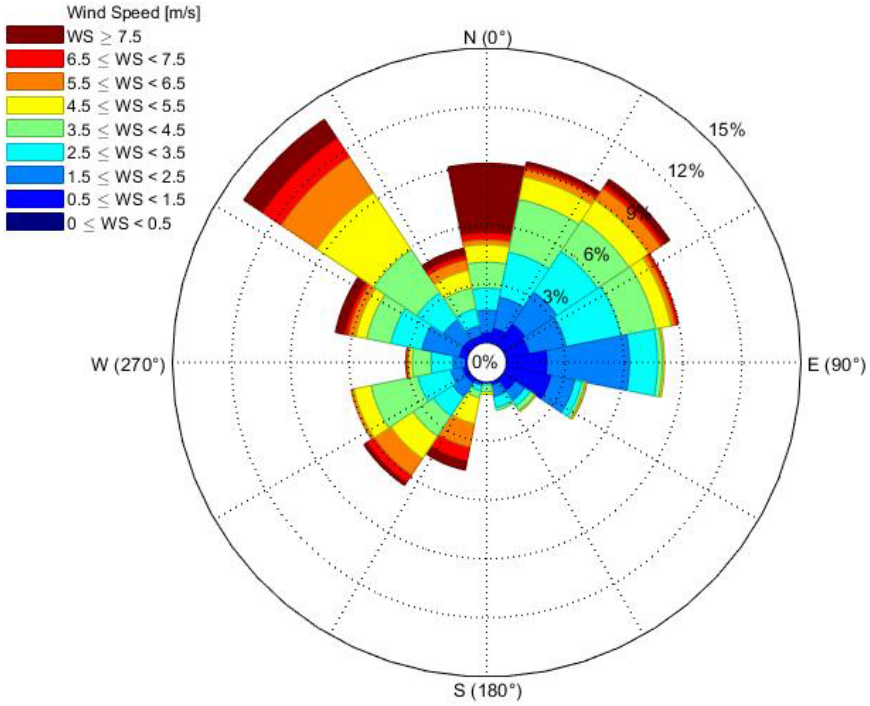


Figure 4b: Wind Direction, Amherst Island Wind Project
Monitoring Location M493, OFF Conditions, March 20 to June 4, 2019

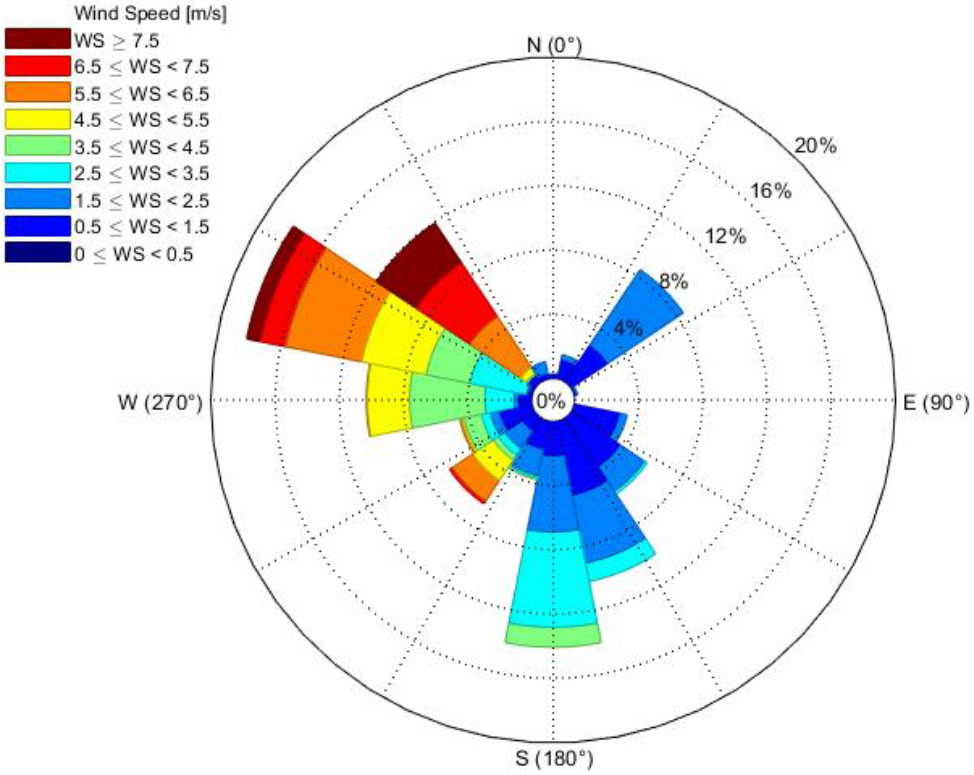


Figure 4c: Wind Direction, Amherst Island Wind Project
Monitoring Location M493, ON Data Used in Analysis, March 20 to June 4, 2019

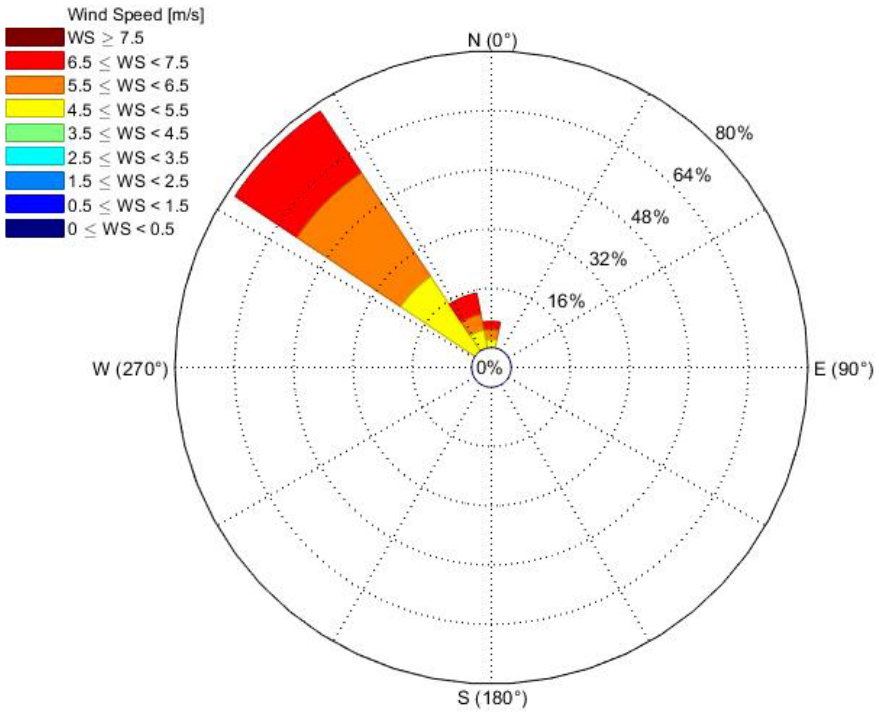


Figure 4d: Wind Direction, Amherst Island Wind Project
Monitoring Location M493, OFF Data Used in Analysis, March 20 to June 4, 2019

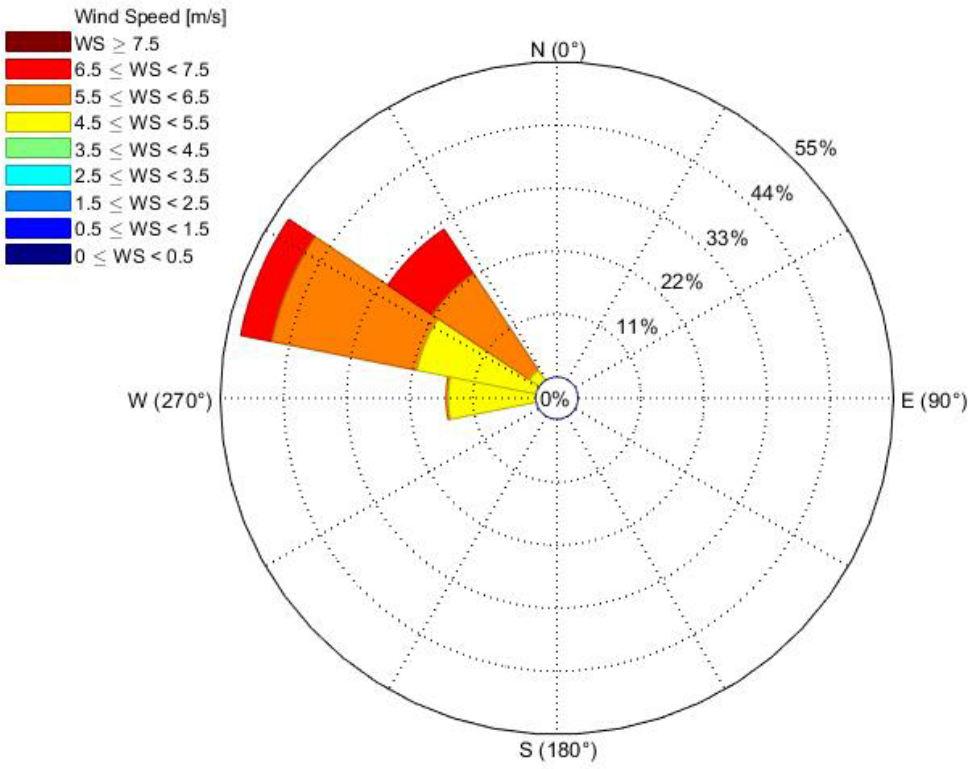


Figure 5a: Wind Direction, Amherst Island Wind Project
Monitoring Location M537, ON Conditions, March 20 to November 25, 2019

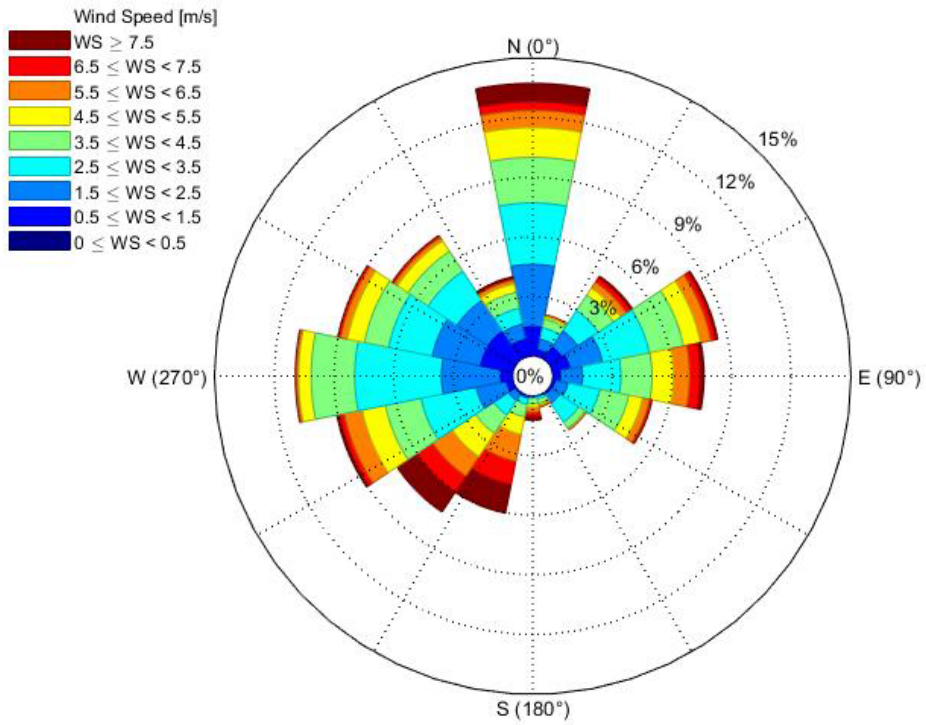


Figure 5b: Wind Direction, Amherst Island Wind Project
Monitoring Location M537, OFF Conditions, March 20 to November 25, 2019

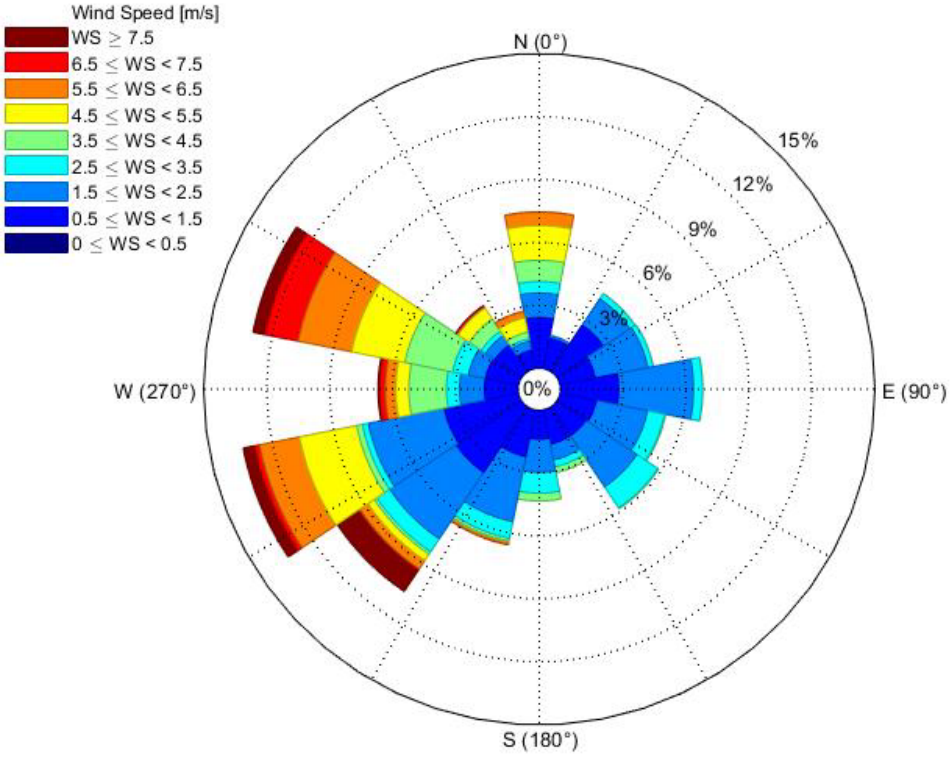


Figure 5c: Wind Direction, Amherst Island Wind Project
Monitoring Location M537, ON Data Used in Analysis, March 20 to November 25, 2019

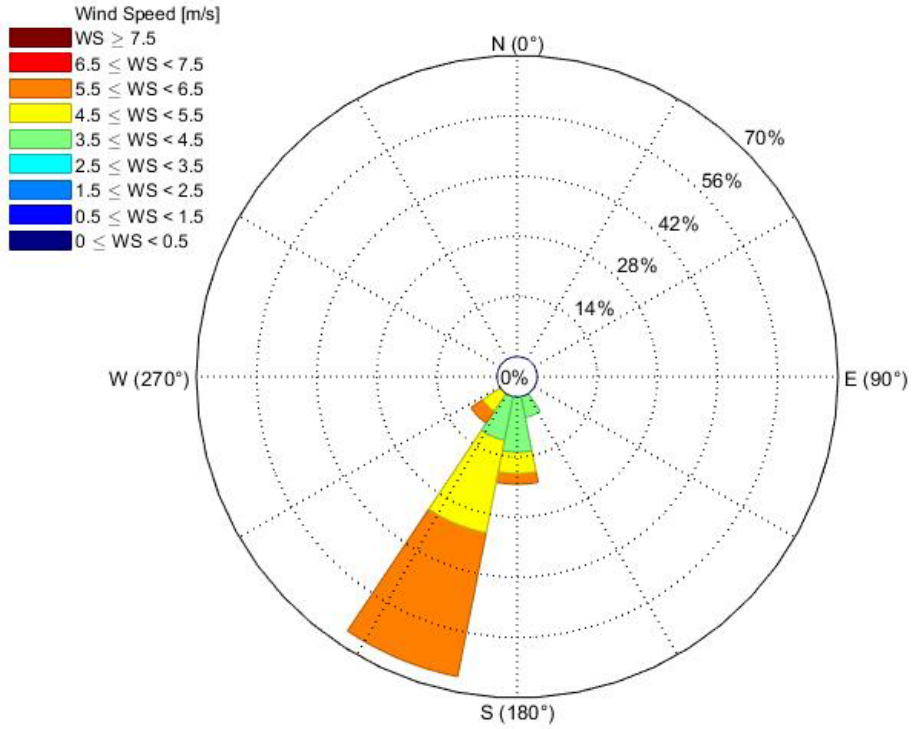


Figure 5d: Wind Direction, Amherst Island Wind Project
Monitoring Location M537, OFF Data Used in Analysis, March 20 to November 25, 2019

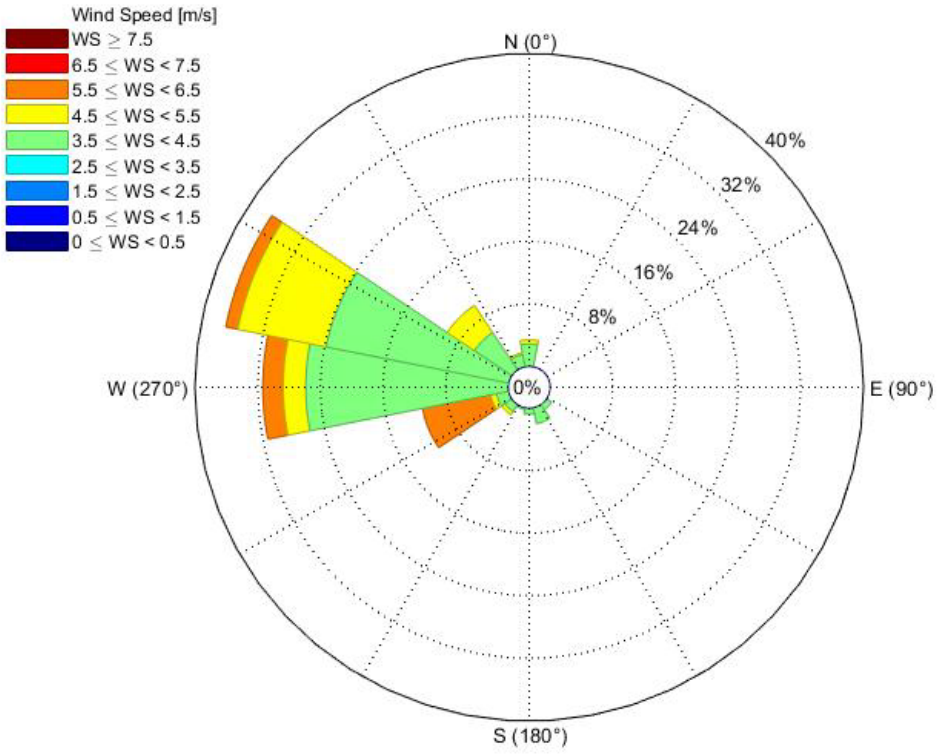


Figure 6a: Wind Direction, Amherst Island Wind Project
Monitoring Location M670, ON Conditions, March 20 to November 25, 2019

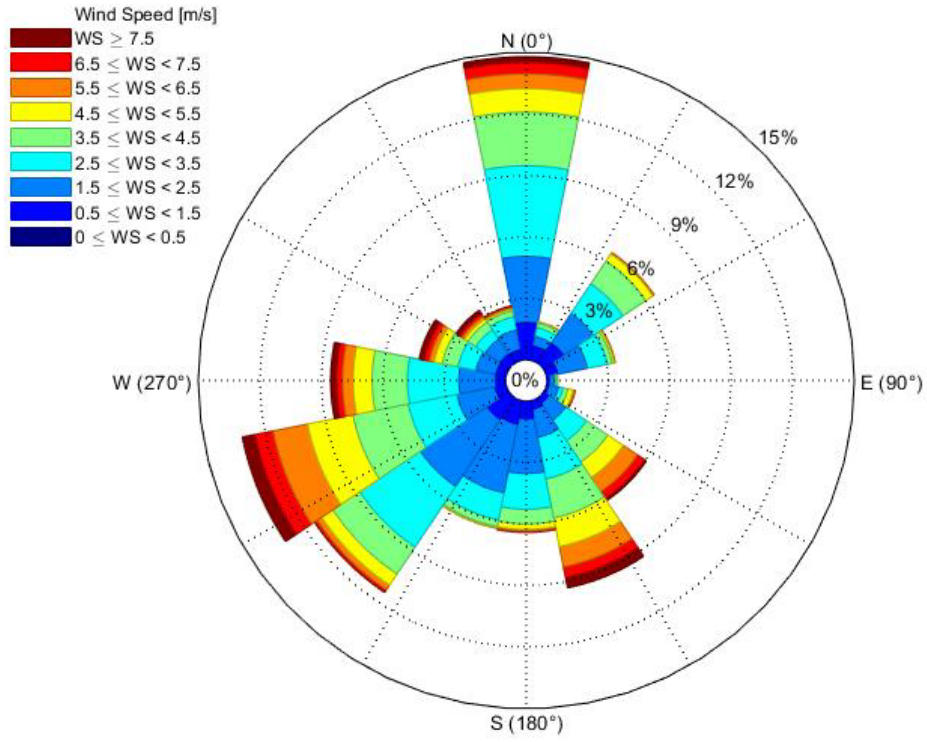


Figure 6b: Wind Direction, Amherst Island Wind Project
Monitoring Location M670, OFF Conditions, March 20 to November 25, 2019

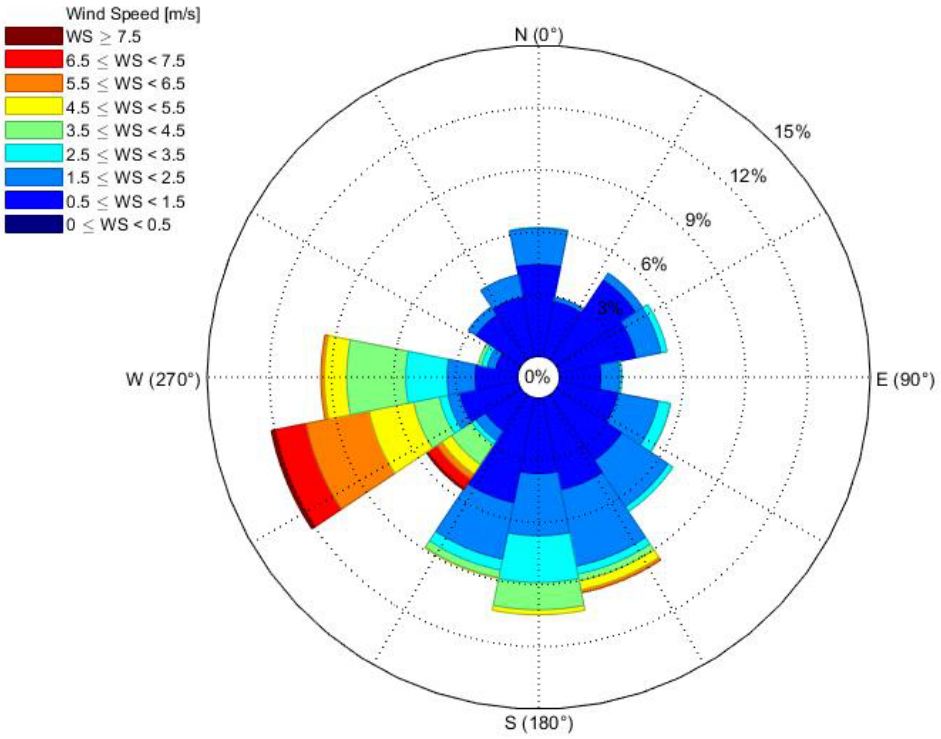


Figure 6c: Wind Direction, Amherst Island Wind Project

Monitoring Location M670, ON Data Used in Analysis, March 20 to November 25, 2019

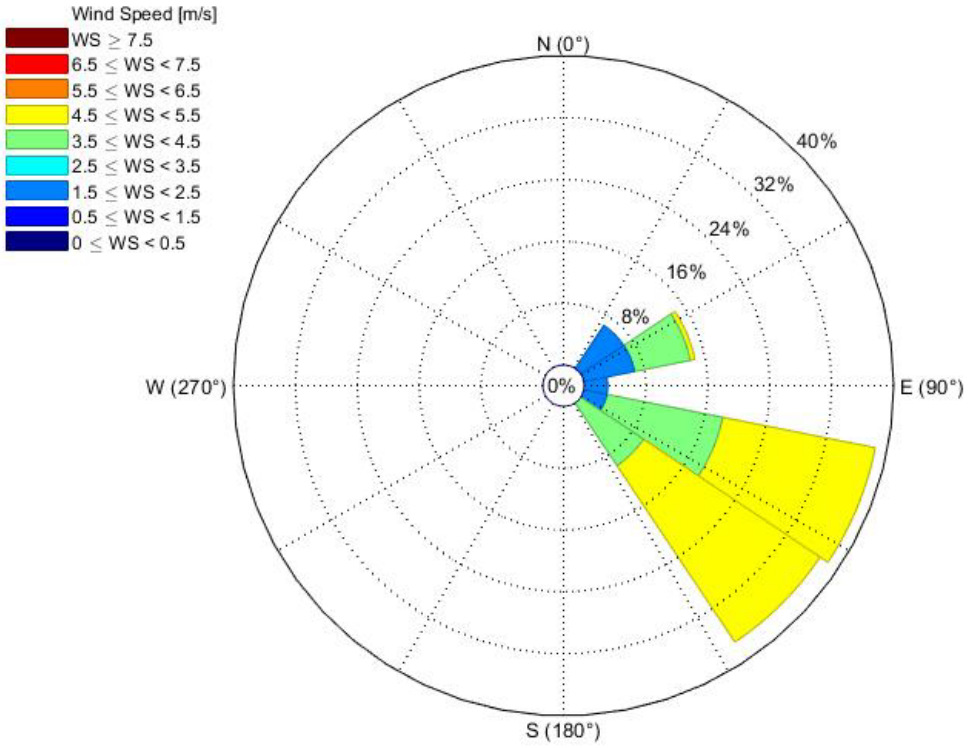


Figure 6d: Wind Direction, Amherst Island Wind Project

Monitoring Location M670, OFF Data Used in Analysis, March 20 to November 25, 2019

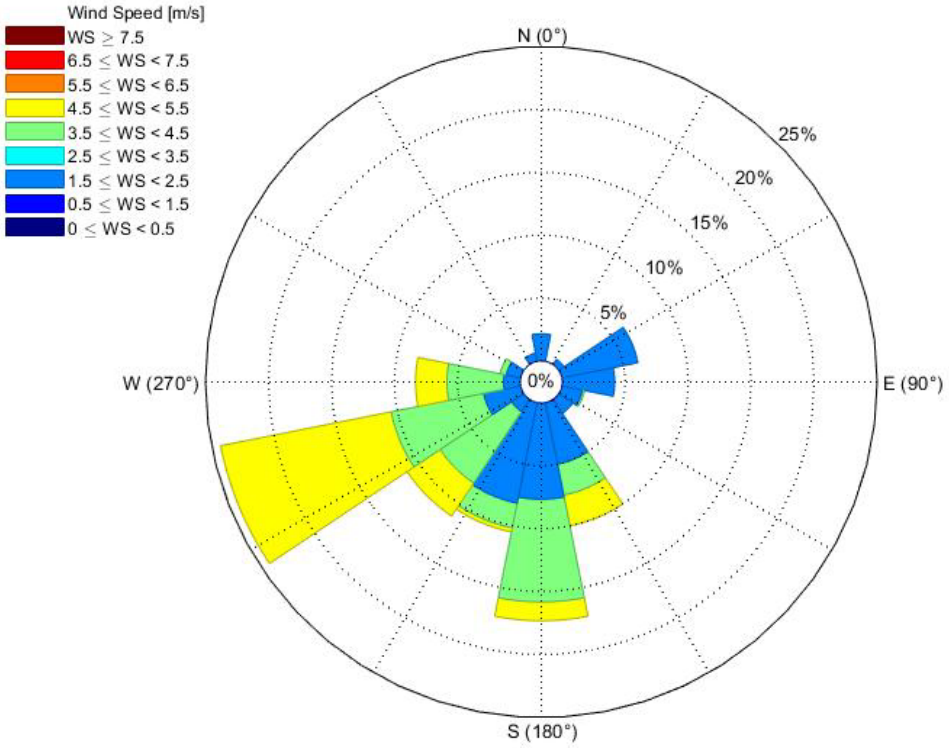


Figure 7a: Immission Results, Amherst Island Wind Project
Monitoring Location M008, March 20 to November 25, 2019

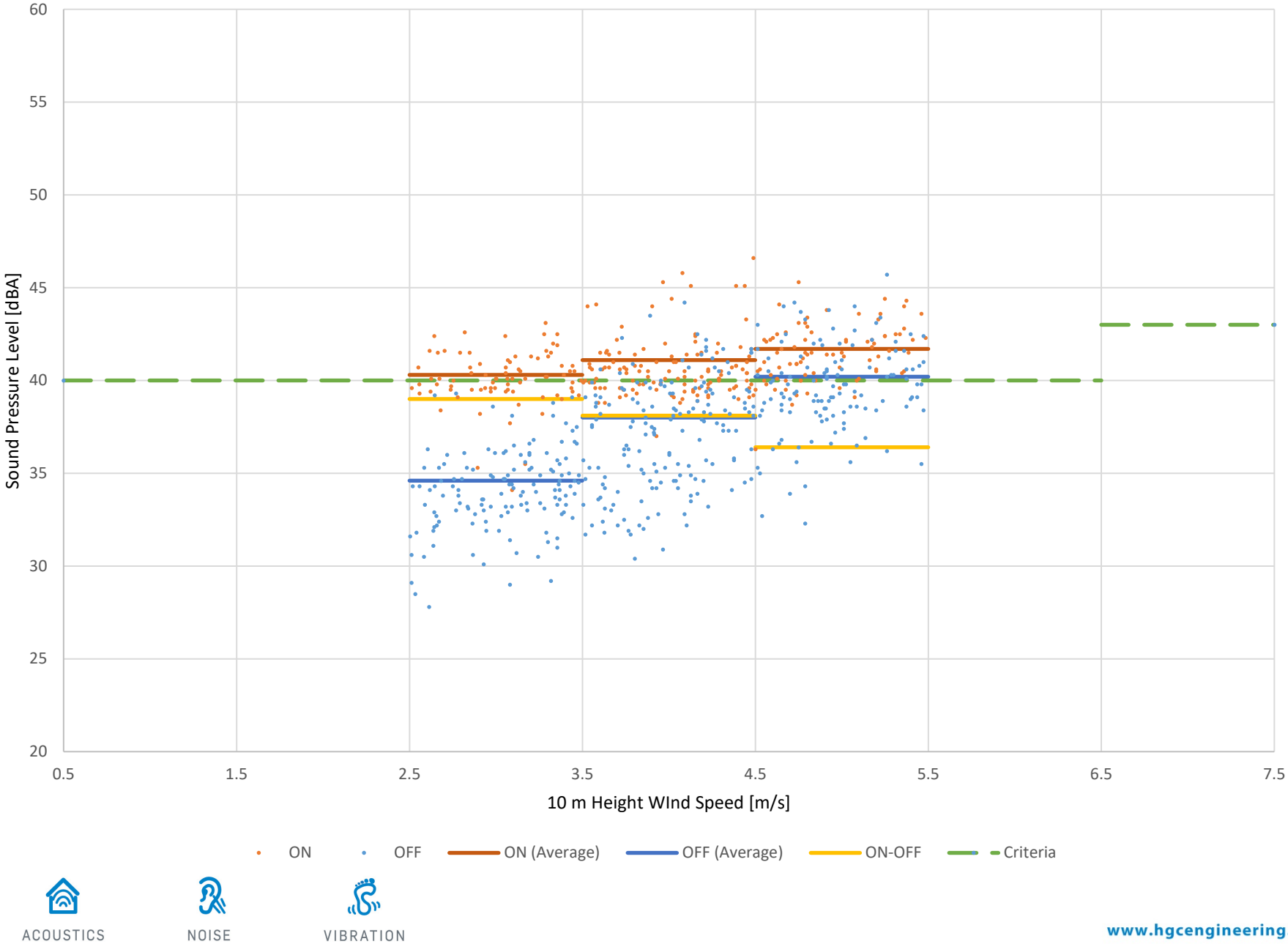


Figure 7b: Immission Results, Amherst Island Wind Project
Monitoring Location M008, March 20 to November 25, 2019

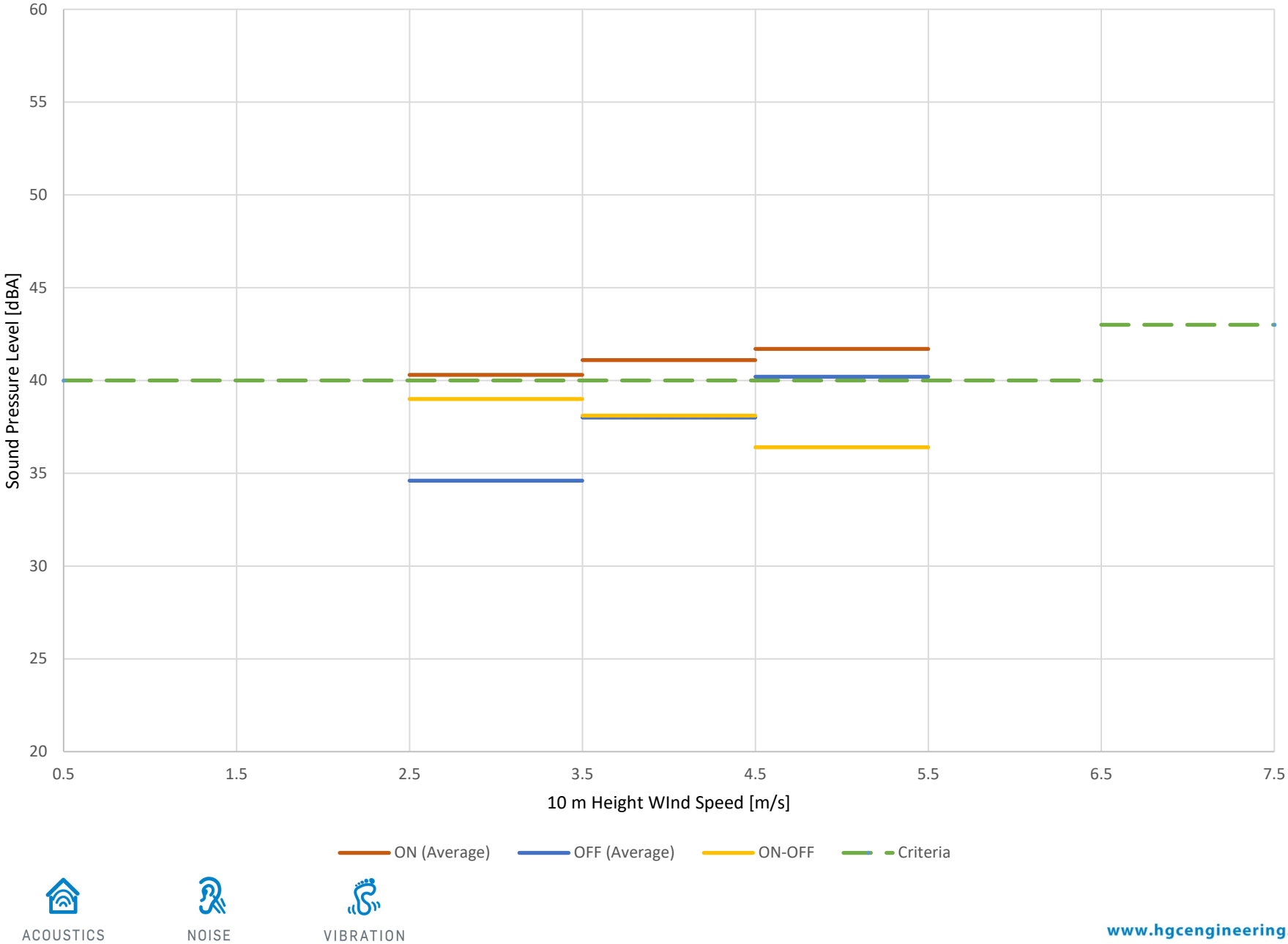


Figure 8a: Immission Results, Amherst Island Wind Project
Monitoring Location M316, March 20 to November 25, 2019

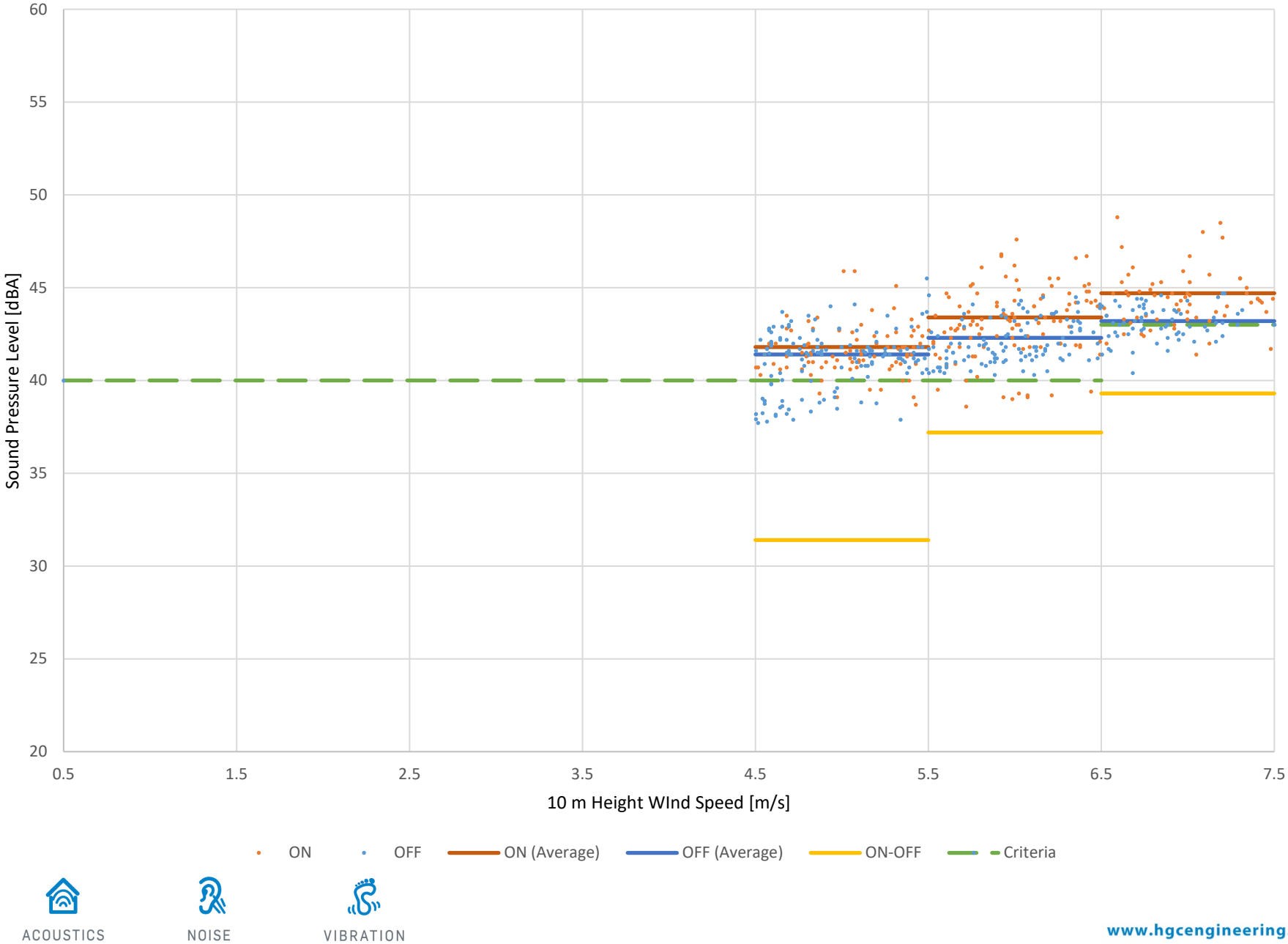


Figure 8b: Immission Results, Amherst Island Wind Project
Monitoring Location M316, March 20 to November 25, 2019

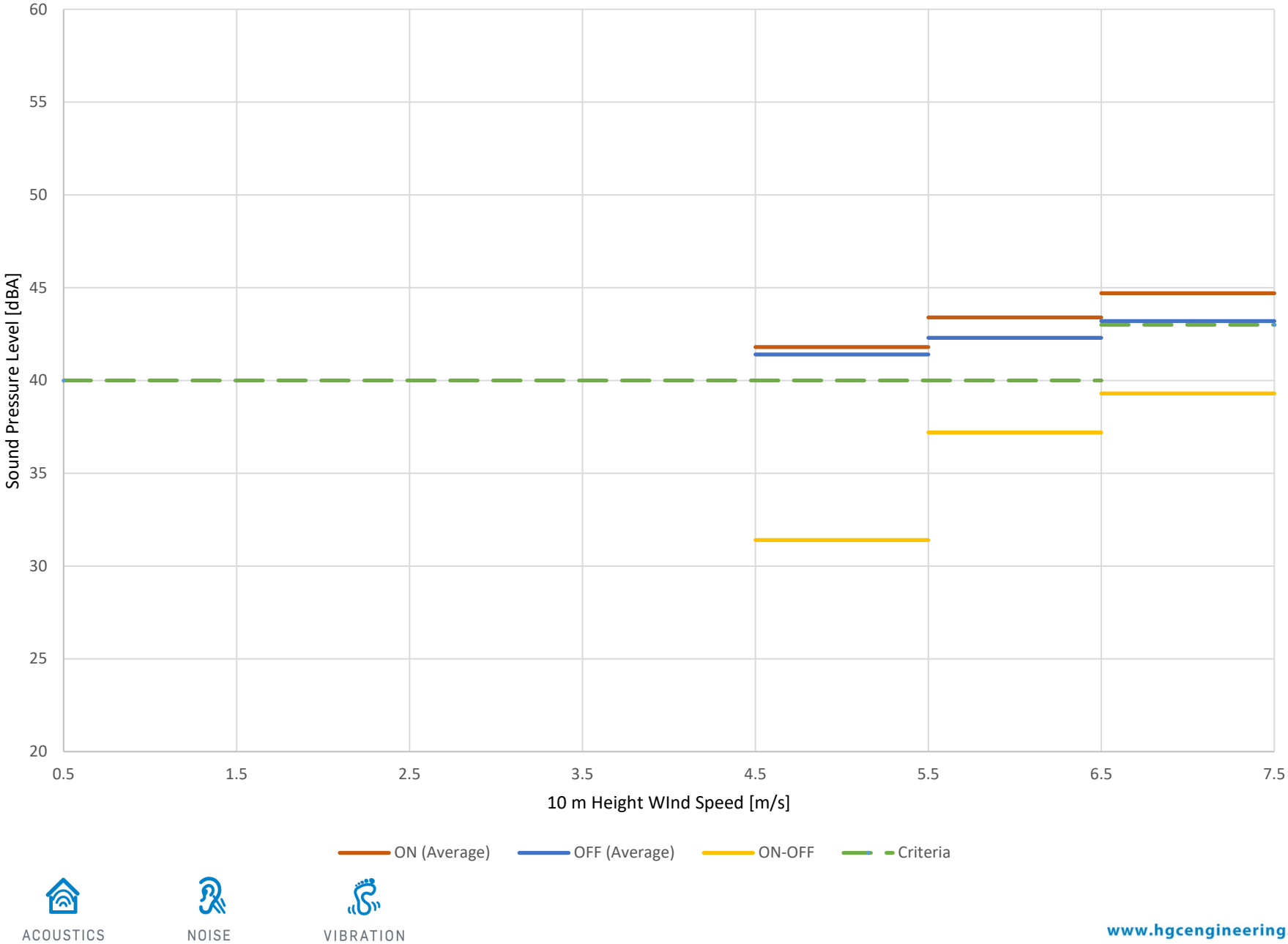


Figure 9a: Immission Results, Amherst Island Wind Project
Monitoring Location M493, March 20 to June 4, 2019

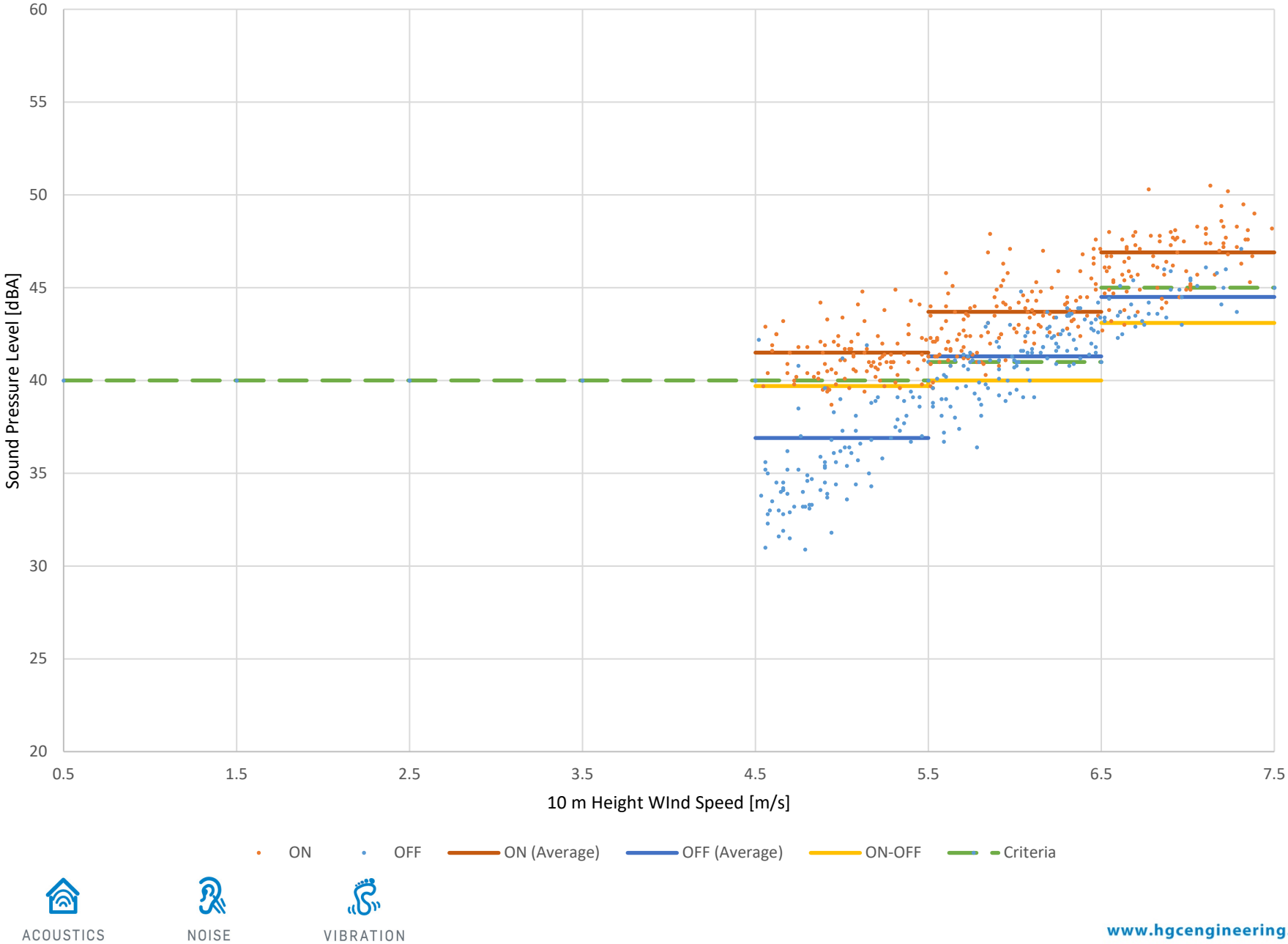


Figure 9b: Immission Results, Amherst Island Wind Project
Monitoring Location M493, March 20 to June 4, 2019

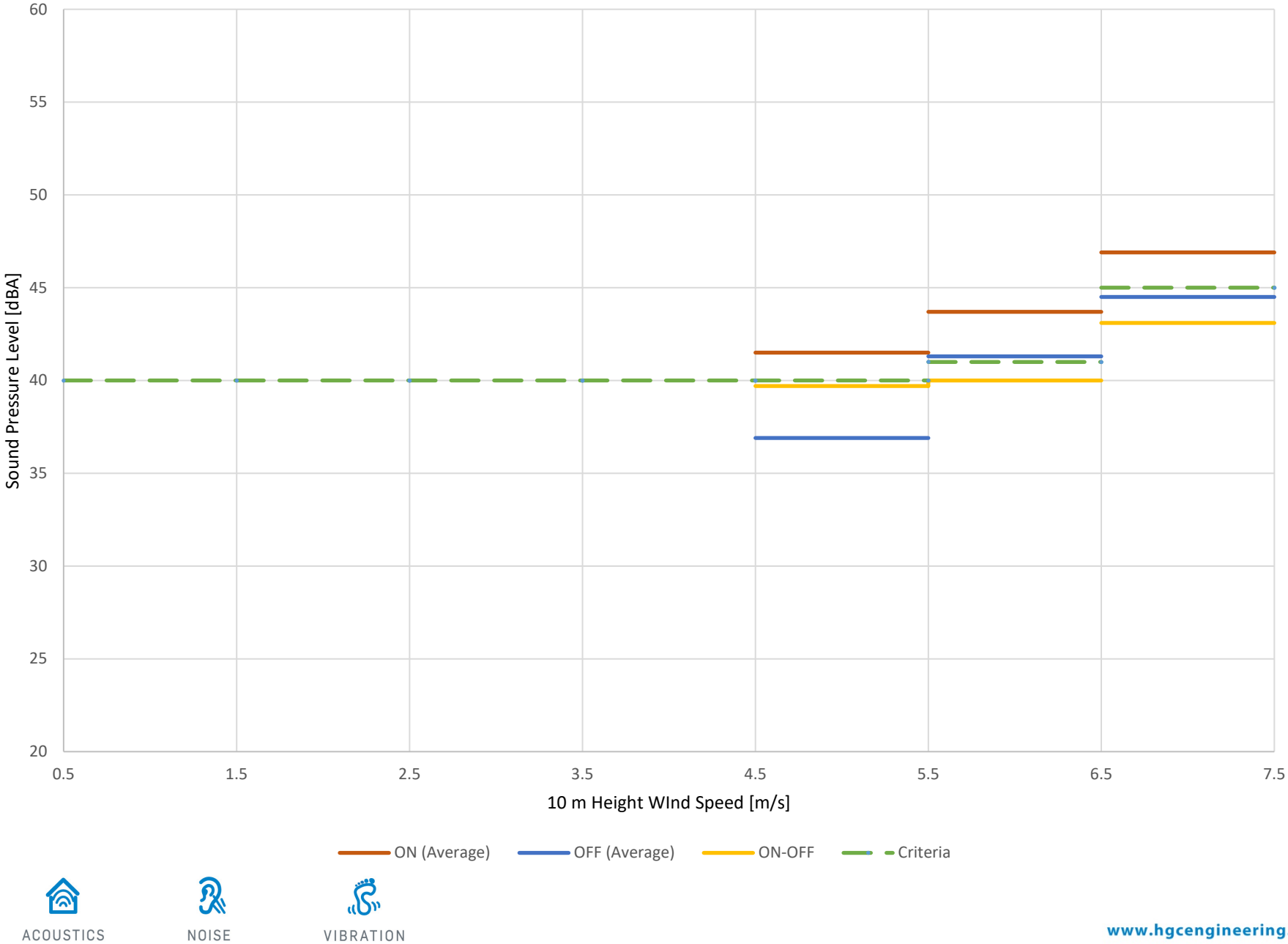


Figure 10a: Immission Results, Amherst Island Wind Project
Monitoring Location M537, March 20 to November 25, 2019

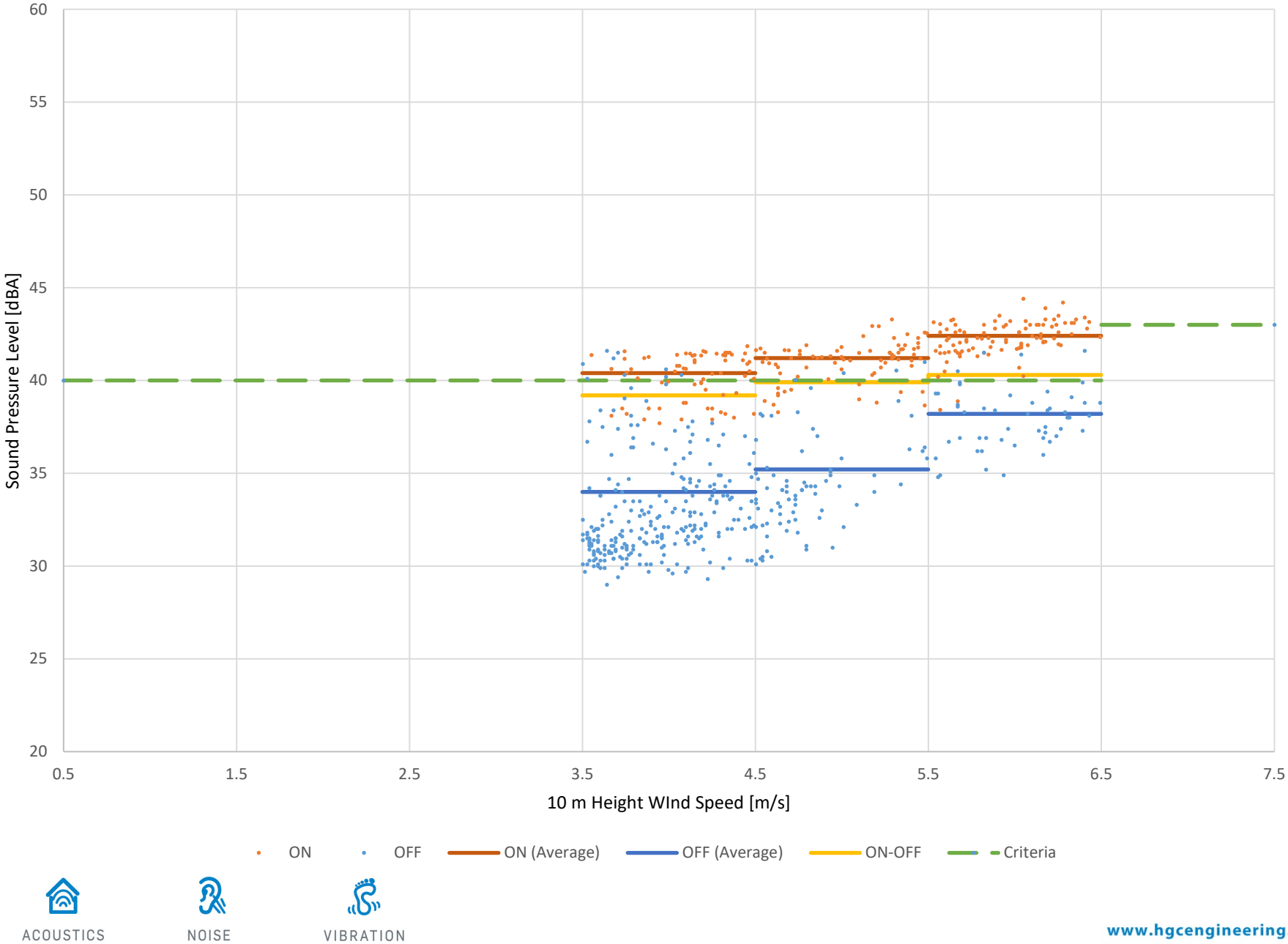


Figure 10b: Immission Results, Amherst Island Wind Project
Monitoring Location M537, March 20 to November 25, 2019

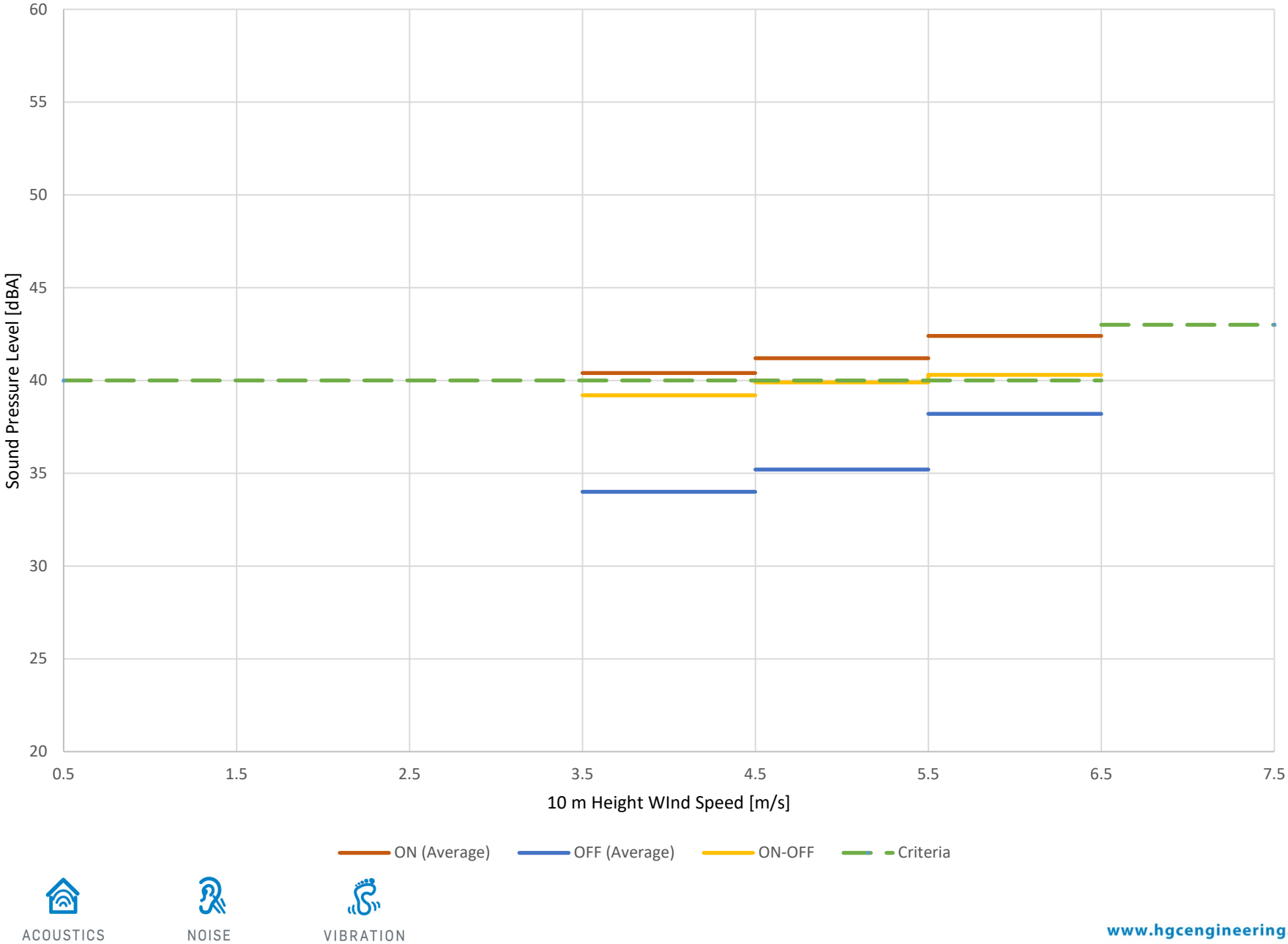


Figure 11a: Amherst Island Wind Project, Immission Results
Monitoring Location M670, March 20 to November 25, 2019

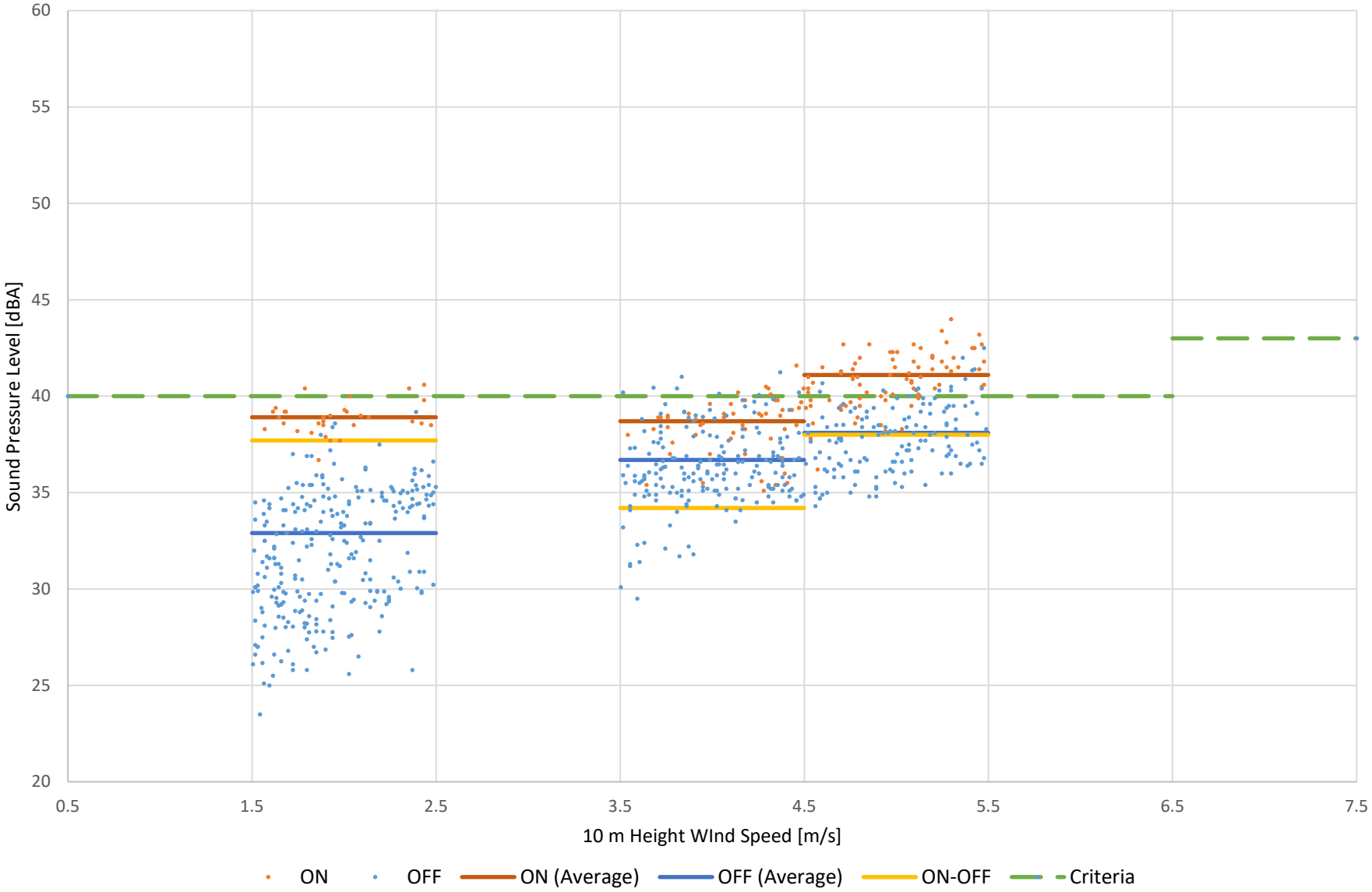
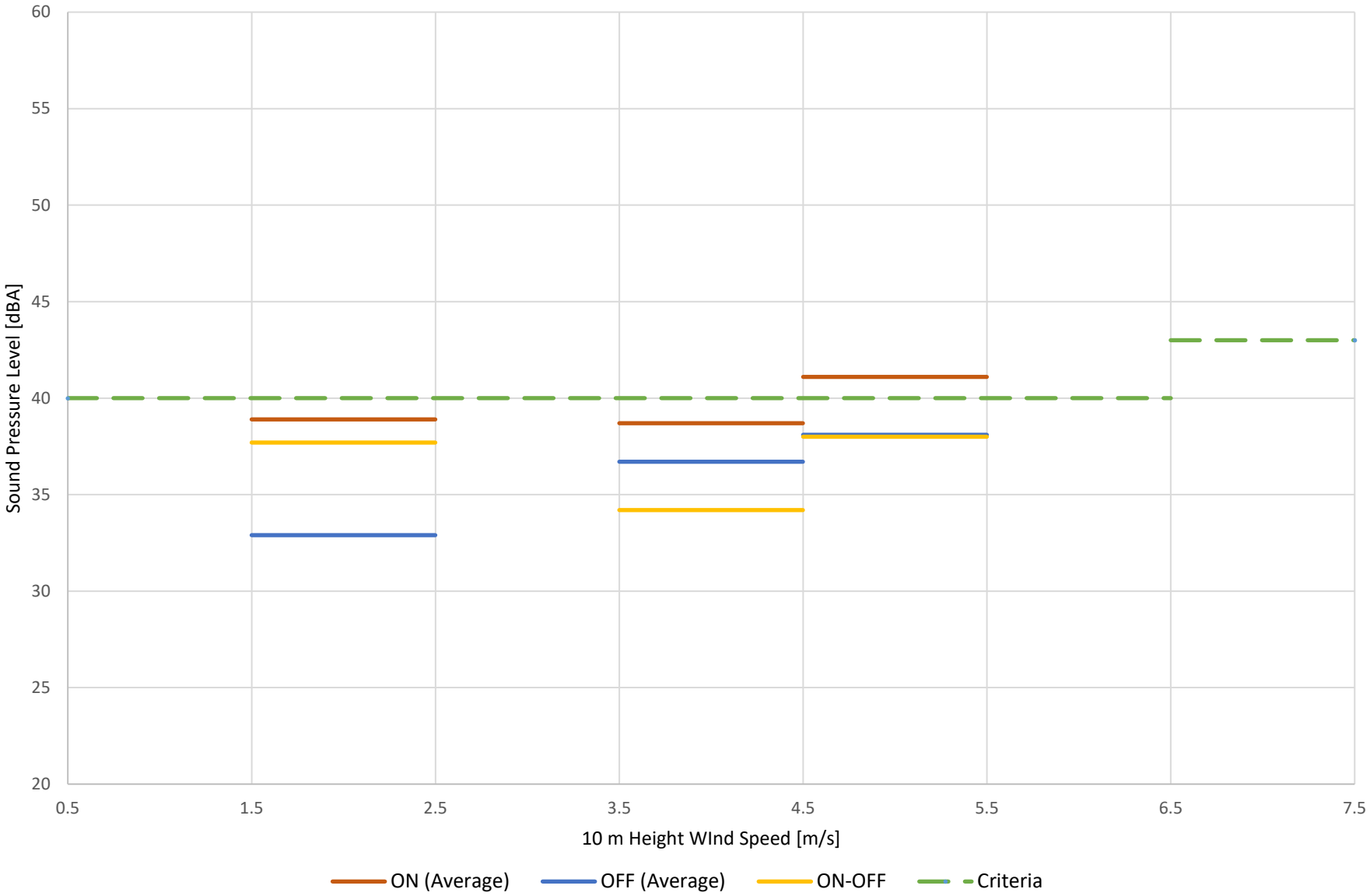


Figure 11b: Amherst Island Wind Project, Immission Results
Monitoring Location M670, March 20 to November 25, 2019



APPENDIX A:
MONITORING LOCATION SELECTION

Figure A1: Annual Wind Rose [9]

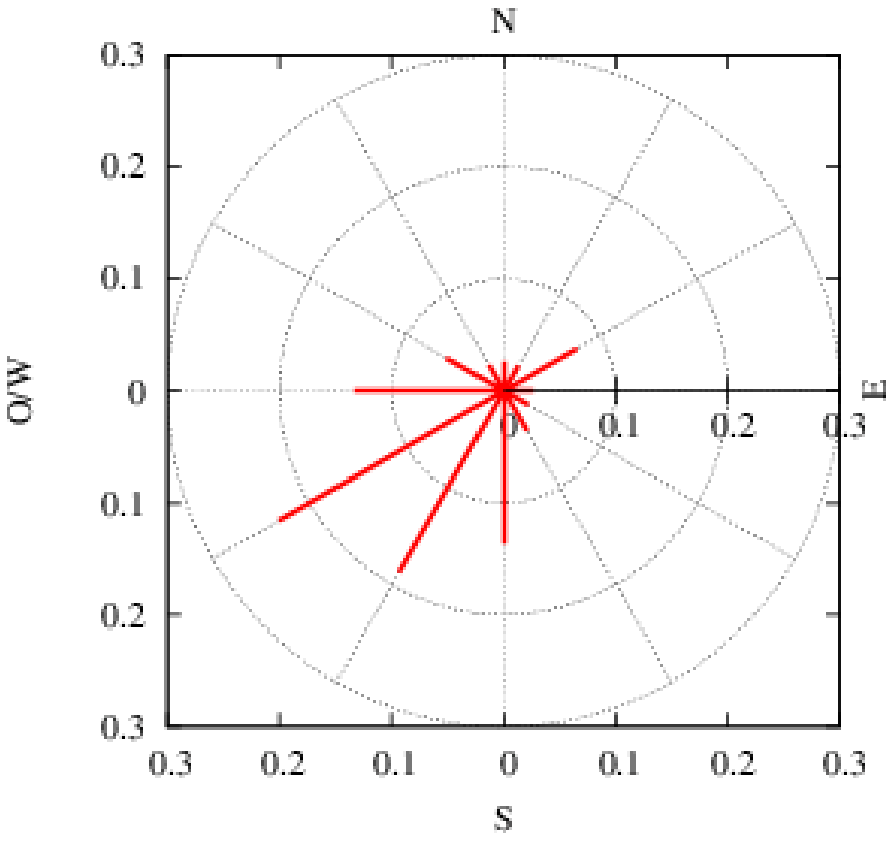


Figure A2a: Wind Direction - Amherst Island Wind Project
Meteorological Tower,100 m Height, Wind Speeds 4-7 m/s
September 1 to November 30, 2012 to 2018

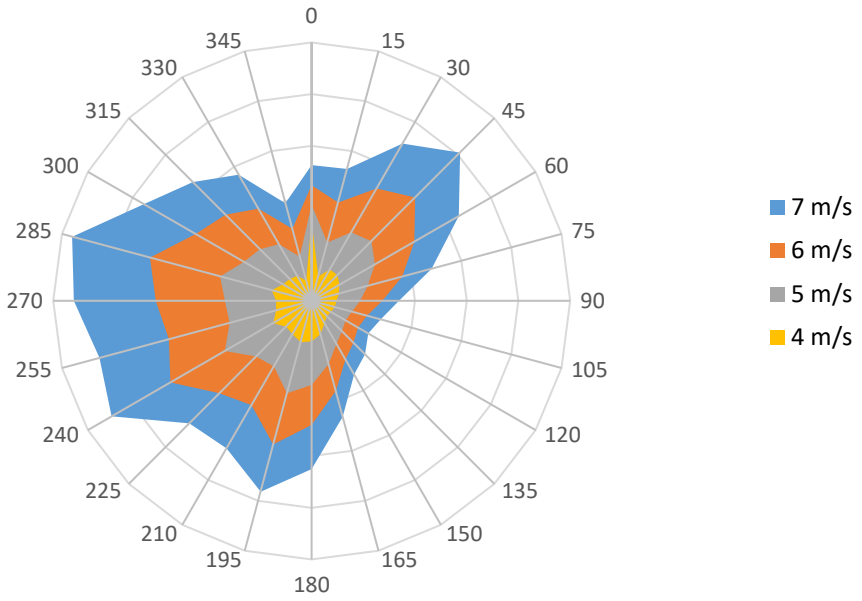


Figure A2b: Wind Direction - Amherst Island Wind Project
Meteorological Tower,100 m Height, Wind Speeds 8-13 m/s
September 1 to November 30, 2012 to 2018

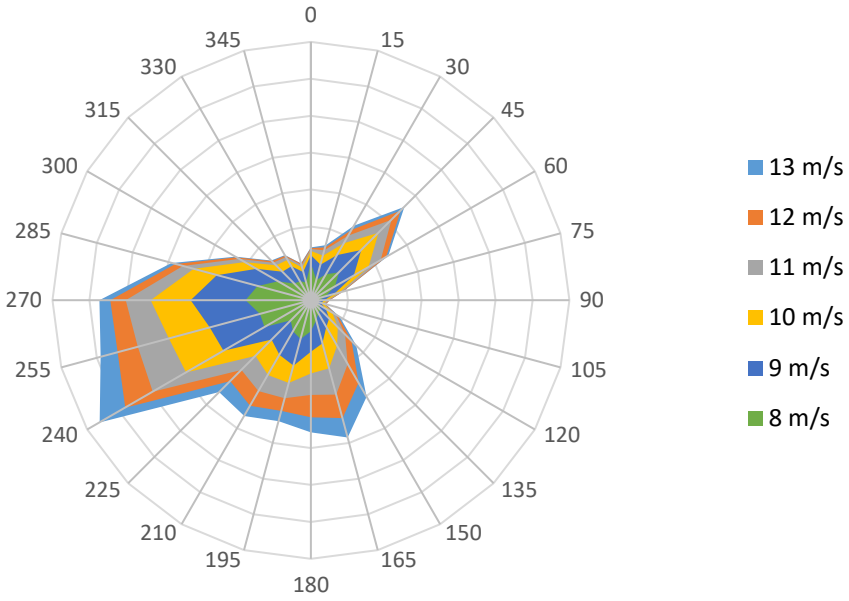


Table A1: Potential Receptor Locations

ID	Description	Coordinates		Nearest Source Distance (m)			Predicted Sound Level @ 4.5 m Height (dBA) ±	Notes
				WTG		Transformer		
		X	Y	Distance	ID	Distance		
R503	Vacant	363155	4888902	434	S20	2197	43.1	Participating
R457	Existing	365771	4889428	504	S37	3006	41.9	Participating
R435	Vacant	363314	4888993	492	S20	2103	41.7	Participating
R678	Vacant	364467	4889566	640	S19	1943	40.2	Participating
R556	Existing	366391	4889653	684	S27	3439	39.7	Participating
R376	Existing	362412	4889866	783	S20	1499	39.6	Participating
R177	Existing	366495	4889660	712	S02	3531	39.2	Participating
R297	Existing	365371	4888610	651	S21	3255	39.2	Participating
R369	Existing	360965	4890937	558	S22	2310	39.2	Large pond and close to lake, not downwind
R008	Vacant	363457	4888709	780	S20	2394	39.1	Selected Receptor
M008	Monitoring Location	363474	4888697	801	S20	2407	38.9*	Selected Monitoring Location
R015	Existing	365758	4889070	816	S19	3208	39.1	Participating
R044	Vacant	362910	4890438	679	S34	749	39.1	Participating
R048	Vacant	362789	4890459	724	S31	797	39.1	Participating
R115	Vacant	365282	4888463	696	S36	3314	39.1	Participating
R179	Vacant	366131	4889365	798	S37	3345	39.1	Participating
R577	Vacant	359041	4890166	581	S29	4329	39.1	Participating
R727	Existing	366503	4892626	622	S30	3578	39.1	Inaccessible
R142	Existing	364168	4889387	794	S21	1930	39.0	Not downwind
R600	Existing	362831	4891653	793	S31	709	39.0	Participating
R673	Existing	366974	4890051	582	S02	3849	39.0	Lake noise interference, not downwind
R235	Vacant	365888	4889147	806	S37	3265	38.9	Lake noise interference, not downwind
R337	Existing	368133	4891327	605	S13	4869	38.9	Participating
R467	Existing	363656	4888940	822	S20	2190	38.9	R008 and R493 are representative
R493	Existing	363947	4889535	722	S34	1701	38.9	Selected Receptor
M493	Monitoring Location	363913	4889495	715	S34	1725	39.0*	Selected Monitoring Location
R526	Existing	362022	4891479	553	S31	1305	38.9	Difficult access, large trees

ID	Description	Coordinates		Nearest Source Distance (m)			Predicted Sound Level @ 4.5 m Height (dBA) ±	Notes
				WTG		Transformer		
		X	Y	Distance	ID	Distance		
R537	Vacant	366953	4893452	519	S30	4374	38.9	Selected to represent R470 and R401
M537	Monitoring Location	366918	4893452	525	S30	4344	38.7	Selected Monitoring Location
R578	Vacant	365567	4888834	716	S21	3224	38.9	Participating
R582	Existing	368198	4891377	603	S13	4937	38.9	Lake noise interference
R609	Vacant	369303	4891969	659	S12	6097	38.9	Lake noise interference
R670	Existing	361834	4891347	600	S31	1457	38.9	Selected Receptor
M670	Monitoring Location	361788	4891384	659	S31	1509	38.1*	Selected Monitoring Location
R099	Existing	368290	4891445	620	S13	5033	38.8	Large trees and lake interference
R127	Existing	363902	4889092	977	S36	2101	38.8	R008 and R493 are representative
R211	Vacant	362482	4890207	834	S31	1187	38.8	Participating
R248	Vacant	363980	4889192	913	S21	2032	38.8	Participating
R265	Existing	368058	4891269	622	S13	4792	38.8	Lake noise interference
R322	Existing	365833	4889090	834	S37	3256	38.8	Lake noise interference
R463	Vacant	361867	4889920	848	S22	1830	38.8	Participating
R602	Existing	362078	4891512	552	S31	1262	38.8	R670 is representative
R608	Vacant	369253	4891943	656	S12	6044	38.8	Lake noise interference
R720	Vacant	363943	4889237	907	S34	1977	38.8	Participating
R040	Existing	365623	4888851	766	S21	3253	38.7	Lake noise interference
R128	Existing	366068	4889271	813	S37	3341	38.7	Lake noise interference
R180	Vacant	366000	4889211	814	S37	3318	38.7	Lake noise interference
R231	Existing	362126	4891540	556	S31	1227	38.7	R670 is representative
R239	Existing	366019	4889228	813	S37	3324	38.7	Lake noise and large trees
R251	Vacant	366186	4889351	839	S27	3399	38.7	Lake noise interference
R390	Vacant	364033	4889676	743	S34	1612	38.7	Alternative location for R493
R439	Existing	365949	4889171	817	S37	3299	38.7	Lake noise interference
R532	Vacant	366125	4889308	829	S37	3369	38.7	Lake noise interference

ID	Description	Coordinates		Nearest Source Distance (m)			Predicted Sound Level @ 4.5 m Height (dBA) ±	Notes
				WTG		Transformer		
		X	Y	Distance	ID	Distance		
R724	Existing	367973	4891218	643	S13	4705	38.7	Lake noise interference
R156	Vacant	358969	4890147	630	S01	4403	38.6	Participating
R224	Vacant	365458	4888627	710	S21	3300	38.6	Participating
R316	Existing	358861	4890030	571	S01	4535	38.6	Selected Receptor
M316	Monitoring Location	358813	4889962	546	S01	459851	38.7*	Selected Monitoring Location
R454	Existing	368019	4891231	644	S13	4752	38.6	Lake noise interference
R571	Vacant	364037	4889790	721	S34	1514	38.6	Alternative Location for R493
R584	Existing	359512	4890469	563	S29	3809	38.6	Lake noise interference
R667	Vacant	361446	4889693	781	S16	2300	38.6	Participating

± Sound levels taken from ENIA, unless otherwise specified [2]

* Sound level predicted by acoustic model prepared by HGC Engineering

APPENDIX B:
MONITORING LOCATION PHOTOS

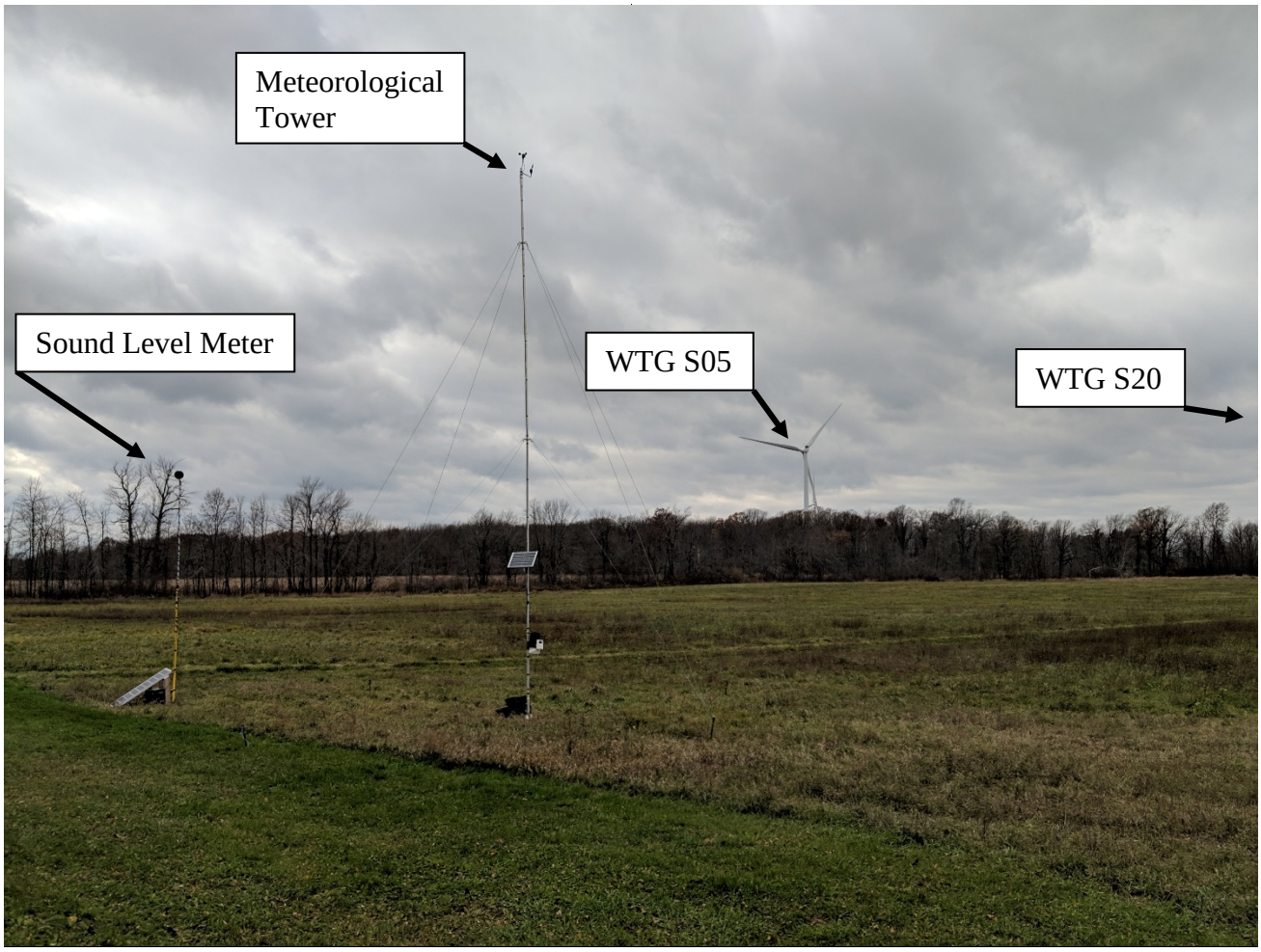


Photo of Meteorological Tower and Sound Level Meter at Location M008 (looking northwest)

Photo of Meteorological Tower and Sound Level Meter at Location M008 (looking southwest)

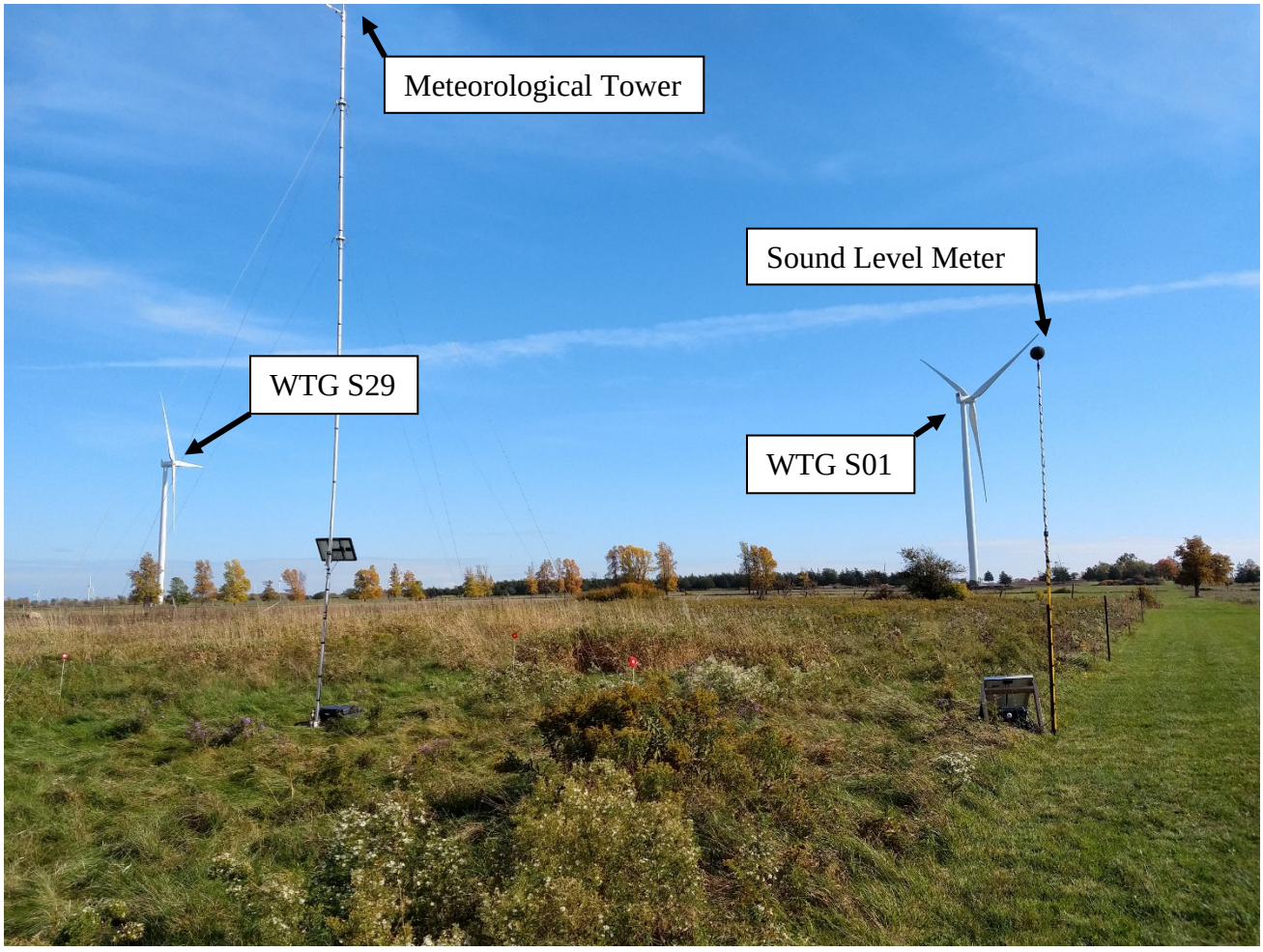


Photo of Meteorological Tower and Sound Level Meter at Location M316 (looking southeast)

Photo of Meteorological Tower and Sound Level Meter at Location M316 (looking north)

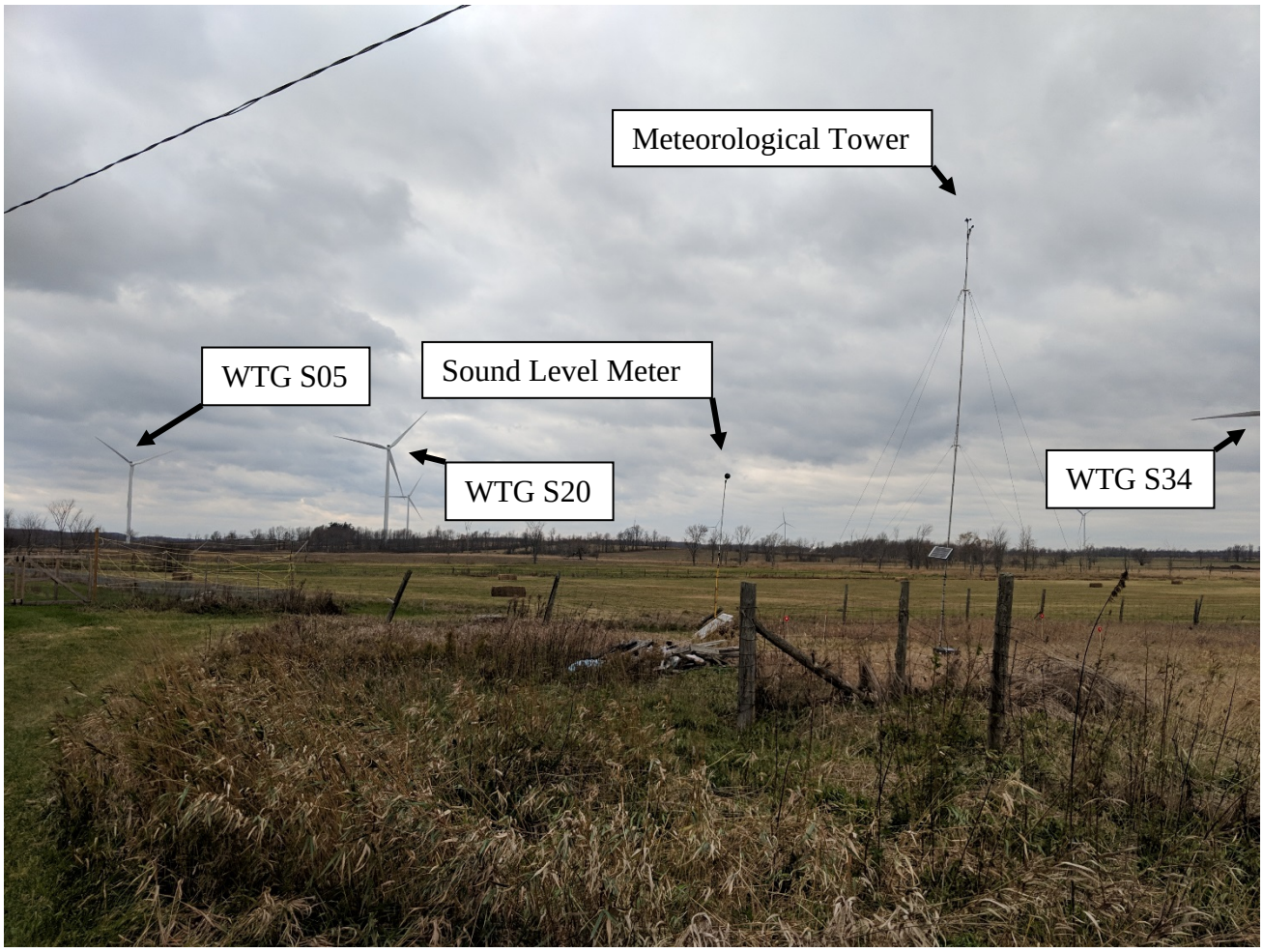


Photo of Meteorological Tower and Sound Level Meter at Location M493 (looking northwest)

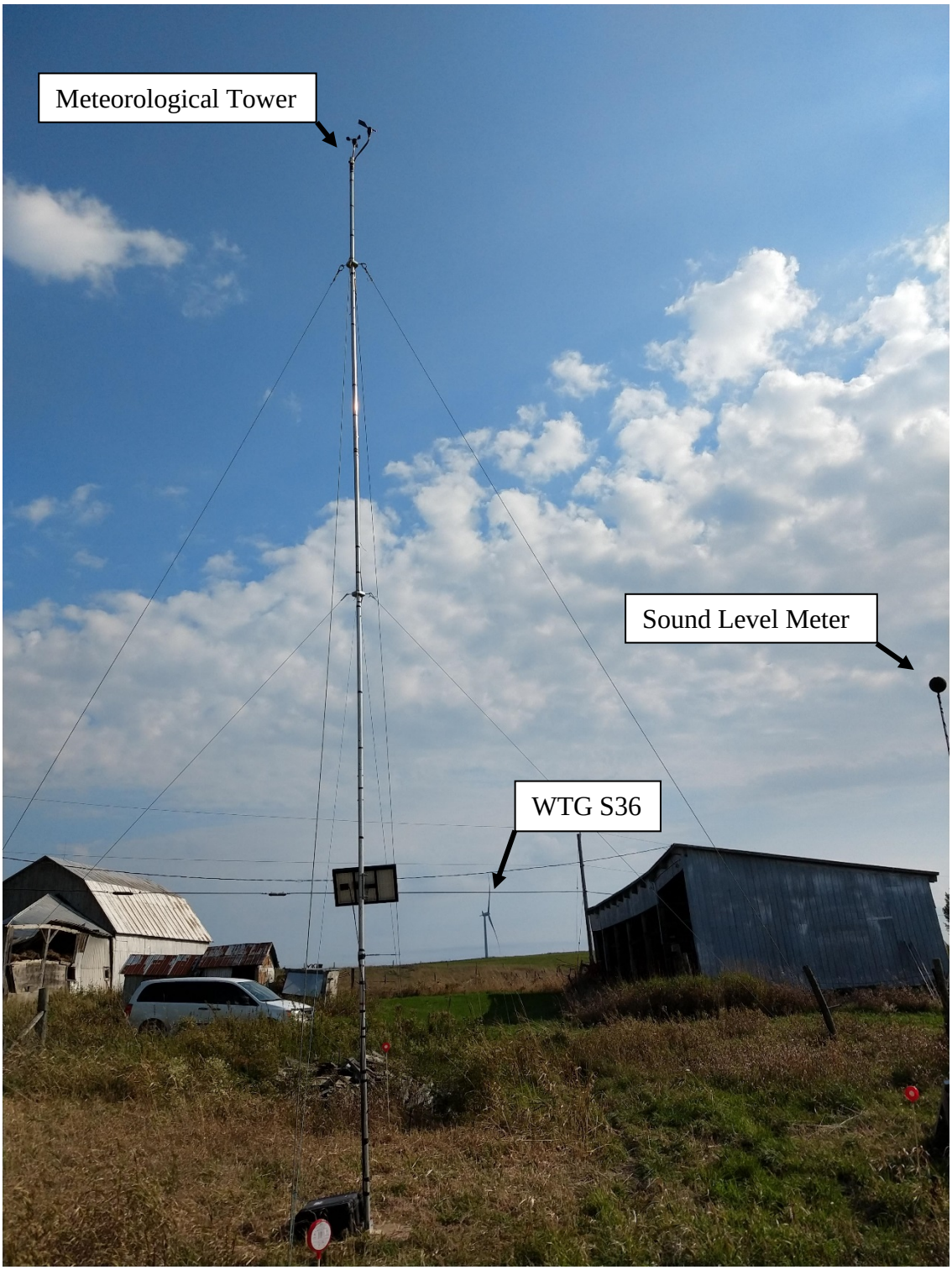


Photo of Meteorological Tower and Sound Level Meter at Location M493 (looking southeast)

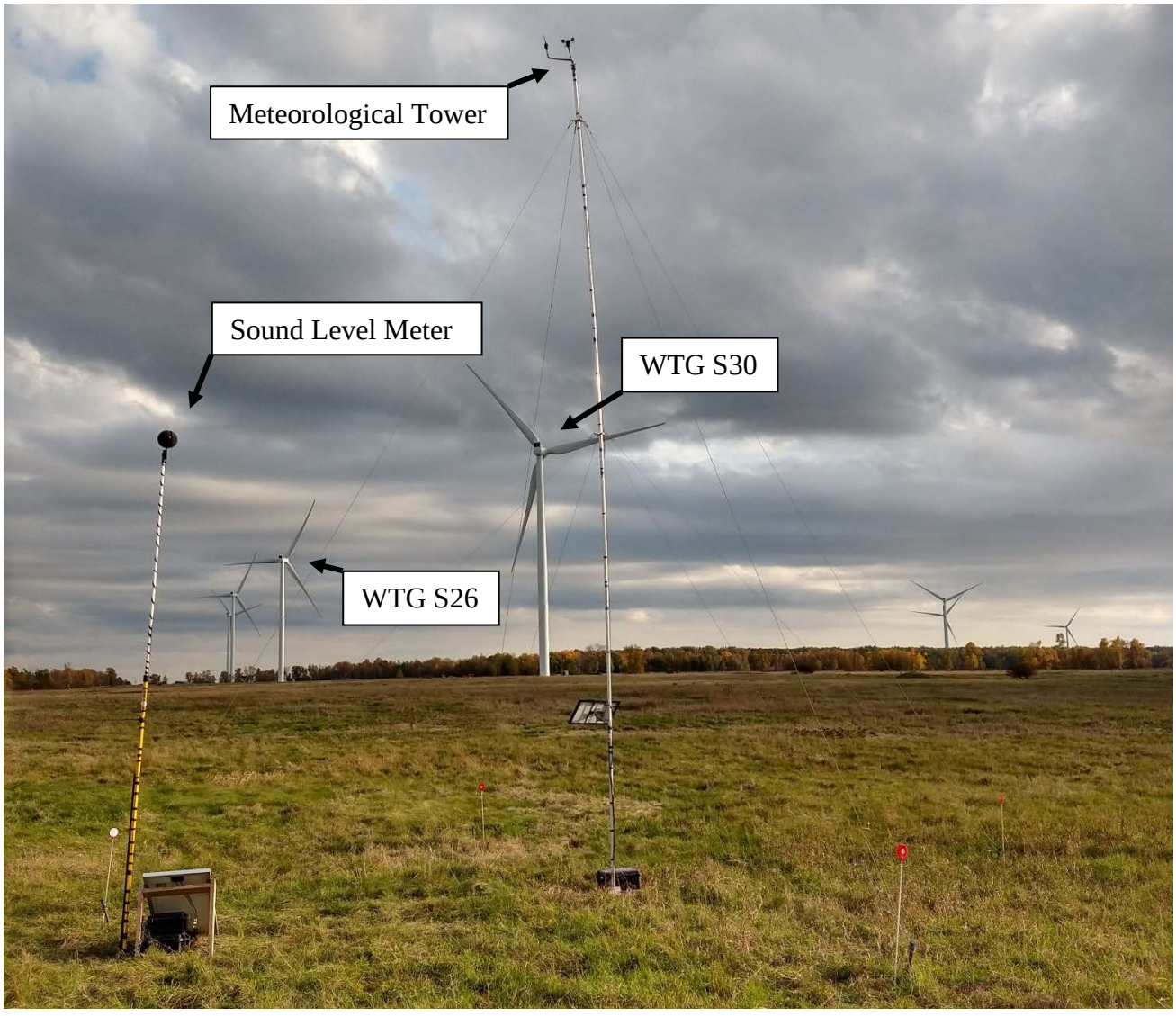


Photo of Meteorological Tower and Sound Level Meter at Location M537 (looking south)

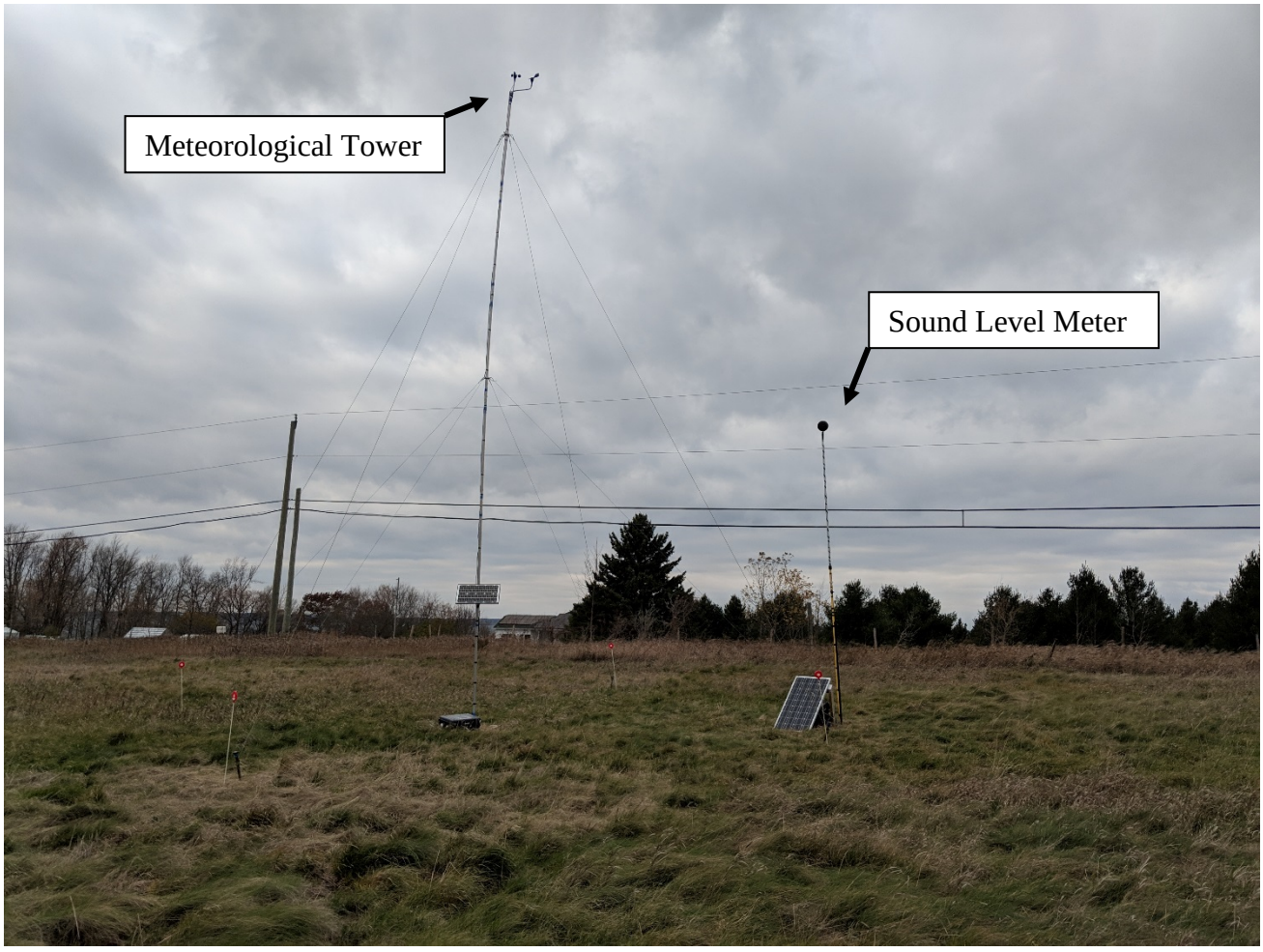


Photo of Meteorological Tower and Sound Level Meter at Location M537 (looking north)

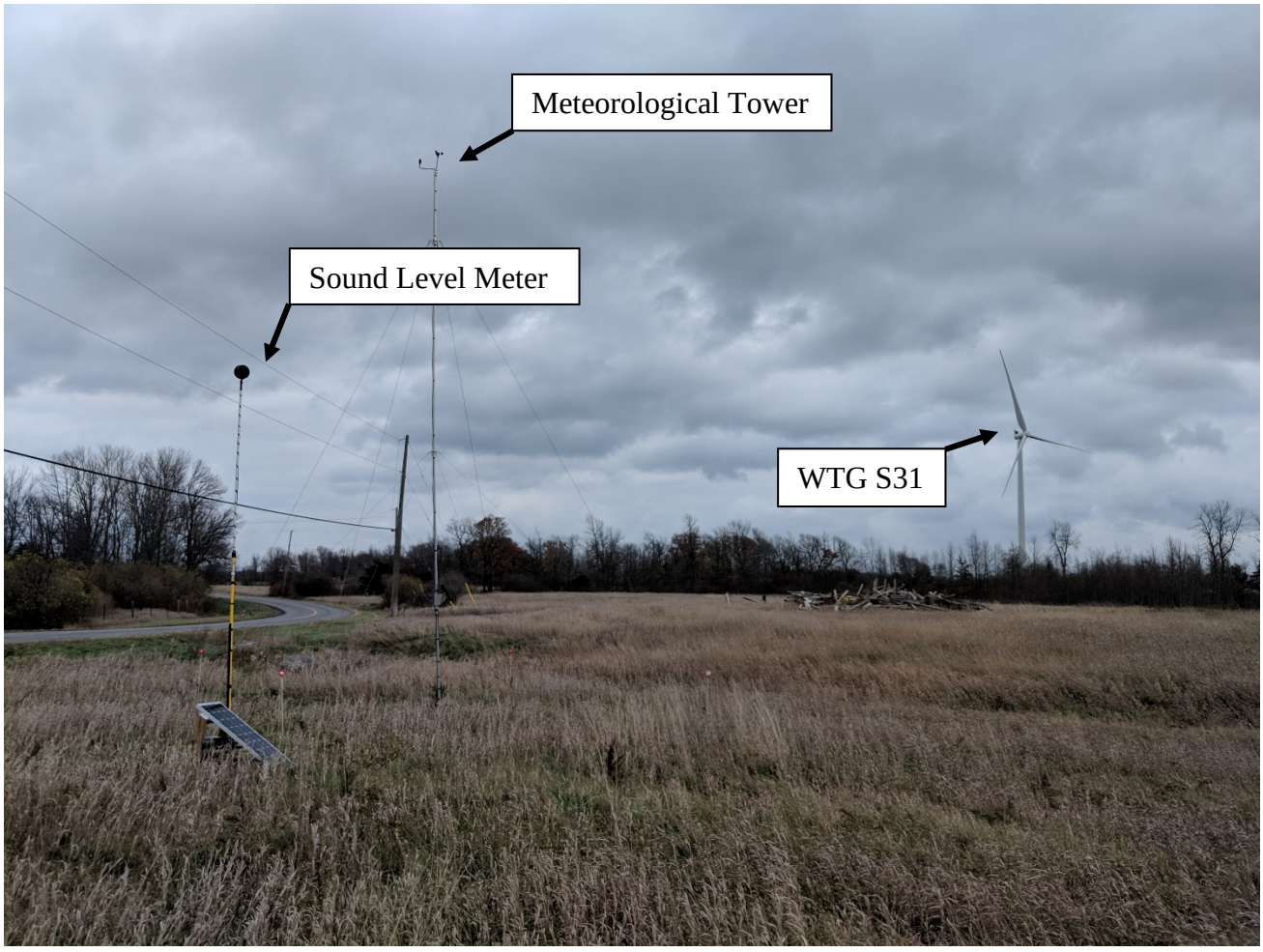


Photo of Meteorological Tower and Sound Level Meter at Location M670 (looking east)

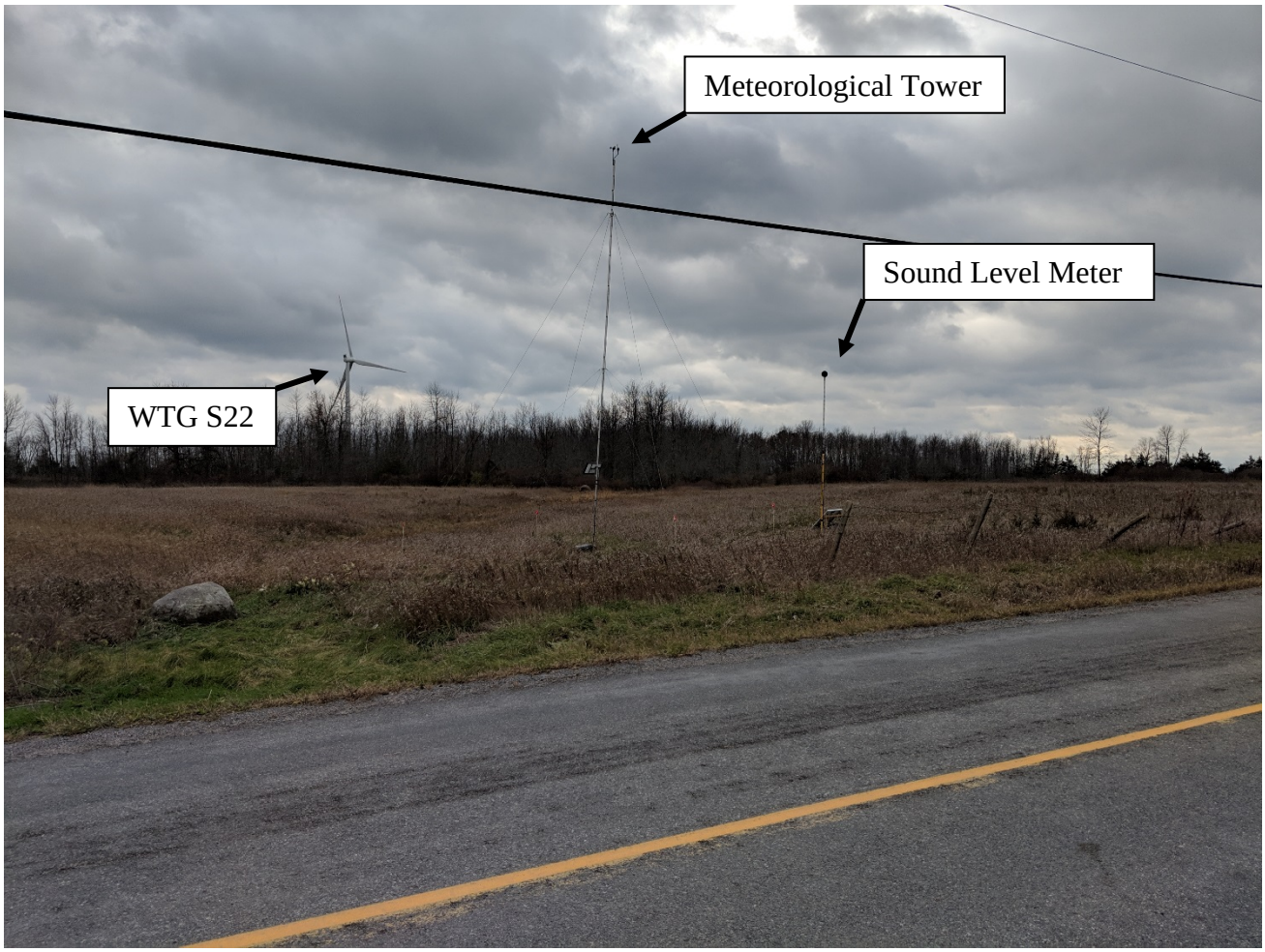


Photo of Meteorological Tower and Sound Level Meter at Location M670 (looking southwest)

APPENDIX C:
CALIBRATION CERTIFICATES

SOH Wind Engineering LLC
141 Leroy Road · Williston, VT 05495 · USA
Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

CERTIFICATE FOR CALIBRATION OF CUP ANEMOMETER

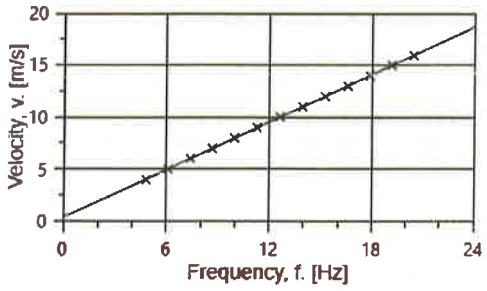
Certificate number: 19.US2.00555 **Date of issue:** January 18, 2019
Type: NRG 40C Anemometer **Serial number:** 179500245122
Manufacturer: NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA
Client: HGC Engineering, 2000 Argentia Road, Plaza One, Suite 203, Mississauga, ON L5N 1P7, Canada
Anemometer received: January 17, 2019 **Anemometer calibrated:** January 17, 2019
Calibrated by: MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
Certificate prepared by: EJF **Approved by:** Calibration engineer, EJF

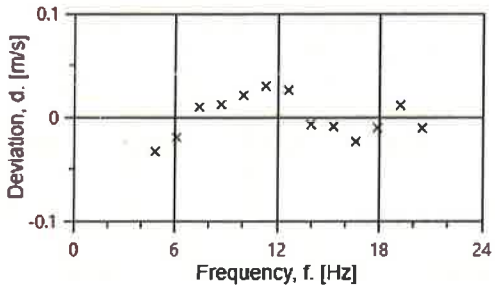
NR67
MJ
23 Jan 2019
Eric Jeffrey

Calibration equation obtained: v [m/s] = 0.76386 · f [Hz] + 0.35132

Standard uncertainty, slope: 0.00155 **Standard uncertainty, offset:** 0.04557
Covariance: -0.0000177 (m/s)²/Hz **Coefficient of correlation:** $\rho = 0.999987$
Absolute maximum deviation: -0.033 m/s at 3.983 m/s
Barometric pressure: 1018.3 hPa **Relative humidity:** 7.9%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	9.48	23.4	27.0	3.983	4.7970	-0.033	0.024
4	14.82	23.5	27.0	4.979	6.0846	-0.020	0.028
6	21.54	23.5	27.1	6.004	7.3865	0.010	0.032
8	29.15	23.4	27.1	6.984	8.6668	0.012	0.037
10	38.16	23.4	27.1	7.991	9.9728	0.022	0.041
12	48.35	23.4	27.1	8.995	11.2763	0.030	0.046
13-last	59.85	23.4	27.1	10.007	12.6070	0.026	0.051
11	72.19	23.4	27.1	10.991	13.9383	-0.007	0.055
9	86.02	23.4	27.1	11.998	15.2590	-0.009	0.060
7	100.80	23.4	27.1	12.989	16.5746	-0.023	0.065
5	116.98	23.4	27.0	13.993	17.8727	-0.011	0.070
3	134.41	23.4	27.0	15.000	19.1614	0.012	0.074
1-first	152.14	23.4	27.0	15.957	20.4437	-0.010	0.079





AC-1746

SOH Wind Engineering LLC
141 Leroy Road · Williston, VT 05495 · USA
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CERTIFICATE FOR CALIBRATION OF CUP ANEMOMETER

NRG 11
N6
8 Jan 2018

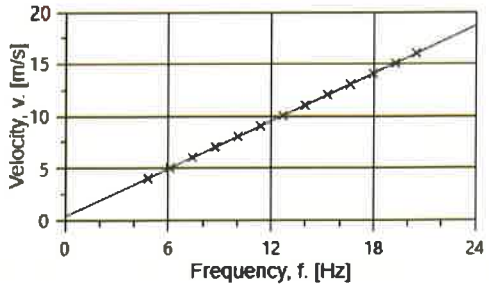
Certificate number: 18.US2.00837 **Date of issue:** January 25, 2018
Type: NRG 40C Anemometer **Serial number:** 179500262926
Manufacturer: NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA
Client: HGC Engineering, 2000 Argentia Road, Plaza One, Suite 203, Mississauga, ON L5N 1P7, Canada
Anemometer received: January 19, 2018 **Anemometer calibrated:** January 23, 2018
Calibrated by: MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
Certificate prepared by: EJF **Approved by:** Calibration engineer, EJF

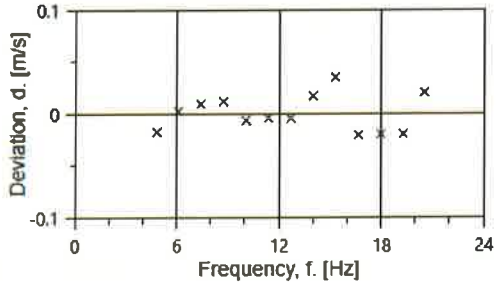
Eric Jeffcott

Calibration equation obtained: v [m/s] = 0.76360 · f [Hz] + 0.34642

Standard uncertainty, slope: 0.00137 **Standard uncertainty, offset:** 0.04097
Covariance: -0.0000138 (m/s)²/Hz **Coefficient of correlation:** ρ = 0.999990
Absolute maximum deviation: 0.035 m/s at 12.044 m/s
Barometric pressure: 992.9 hPa **Relative humidity:** 17.1%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	Temperature in d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	9.38	20.7	25.7	3.994	4.8006	-0.018	0.024
4	14.69	20.7	25.7	5.000	6.0908	0.002	0.025
6	21.18	20.8	25.7	6.003	7.3958	0.009	0.027
8	28.90	20.8	25.7	7.014	8.7162	0.012	0.030
10	37.73	20.8	25.7	8.015	10.0510	-0.007	0.033
12	47.81	20.8	25.7	9.022	11.3673	-0.004	0.036
13-last	59.05	20.8	25.7	10.027	12.6836	-0.005	0.039
11	71.49	20.8	25.7	11.032	13.9724	0.017	0.042
9	85.20	20.8	25.7	12.044	15.2729	0.035	0.045
7	99.66	20.8	25.7	13.026	16.6320	-0.021	0.048
5	116.08	20.7	25.7	14.057	17.9817	-0.020	0.051
3	132.84	20.7	25.7	15.037	19.2645	-0.020	0.054
1-first	150.83	20.6	25.7	16.020	20.4996	0.020	0.057





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SOH Wind Engineering LLC
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NRG 12
NG 30 Jan 2018

CERTIFICATE FOR CALIBRATION OF CUP ANEMOMETER

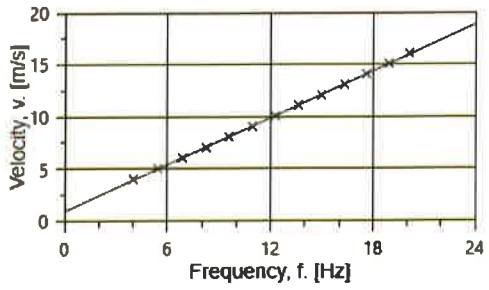
Certificate number: 18.US2.00838 **Date of issue:** January 25, 2018
Type: NRG 40C Anemometer **Serial number:** 179500262946
Manufacturer: NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA
Client: HGC Engineering, 2000 Argentia Road, Plaza One, Suite 203, Mississauga, ON L5N 1P7, Canada
Anemometer received: January 19, 2018 **Anemometer calibrated:** January 23, 2018
Calibrated by: MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
Certificate prepared by: EJF **Approved by:** Calibration engineer, EJF

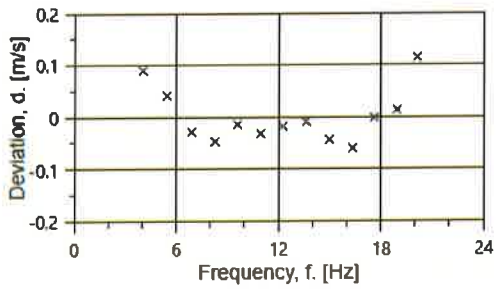
Eric Jeffrey

Calibration equation obtained: $v\,[m/s] = 0.74720 \cdot f\,[Hz] + 0.88867$

Standard uncertainty, slope: 0.00405 **Standard uncertainty, offset:** 0.04506
Covariance: -0.0001122 $(m/s)^2/Hz$ **Coefficient of correlation:** $\rho = 0.999910$
Absolute maximum deviation: 0.114 m/s at 16.027 m/s
Barometric pressure: 992.5 hPa **Relative humidity:** 17.0%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	9.37	21.0	25.7	3.995	4.0382	0.089	0.024
4	14.64	21.1	25.7	4.994	5.4391	0.041	0.025
6	21.11	21.1	25.7	5.997	6.8757	-0.029	0.027
8	28.78	21.1	25.7	7.004	8.2478	-0.047	0.030
10	37.78	21.1	25.7	8.025	9.5707	-0.015	0.033
12	47.78	21.1	25.7	9.026	10.9333	-0.032	0.036
13-last	59.01	21.1	25.7	10.031	12.2603	-0.018	0.039
11	71.66	21.1	25.7	11.054	13.6165	-0.009	0.042
9	84.82	21.1	25.7	12.025	14.9637	-0.044	0.045
7	99.53	21.1	25.7	13.026	16.3247	-0.061	0.048
5	115.73	21.1	25.7	14.045	17.6103	-0.002	0.051
3	132.88	21.0	25.7	15.049	18.9338	0.013	0.054
1-first	150.76	20.9	25.7	16.027	20.1077	0.114	0.057





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NRG 13
NG
30 Jan 2018

CERTIFICATE FOR CALIBRATION OF CUP ANEMOMETER

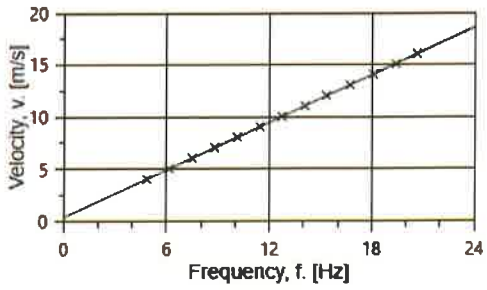
Certificate number: 18.US2.00840 **Date of issue:** January 25, 2018
Type: NRG 40C Anemometer **Serial number:** 179500265230
Manufacturer: NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA
Client: HGC Engineering, 2000 Argentia Road, Plaza One, Suite 203, Mississauga, ON L5N 1P7, Canada
Anemometer received: January 19, 2018 **Anemometer calibrated:** January 23, 2018
Calibrated by: MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
Certificate prepared by: EJF **Approved by:** Calibration engineer, EJF

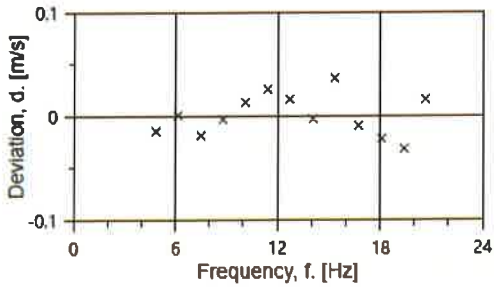
Eric Jeffcott

Calibration equation obtained: v [m/s] = 0.76049 · f [Hz] + 0.31991

Standard uncertainty, slope: 0.00155 **Standard uncertainty, offset:** 0.05025
Covariance: -0.0000176 (m/s)²/Hz **Coefficient of correlation:** ρ = 0.999987
Absolute maximum deviation: 0.036 m/s at 12.021 m/s
Barometric pressure: 991.5 hPa **Relative humidity:** 16.9%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	9.33	21.6	25.8	3.992	4.8481	-0.015	0.024
4	14.61	21.6	25.8	4.998	6.1507	0.000	0.025
6	21.06	21.6	25.8	6.000	7.4939	-0.019	0.027
8	28.72	21.7	25.8	7.007	8.7973	-0.004	0.030
10	37.63	21.7	25.8	8.021	10.1098	0.013	0.033
12	47.71	21.7	25.8	9.032	11.4232	0.025	0.036
13-last	58.59	21.7	25.8	10.009	12.7205	0.016	0.039
11	70.99	21.7	25.8	11.018	14.0710	-0.003	0.042
9	84.50	21.7	25.8	12.021	15.3385	0.036	0.045
7	99.29	21.6	25.8	13.030	16.7259	-0.010	0.048
5	115.45	21.6	25.8	14.051	18.0846	-0.022	0.051
3	132.30	21.6	25.8	15.040	19.3983	-0.032	0.054
1-first	150.21	21.5	25.8	16.024	20.6302	0.015	0.057





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CERTIFICATE FOR CALIBRATION OF CUP ANEMOMETER

NRG IS
30 Jan 208
MG

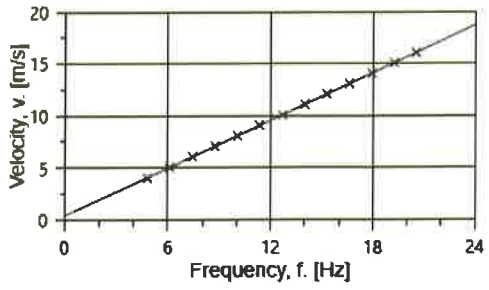
Certificate number: 18.US2.00839 **Date of issue:** January 25, 2018
Type: NRG 40C Anemometer **Serial number:** 179500266979
Manufacturer: NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA
Client: HGC Engineering, 2000 Argentia Road, Plaza One, Suite 203, Mississauga, ON L5N 1P7, Canada
Anemometer received: January 19, 2018 **Anemometer calibrated:** January 23, 2018
Calibrated by: MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
Certificate prepared by: EJF **Approved by:** Calibration engineer, EJF

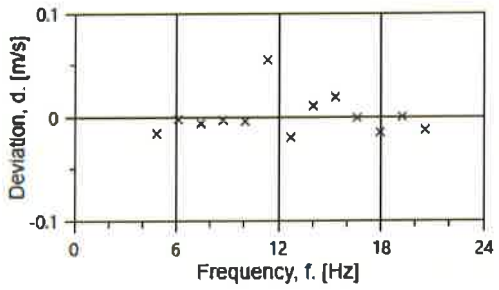
Eric Jeffrey

Calibration equation obtained: v [m/s] = 0.76400 · f [Hz] + 0.34251

Standard uncertainty, slope: 0.00151 **Standard uncertainty, offset:** 0.04584
Covariance: -0.0000169 (m/s)²/Hz **Coefficient of correlation:** ρ = 0.999987
Absolute maximum deviation: 0.055 m/s at 9.043 m/s
Barometric pressure: 992.0 hPa **Relative humidity:** 17.0%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	9.36	21.3	25.8	3.996	4.8028	-0.016	0.024
4	14.66	21.3	25.8	5.001	6.1008	-0.003	0.025
6	21.16	21.4	25.8	6.009	7.4256	-0.006	0.027
8	28.82	21.4	25.8	7.014	8.7375	-0.004	0.030
10	37.62	21.4	25.8	8.015	10.0485	-0.005	0.033
12	47.88	21.4	25.8	9.043	11.3161	0.055	0.036
13-last	58.76	21.4	25.8	10.018	12.6902	-0.020	0.039
11	71.41	21.4	25.8	11.043	13.9927	0.010	0.042
9	84.88	21.4	25.8	12.039	15.2854	0.019	0.045
7	99.39	21.4	25.8	13.028	16.6057	-0.001	0.048
5	115.47	21.3	25.8	14.041	17.9503	-0.015	0.051
3	132.54	21.3	25.8	15.042	19.2401	0.000	0.054
1-first	150.27	21.2	25.8	16.014	20.5291	-0.013	0.057





AC-1746

CERTIFICATE of CALIBRATION

Make : Svantek

Model : SVAN977

Descr. : Sound Level Meter Type 1

Serial # : 36426

Asset # : SV977-2

Reference # : 155091

Customer : HGC Engineering
Mississauga, ON

P. Order : Sean Richardson

NG 17 Jan 2019

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 calibration system complies with the requirements of ISO-17025 standard, 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 : Jan 15, 2019

Cal. Due : Jan 15, 2020

By : T. Beilin

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

Standards used : J-216 J-303 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

CERTIFICATE of CALIBRATION

Make : Norsonic

Model : NOR140

Descr. : Sound Level Meter Type 1

Serial # : 1404511

Asset # : N140-3

Reference # : 154933

Customer : HGC Engineering
Mississauga, ON

P. Order : Sean Richardson

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 calibration system complies with the requirements of ISO-17025 standard, 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 : Dec 21, 2018

Cal. Due : Dec 21, 2019

By : T. Beilin

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

Standards used : J-216 J-303 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

CERTIFICATE of CALIBRATION

Make : Norsonic

Model : NOR140

Descr. : Sound Level Meter Type 1

Serial # : 1403362

Asset # : N-140-2

Reference # : 154932

Customer : HGC Engineering
Mississauga, ON

P. Order : Sean Richardson

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 calibration system complies with the requirements of ISO-17025 standard, 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 : Dec 21, 2018

Cal. Due : Dec 21, 2019

By : T. Beilin

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

Standards used : J-216 J-303 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

CERTIFICATE of CALIBRATION

Make : Svantek

Model : SVAN977

Descr. : Sound Level Meter Type 1

Serial # : 36439

Asset # : SV977-4

Reference # : 155094

Customer : HGC Engineering
Mississauga, ON

P. Order : Sean Richardson
AG 17 Jan 2019

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 calibration system complies with the requirements of ISO-17025 standard, 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 : Jan 15, 2019

Cal. Due : Jan 15, 2020

By : T. Beilin

Temperature : 23 °C ± 2 °C

Relative Humidity : 30% to 70%

Standards used : J-216 J-303 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584
Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

CERTIFICATE of CALIBRATION

Make : Svantek

Model : SVAN977

Descr. : Sound Level Meter Type 1

Serial # : 36816

Asset # : SV977-5

Reference # : 155089

Customer : HGC Engineering
Mississauga, ON

P. Order : Sean Richardson

MG 17 Jan 2019

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 calibration system complies with the requirements of ISO-17025 standard, 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 : Jan 15, 2019

Cal. Due : Jan 15, 2020

By : T. Beilin

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

Standards used : J-216 J-303 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

CERTIFICATE of CALIBRATION

Make : Svantek

Model : SVAN977

Descr. : Sound Level Meter Type 1

Serial # : 36827

Asset # : SV977-6

Reference # : 155093

Customer : HGC Engineering
Mississauga, ON

P. Order : Sean Richardson
NB 17 Jan 2019

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 calibration system complies with the requirements of ISO-17025 standard, 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 : Jan 16, 2019

Cal. Due : Jan 16, 2020

By : T. Beilin

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

Standards used : J-216 J-303 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

CERTIFICATE of CALIBRATION

Make : Svantek

Model : SVAN977

Descr. : Sound Level Meter Type 1

Serial # : 45419

Asset # : SV977-7

Reference # : 155884

Customer : HGC Engineering
Mississauga, ON

P. Order :

15 Mar 2019

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 calibration system complies with the requirements of ISO-17025 standard, 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 : Mar 11, 2019

Cal. Due : Mar 11, 2020

By : T. Beilin

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

Standards used : J-216 J-303 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584
Fax: 905 565 8325
http: // www.navair.com
e-Mail: service @ navair.com

APPENDIX D:

DATA SUPPORTING THE USE OF MODIFIED FILTERS

Table D1 - Power Filter Comparison, M008, Amherst Island Wind Project

% of Rated Power (Turbine S20)	Parameter	10 m Height Wind Speed [m/s]		
		3	4	5
0 (OFF Condition)	No. of Data Points	134	162	122
	Std. Dev.	2.2	2.9	2.4
	Sound Level [dBA]	35	38	40
80 (Used in Analysis)	No. of Data Points	81	124	84
	Std. Dev.	1.5	1.6	1.5
	Sound Level [dBA]	40	41	42
	ON-OFF Sound Level [dBA]	**39**	**38**	**36**
85	No. of Data Points	50	98	75
	Std. Dev.	1.2	1.7	1.5
	Sound Level [dBA]	41	41	42
	ON-OFF Sound Level [dBA]	**40**	**38**	**36**

Table D2 - Power Filter Comparison, M316, Amherst Island Wind Project

% of Rated Power (Turbine S01)	Parameter	10 m Height Wind Speed [m/s]		
		5	6	7
0 (OFF Condition)	No. of Data Points	139	107	63
	Std. Dev.	1.6	1.2	0.9
	Sound Level [dBA]	41	42	43
70 (Used in Analysis)	No. of Data Points	86	107	64
	Std. Dev.	1.3	1.9	1.5
	Sound Level [dBA]	42	43	45
	ON-OFF Sound Level [dBA]	**31**	**37**	**39**
85	No. of Data Points	44	55	51
	Std. Dev.	1.5	1.7	1.5
	Sound Level [dBA]	42	44	45
	ON-OFF Sound Level [dBA]	**30**	**39**	**40**

Table D3 - Power Filter Comparison, M537, Amherst Island Wind Project

% of Rated Power (Turbine S30)	Parameter	10 m Height Wind Speed [m/s]		
		4	5	6
0 (OFF Condition)	No. of Data Points	254	79	50
	Std. Dev.	2.7	2.6	1.6
	Sound Level [dBA]	34	35	38
65 (Used in Analysis)	No. of Data Points	68	77	96
	Std. Dev.	1.3	1.1	1.0
	Sound Level [dBA]	40	41	42
	ON-OFF Sound Level [dBA]	**39**	**40**	**40**
85	No. of Data Points	16	22	59
	Std. Dev.	0.3	1.4	0.8
	Sound Level [dBA]	38	41	42
	ON-OFF Sound Level [dBA]	**36**	**39**	**40**

Table D4 – Power Filter Comparison, M670, Amherst Island Wind Project

% of Rated Power (Turbine S31)	Parameter	10 m Height Wind Speed [m/s]		
		2	4	5
N/A (OFF Condition)	No. of Data Points	265	194	143
	Std. Dev.	3.1	2.1	1.7
	Sound Level [dBA]	33	37	38
65 (Used in Analysis)	No. of Data Points	32	53	79
	Std. Dev.	0.8	1.5	1.4
	Sound Level [dBA]	39	39	41
	ON-OFF Sound Level [dBA]	**38**	**34**	**38**
85	No. of Data Points	6	23	55
	Std. Dev.	1.2	2.0	1.3
	Sound Level [dBA]	40	39	41
	ON-OFF Sound Level [dBA]	**39**	**35**	**39**

APPENDIX E:
TONALITY ANALYSIS

Table E1 – Summary of Tonality Analysis, M008, Amherst Island Wind Project

10 m Height Wind Speed Bin	Tone Count (of the same origin)	Data Bins Analyzed	Tone Presence	Average Tonal Audibility [dB]	Tonal Penalty [dB]
3	2	79	3%	No Relevant Tones	**0**
4	1	121	1%	No Relevant Tones	**0**
5	0	80	0%	No Relevant Tones	**0**

Table E2 – Summary of Tonality Analysis, M316, Amherst Island Wind Project

10 m Height Wind Speed Bin	Tone Count (of the same origin)	Data Bins Analyzed	Tone Presence	Average Tonal Audibility [dB]	Tonal Penalty [dB]
5	8	86	9%	No Relevant Tones	**0**
6	19	107	18%	No Relevant Tones	**0**
7	23	64	36%	1.4	**0**

Table E3 – Summary of Tonality Analysis, M493, Amherst Island Wind Project

10 m Height Wind Speed Bin	Tone Count (of the same origin)	Data Bins Analyzed	Tone Presence	Average Tonal Audibility [dB]	Tonal Penalty [dB]
5	1	101	1%	No Relevant Tones	**0**
6	4	132	3%	No Relevant Tones	**0**
7	0	91	0%	No Relevant Tones	**0**

Table E4 – Summary of Tonality Analysis, M537, Amherst Island Wind Project

10 m Height Wind Speed Bin	Tone Count (of the same origin)	Data Bins Analyzed	Tone Presence	Average Tonal Audibility [dB]	Tonal Penalty [dB]
4	13	68	19%	No Relevant Tones	**0**
5	3	77	4%	No Relevant Tones	**0**
6	1	96	1%	No Relevant Tones	**0**

Table E5 – Summary of Tonality Analysis, M670, Amherst Island Wind Project

10 m Height Wind Speed Bin	Tone Count (of the same origin)	Data Bins Analyzed	Tone Presence	Average Tonal Audibility [dB]	Tonal Penalty [dB]
2	6	32	19%	No Relevant Tones	**0**
4	2	53	4%	No Relevant Tones	**0**
5	0	79	0%	No Relevant Tones	**0**

APPENDIX F:

STATEMENT OF OPERATION

Liberty Power

December 11, 2019

Re: Statement of Operation
Amherst Island Wind Project
Amherst Island, Ontario

To whom it may concern,

This letter is to confirm that the wind turbine generators at the Amherst Island Wind Project were operating normally during the post-construction acoustic audit, conducted March 20 and November 25, 2019. Additionally, this letter confirms that the relevant turbines were parked for ambient (OFF) condition measurements.

Yours Truly,

Ian MacRobbie
Vice President, Operations
Liberty Power

APPENDIX G:

REPORT CHECKLIST

Information Required in the Acoustic Audit Report – Immission

Amherst Island Wind Farm, Phase 2 Immission, Version 4

Requirement	Complete?	Notes
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?	Y ☒ N ☐ N/A ☐	
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)?	Y ☒ N ☐ N/A ☐	
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?	Y ☒ N ☐ N/A ☐	
Was the predictable worst case parameters such as high wind shear and wind direction toward the Receptor considered? Section D3.2	Y ☒ N ☐ N/A ☐	
Is there a Wind Rose showing the wind directions at the site?	Y ☒ N ☐ N/A ☐	
Did the results cover a wind speed range of at least 4-7 m/s as outlined in section D 3.8.?	Y ☐ N ☐ N/A ☒	RAM-I audit used (Section E5.2)
Was the weather report during the measurement campaign included in the report?	Y ☒ N ☐ N/A ☐	
Did the audit state there was compliance with the limits at each wind speed category?	Y ☒ N ☐ N/A ☐	
Are pictures of the noise measurement setup near Point of reception provided?	Y ☒ N ☐ N/A ☐	
Was there justification of the Receptor location choice(s) prior to commencement of the I-Audit?	Y ☒ N ☐ N/A ☐	
Was there sufficient valid data for different wind speeds?	Y ☒ N ☐ N/A ☐	
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)?	Y ☒ N ☐ N/A ☐	

Requirement	Complete?	Notes
Were all the calculated standard deviations at all relevant integer wind speeds provided?	Y [X] N [ ] N/A [ ]	
Compliance statement	Y [X] N [ ] N/A [ ]	
All data included in an Excel spreadsheet	Y [X] N [ ] N/A [ ]	To be provided separately
If deviations from standard; was justification of the deviations provided	Y [ ] N [ ] N/A [X]	