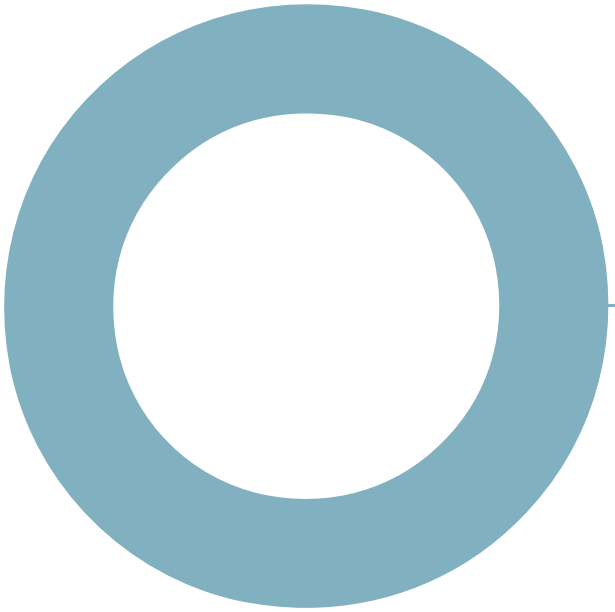
HOARE LEA

Millmoor Rig Wind Farm.
Technical Appendix 11.1 Noise

REVISION 02 – 24 AUGUST 2022

AUTHOR: RYLAN NORCROSS



Audit sheet.

Rev.	Date	Description	Prepared	Verified
01	08/07/2022	First version	RN	MMC
02	24/08/2022	Second version following comments	RN	MMC

Annex A – Glossary

Terminology	Description
A-weighting	A filter that down-weights low frequency and high frequency sound to better represent the frequency response of the human ear when assessing the likely effects of noise on humans
Acoustic character	One or more distinctive features of a sound (e.g. Tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest
Acoustic screening	The presence of a solid barrier (natural landform or manmade) between a source of sound and a receiver that interrupts the direct line of sight between the two, thus reducing the sound level at the receiver compared to that in the absence of the barrier
Ambient noise	All-encompassing noise associated with a given environment, usually a composite of sounds from many sources both far and near, often with no particular sound being dominant
Annoyance	A feeling of displeasure in this case evoked by noise
Attenuation	The reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.
Audio frequency	Any frequency of a sound wave that lies within the frequency limits of audibility of a healthy human ear, generally accepted as being from 20 Hz To 20,000 Hz
Background noise	The noise level rarely fallen below in any given location over any given time period, often classed according to day time, evening or night time periods (for the majority of the population of the UK the lower limiting noise level is usually controlled by noise emanating from distant road, rail or air traffic)
Db	Abbreviation for 'decibel'
Db(a)	Abbreviation for the decibel level of a sound that has been a-weighted
Decibel	The unit normally employed to measure the magnitude of sound
Directivity	The property of a sound source that causes more sound to be radiated in one direction than another
Equivalent continuous sound pressure level	The steady sound level which has the same energy as a time varying sound signal when averaged over the same time interval, t, denoted by $L_{Aeq,t}$
External noise level	The noise level, in decibels, measured outside a building
Filter	A device for separating components of an acoustic signal on the basis of their frequencies
Frequency	The number of acoustic pressure fluctuations per second occurring about the atmospheric mean pressure (also known as the 'pitch' of a sound)
Frequency analysis	The analysis of a sound into its frequency components
Ground effects	The modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver
Hertz	The unit normally employed to measure the frequency of a sound, equal to cycles per second of acoustic pressure fluctuations about the atmospheric mean pressure
Impulsive sound	A sound having all its energy concentrated in a very short time period
Instantaneous sound pressure	At a given point in space and at a given instant in time, the difference between the instantaneous pressure and the mean atmospheric pressure
Internal noise level	The noise level, in decibels, measured inside a building
L_{Aeq}	The abbreviation of the a-weighted equivalent continuous sound pressure level
L_{A10}	The abbreviation of the 10 percentile noise indicator, often used for the measurement of road traffic noise
L_{A90}	The abbreviation of the 90 percentile noise indicator, often used for the measurement of background noise
Level	The general term used to describe a sound once it has been converted into decibels
Loudness	The attribute of human auditory response in which sound may be ordered on a subjective scale that typically extends from barely audible to painfully loud
Noise	Physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure.

Terminology	Description
	Subjectively: sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise emission	The noise emitted by a source of sound
Noise immission	The noise to which a receiver is exposed
Noise nuisance	An unlawful interference with a person's use or enjoyment of land, or of some right over, or in connection with it
Octave band frequency analysis	A frequency analysis using a filter that is an octave wide (the upper limit of the filter's frequency band is exactly twice that of its lower frequency limit)
Percentile exceeded sound level	The noise level exceeded for n% of the time over a given time period, t, denoted by $L_{An,t}$
Receiver	A person or property exposed to the noise being considered
Residual noise	The ambient noise that remains in the absence of the specific noise whose effects are being assessed
Sound	Physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure
	Subjectively: the sensation of hearing excited by the acoustic oscillations described above (see also 'noise')
Sound level meter	An instrument for measuring sound pressure level
Sound pressure amplitude	The root mean square of the amplitude of the acoustic pressure fluctuations in a sound wave around the atmospheric mean pressure, usually measured in pascals (Pa)
Sound pressure level	A measure of the sound pressure at a point, in decibels
Sound power level	The total sound power radiated by a source, in decibels
Spectrum	A description of the amplitude of a sound as a function of frequency
Standardised wind speed	Values of wind speed at hub height corrected to a standardised height of ten metres using the same procedure as used in wind turbine emission testing
Threshold of hearing	The lowest amplitude sound capable of evoking the sensation of hearing in the average healthy human ear (0.00002 Pa)
Tone	The concentration of acoustic energy into a very narrow frequency range

Annex B – Location Maps and Turbine Coordinates

Figure B1 Map showing the layout of the turbines (red dots), the noise monitoring locations (yellow dots) and the noise assessment locations (black dots).

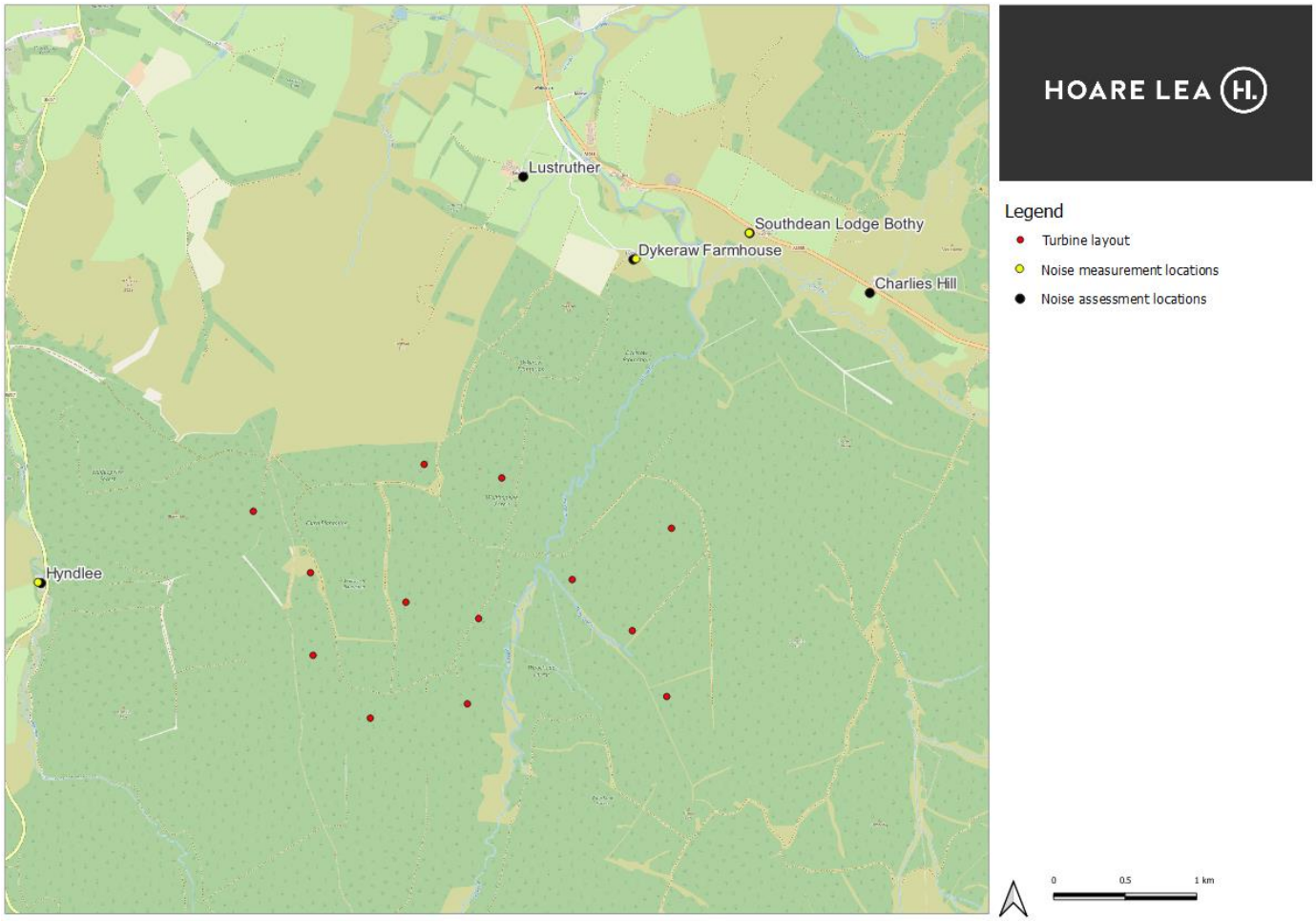


Table B1 – Turbine coordinates and hub heights for the proposed development

Turbine	Easting	Northing	Hub height (m)
1	363467	605540	118.5
2	363225	606000	118.5
3	363500	606716	98.5
4	362806	606357	128.5
5	362152	606085	148.5
6	362073	605489	148.5
7	362314	607067	98.5
8	361771	607162	98.5
9	360577	606834	98.5
10	360977	606405	98.5
11	360995	605828	128.5
12	361395	605389	128.5
13	361644	606198	128.5

Table B2 - Propagation attenuation effects due to terrain (dB) – positive numbers are due to terrain shielding barrier effects (e.g. 2), representing a decrease in noise levels, and negative numbers (e.g. -3) represent an increase in predicted noise levels due to concave ground effects. Where there is a zero shown, neither terrain shielding nor concave ground were found.

Turbine number	Property				
	Dykeraw Farmhouse	Lustruther	Hyndlee	Charlies Hill	Southdean Lodge Bothy
1	0	0	2	0	-3
2	0	0	2	0	0
3	0	0	2	0	0
4	0	0	2	0	0
5	0	0	2	0	0
6	0	0	2	0	0
7	0	0	2	-3	0
8	0	0	2	0	0
9	0	0	2	-3	0
10	0	0	2	-3	-3
11	0	0	2	-3	0
12	0	0	2	0	0
13	0	0	2	-3	0

Turbine Details: the Proposed Development

The exact model of turbine to be used at the site will be the result of a future tendering process and therefore a representative turbine model has been assumed for this noise assessment. This operational noise assessment is based upon the noise specification of the Nordex N163 5.7 MW wind turbine. 13 turbines have been modelled using the layout as indicated on the map at Annex B. The candidate turbine is a variable speed, pitch regulated machine with a rotor diameter of 163 metres and hub heights of 98.5, 118.5, 128.5 and 148.5 metres. Due to its variable speed operation the sound power output of the N163 5.7 MW turbine varies considerably with wind speed, being quieter at the lower wind speeds when the blades are rotating more slowly.

Nordex have supplied specified noise emission data for the N163 5.7 MW turbine. In the absence of specific information about uncertainty allowances in the data, a further correction factor of +2 dB was added to the specification data in line with advice in the IOA GPG. The sound power data has been made available for standardised 10 m reference wind speeds of 3 m/s to 12 m/s inclusive. In addition to the overall sound power data, reference has been made to the Nordex N133 4.8 MW turbine test reports in the absence of available sound power spectra for the N163 5.7 MW turbine, to derive a representative sound spectrum for the turbine. The overall sound power and spectral data are presented in Table B3 and Table B4 respectively.

Table B3 - Wind turbine sound power levels (dB L_{Aeq}) used in the noise assessment - the Proposed Development

Turbine make / model	Standardised 10 m Wind Speed (m/s)									
	3	4	5	6	7	8	9	10	11	12
Nordex N163 5.7MW (Mode 0) 98.5 m & 118.5 m hub heights	97.5	100	104.8	108.9	109.2	109.2	109.2	109.2	109.2	109.2
Nordex N163 5.7MW (Mode 0) 128.5 m & 148.5 m hub heights	97.5	100.5	105.4	109.2	109.2	109.2	109.2	109.2	109.2	109.2
Derived from: Nordex document 'Noise level, Power curves, Thrust curves', F008_276_A13_EN, 08/07/2021										

Table B4 - Octave band sound power spectrum (dB L_{Aeq}) for reference wind speed conditions (v_{10} = 8 m/s) - the Proposed Development

Turbine make / model	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	A
Nordex N133 4.8MW	92.1	97.8	100.1	100.9	102.7	103.2	100.9	90.3	109.1
Derived from: Nordex document 'Octave sound power levels', reference F008_272_A14_EN, 01/03/2018									

Cumulative Site Details: Pines Burn Wind Farm

Assessment of the cumulative noise from operating the consented Pines Burn Wind Farm together with the Proposed Development also requires source information for the coordinates and turbine type. The data assumed for Pines Burn Wind Farm, as outlined in Table B3, is based on the Nordex N100/3300, N117/3000 and N100/2500 turbine models, which are consistent with the candidate turbines specified in the noise assessment[1] for Pines Burn Wind Farm. Specified noise emission data for these turbines running unconstrained are also presented in Table B5. In the absence of specific information about uncertainty allowances in the data, a further correction factor of +2 dB was added to the specification data in line with advice in the IOA GPG.

Table B3 – Turbine information, coordinates and modelled hub heights for Pines Burn Wind Farm

Turbine	Model	Easting	Northing	Hub height (m)
PB1	N100/3300	354081	606741	80
PB2	N100/2500	354421	606670	80
PB3	N100/3300	353982	606387	80
PB4	N117/3000	354591	606344	91.4
PB5	N100/3300	353765	606033	80
PB6	N117/3000	354171	605998	91.4
PB7	N117/3000	354828	606020	91.4
PB8	N100/3300	353573	605649	80
PB9	N117/3000	354346	605731	91.4
PB10	N117/3000	354631	605559	91.4
PB11	N117/3000	353891	605415	91.4
PB12	N117/3000	354170	605208	91.4

[1] Pines Burn Wind Farm Environmental Statement: Volume 1, Energiekontor Uk Ltd, December 2016

Table B4 - Wind turbine sound power levels (dB L_{Aeq}) used in the noise assessment – Pines Burn Wind Farm

Turbine make / model	Standardised 10 m Wind Speed (m/s)									
	3	4	5	6	7	8	9	10	11	12
Nordex N117/3000[2] (Standard mode) 91.4 m hub height	94.5	97.1	102.8	105	105.5	105.5	105.5	105.5	105.5	105.5
Nordex N100/3300[3] (Standard mode) 80 m hub height	95.1	97.2	100.7	104.8	105.4	106.2	106.5	106.5	106.5	106.5
Nordex N100/2500[4] (Unconstrained) 80m hub height	98.8	100.8	103.1	106.4	107.8	108.0	108.0	108.0	108.0	108.0

Table B5 - Octave band sound power spectrum (dB L_{Aeq}) for reference wind speed conditions (v_{10} = 8 m/s) – Pines Burn Wind Farm

Turbine make / model	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	A
Nordex* N117/3600[5]	80.7	86.9	89.7	90.3	93.1	94.5	93.4	84.2	99.9
Nordex* N100/2500[6]	87.1	92.8	99.6	101.4	99.5	94.9	93.2	85.2	105.9

* In absence of available spectra for the N117/3000, a representative spectrum for the N117/3600 turbine was used.

* In absence of available spectra for the N100/3300, a representative spectrum for the N100/2500 turbine was used.

[2] Nordex N117/3000 document 'Noise level, Power curves, Thrust curves', F008_274_A13_EN, 10/05/2018
[3] Nordex N100/3300 document 'Noise level, Power curves, Thrust curves', F008_242_A13_EN, 23/10/2015
[4] Nordex N100/2500 April 2010 specification documents, F008_228_A03_EN Rev 04, 19/04/2010
[5] N117/3600 Spectra documentation, F008_255_A14_EN, 18/05/2017
[6] N100/2500 Spectra documentation, K0818_014289_EN, 26/04/2010

Annex C – Noise Monitoring Information Sheets

Table C1 – Information on the measurement location, equipment and noise data at Southdean Bothy Lodge.

Measurement Location Name	Southdean Lodge Bothy
Measurement Location Description	The Southdean Lodge Bothy property is situated approximately 1 km south east from the hamlet of Southdean in the Scottish Borders, on the south side of the A6088 road. In relation to the proposed development, the property is located to the northeast, more than 2 km, from the nearest proposed turbine. Despite other residential properties in the area situated closer to the proposed development, such as Dykeraw Farmhouse, a background noise measurement at Southdean Lodge Bothy was requested by Southdean Community Council. The noise logger was situated in the primary rear garden amenity area of the property, alongside the back fence and facing the Proposed Development area. The house, assisted by the slope of the lawn from the house, was used to partially shield road traffic noise from vehicles passing directly in front of the property, likely resulting in lower background noise measurements. The fence adjoining the measurement location was considered unlikely to rattle during high winds. Ambient sources of noise observed during visits included clearly audible but intermittent road traffic noise, with noise from local vegetation and bird noise otherwise present. No boiler outlets or flue was observed on the rear façade of the house, nor any watercourses audible near the property. SLM Location: 364019, 608755

Equipment	Type	Serial Number	Last Calibrated (UKAS)
Sound Level Meter	Rion NL-32	630481	28/09/2020
Pre-amplifier	Rion NH-21	9098	28/09/2020
Microphone	Rion UC-53A	305115	28/09/2020
Calibrator	Rion NC-74	34172706	14/06/2021
SLM Range	20 – 110 dB(A)		

File	Time Start (GMT)	Time End (GMT)	Cal Start	Cal End	Drift	Notes
01	16/05/2022 13:50	31/05/2022 13:20	94.0	93.8	-0.2	No significant drift
02	31/05/2022 13:50	14/06/2022 10:20	94.0	93.9	-0.1	No significant drift

Data Exclusions
Periods 10 minutes before, after and during any rainfall occurrence. Quiet Daytime excluded periods (in GMT time, -1 hour from local BST time) due to atypical noise levels: - 18/05/2022 17:00 to 17:20 - 18/05/2022 18:10 to 18:30 - 28/05/2022 13:30 to 16:30 - 29/05/2022 08:50 to 09:00 - 31/06/2022 14:50 to 15:10 Night-time excluded periods: - Early morning dawn bird chorus from 03:00 to 06:00 GMT.

Figure C1 View of the monitoring location at Southdean Bothy Lodge looking northeast

Figure C2 View of the monitoring location at Southdean Bothy Lodge looking southeast

Figure C3 View of the monitoring location at Southdean Bothy Lodge looking west

Figure C4 View of the monitoring location at Southdean Bothy Lodge looking southwest

Table C2 – Information on the measurement location, equipment and noise data at Dykeraw Farmhouse.

Measurement Location Name	Dykeraw Farmhouse
Measurement Location Description	Dykeraw Farmhouse is situated approximately 500 m south from the hamlet of Southdean in the Scottish Borders, on an elevated hilltop position overlooking the A6088 road, which is also 500 m away. In relation to the Proposed Development, the property is located to the northeast, approximately 1.6 km, from the nearest proposed turbine. The noise logger was situated in the rear garden amenity area for Dykeraw Farmhouse, facing the Proposed Development towards the south. Ambient sources of noise observed during visits included occasional distant road traffic noise when passing vehicles were present on the A6088 in the valley, which was partially shielded by the house. Local vegetation, bird and insect noise were otherwise audible. No boiler flue or extract outlets were observed on the façade of the house facing the logger, nor were any watercourses near the property. SLM Location: 363254, 608572

Equipment	Type	Serial Number	Last Calibrated (UKAS)
Sound Level Meter	Rion NL-52	632045	23/11/2021
Pre-amplifier	Rion NH-25	32073	23/11/2021
Microphone	Rion UC-59	11317	23/11/2021
Calibrator	Rion NC-74	34172706	14/06/2021
SLM Range	20 – 120 dB(A)		

File	Time Start (GMT)	Time End (GMT)	Cal Start	Cal End	Drift	Notes
01	16/05/2022 15:20	31/05/2022 14:10	94.0	93.7	-0.3	No significant drift
02	31/05/2022 14:30	14/06/2022 10:40	94.0	94.0	0.0	No significant drift

Data Exclusions
Periods 10 minutes before, after and during any rainfall occurrence. Quiet Daytime excluded periods (in GMT time, -1 hour from local BST time) due to atypical noise levels: - 06/06/2022 17:20 to 17:50 - 12/06/2022 19:20 to 19:50 Night-time excluded periods: - Early morning dawn bird chorus from 03:00 to 06:00 GMT. Excluded night-time periods (in GMT time, -1 hour from local BST time) due to atypical noise levels: - 26/05/2022 22:20 to 23:20 - 27/05/2022 02:10 to 06:00 - 12/06/2022 04:00 to 06:00

Figure C5 View of the monitoring location at Dykeraw Farmhouse looking northeast

Figure C6 View of the monitoring location at Dykeraw Farmhouse looking southeast

Figure C7 View of the monitoring location at Dykeraw Farmhouse looking southwest

Figure C8 View of the monitoring location at Dykeraw Farmhouse looking northwest

Table C3 – Information on the measurement location, equipment and noise data at Hyndlee.

Measurement Location Name	Hyndlee
Measurement Location Description	Hyndlee is situated west of the proposed turbines, approximately 5.5 km south of the village of Bonchester Bridge, in the Scottish Borders. In relation to the proposed development, the property is located approximately 1.5 km south west of the nearest proposed turbine. To minimise water noise from the Catlee Burn and occasional road traffic noise on the B6357 road, the noise logger was positioned in the rear garden amenity area of the house, screened from these sources. Although this location faces away from the proposed turbines, it provides a more conservative background noise assessment. Bird and insect noise dominated the local noise environment, unless a vehicle passed on road in front of the property which otherwise dominated. Vegetation coverage was similar in front and behind the property, and was also present as a noise source. Noise from distant lambs could also be heard. Watercourse noise from the Catlee Burn was barely audible at the installed logger position in the rear garden. No boiler flue or extract outlets were observed on the façade of the house facing the logger. SLM Location: 359030, 606343

Equipment	Type	Serial Number	Last Calibrated (UKAS)
Sound Level Meter	Rion NL-52	832244	14/01/2022
Pre-amplifier	Rion NH-25	32272	14/01/2022
Microphone	Rion UC-59	05471	14/01/2022
Calibrator	Rion NC-74	34172706	14/06/2021
SLM Range	20 – 120 dB(A)		

File	Time Start (GMT)	Time End (GMT)	Cal Start	Cal End	Drift	Notes
01	17/05/2022 09:40	31/05/2022 15:00	94.0	93.9	-0.1	No significant drift
02	31/05/2022 15:20	14/06/2022 11:20	94.0	94.0	0.0	No significant drift

Data Exclusions
Periods 10 minutes before, after and during any rainfall occurrence. Quiet Daytime excluded periods (in GMT time, -1 hour from local BST time) Quiet Daytime excluded periods (in GMT time, -1 hour from local BST time) due to atypical noise levels: - 28/05/2022 12:40 to 14:00 - 28/05/2022 14:50 to 17:20 - 30/05/2022 21:10 to 21:50 - 31/05/2022 17:20 to 19:50 - 05/06/2022 12:30 to 13:40 - 08/06/2022 08:10 to 09:50 Nighttime excluded periods: Early morning dawn bird chorus from 03:00 to 06:00 GMT.

Figure C9 View of the monitoring location at Hyndlee looking west

Figure C10 View of the monitoring location at Hyndlee looking south

Figure C11 View of the monitoring location at Hyndlee looking east

Figure C12 View of the monitoring location at Hyndlee looking north

Annex D – Wind Speeds and Directions

Figure D1 Wind speed and direction range during all quiet day-time periods (Dykeraw Farmhouse data shown; other data excluded at some of the other locations).

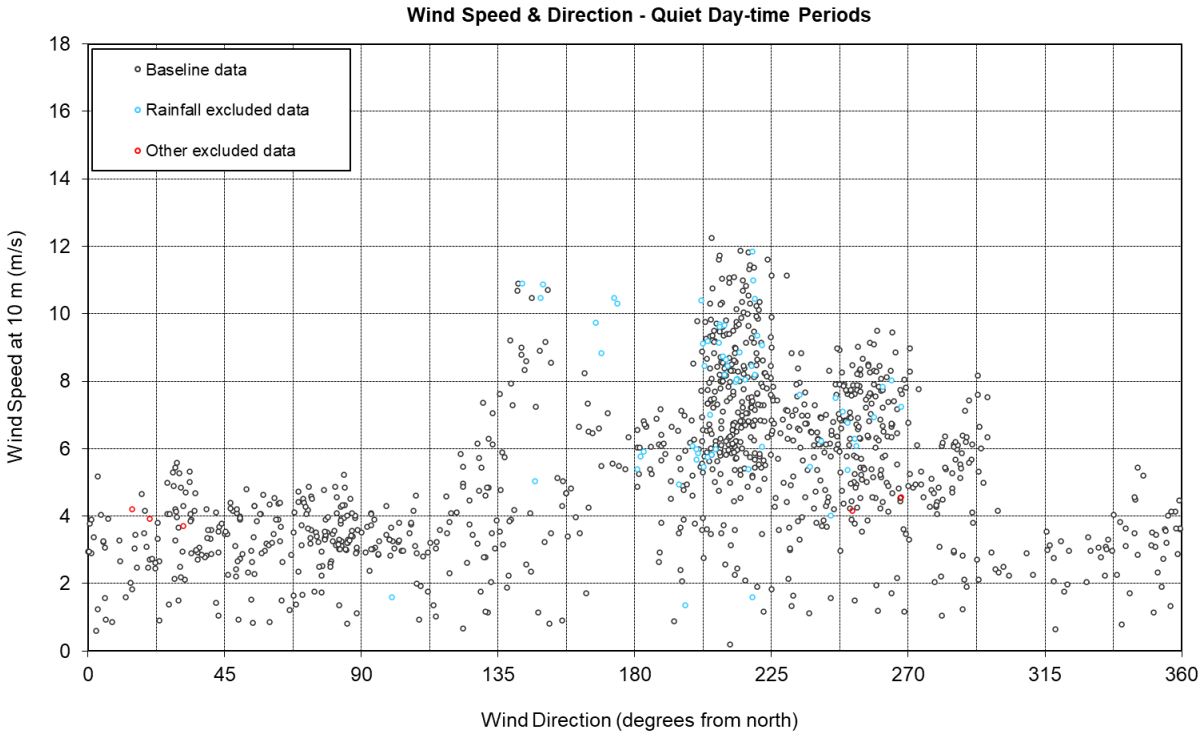
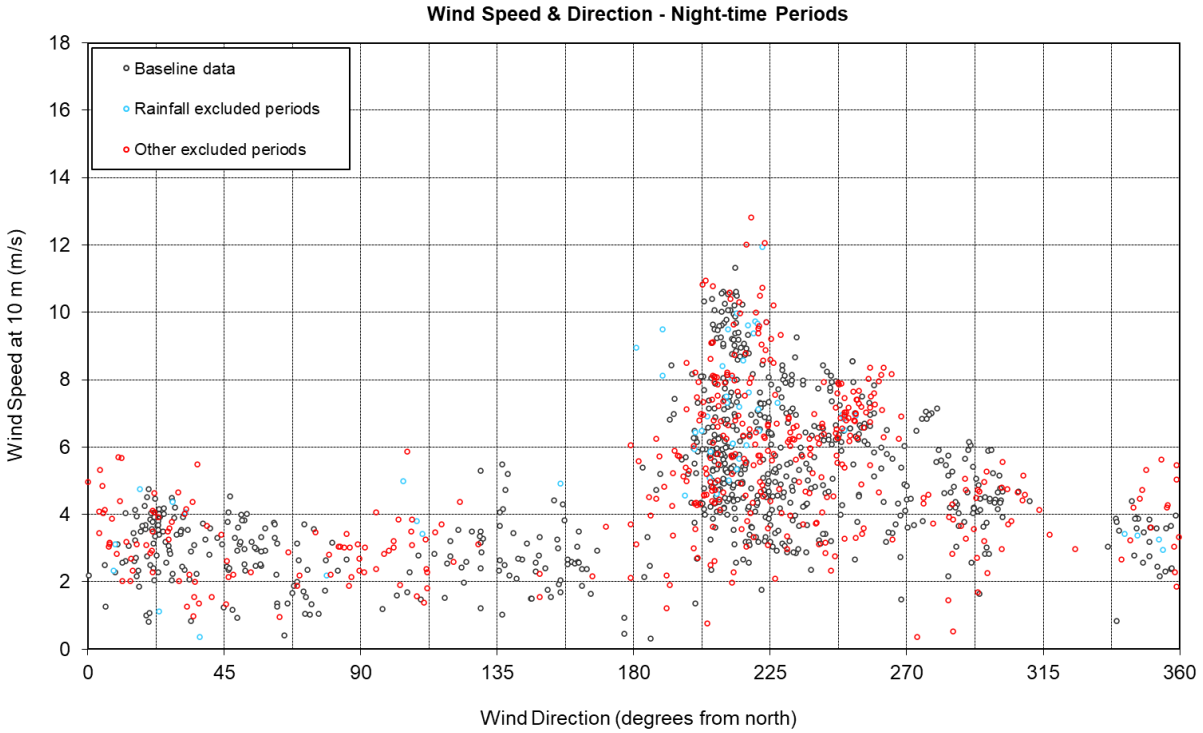


Figure D2 Wind speed and direction range during all night-time periods (Dykeraw Farmhouse data shown; other data excluded at some of the other locations).



Annex E – Background Noise and Noise Limits

Figure E1 Chart of background noise levels against wind speeds, the best fit curve to the data, the derived noise limit curve for Southdean Lodge Bothy during quiet day time periods. Predicted immission noise levels are also shown for the Proposed Development.

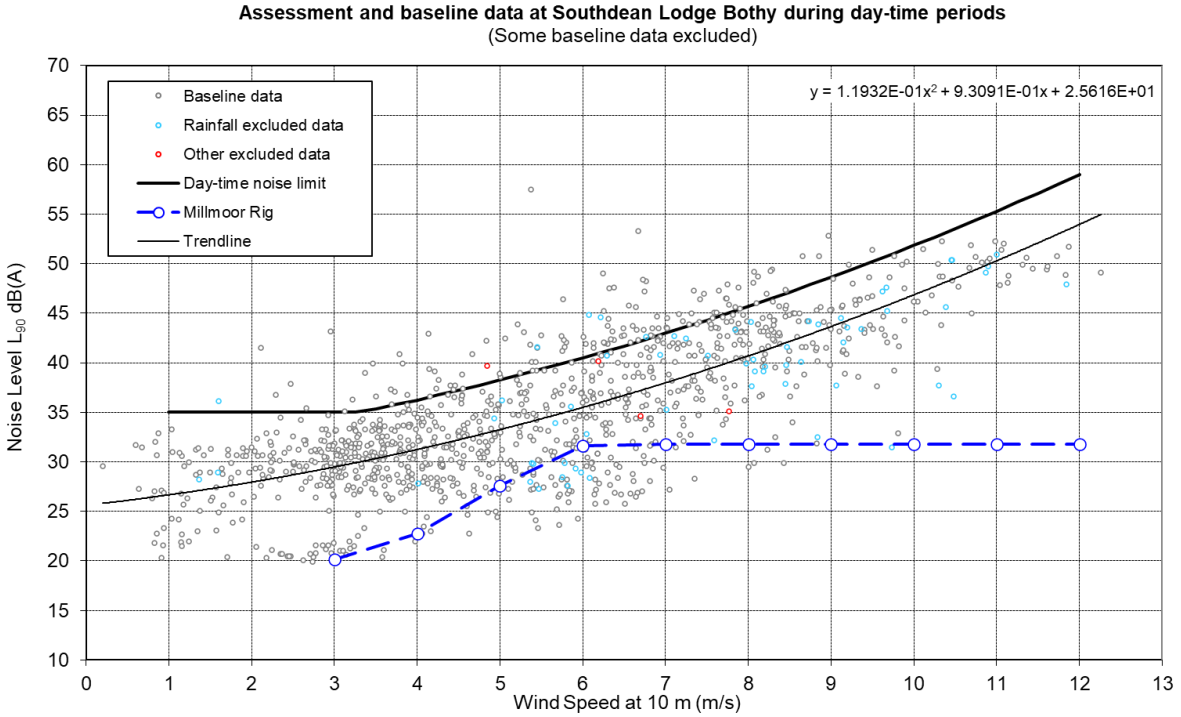


Figure E2 Chart of background noise levels against wind speeds, the best fit curve to the data, the derived noise limit curve for Southdean Lodge Bothy during nighttime periods. Predicted immission noise levels are also shown for the proposed Development.

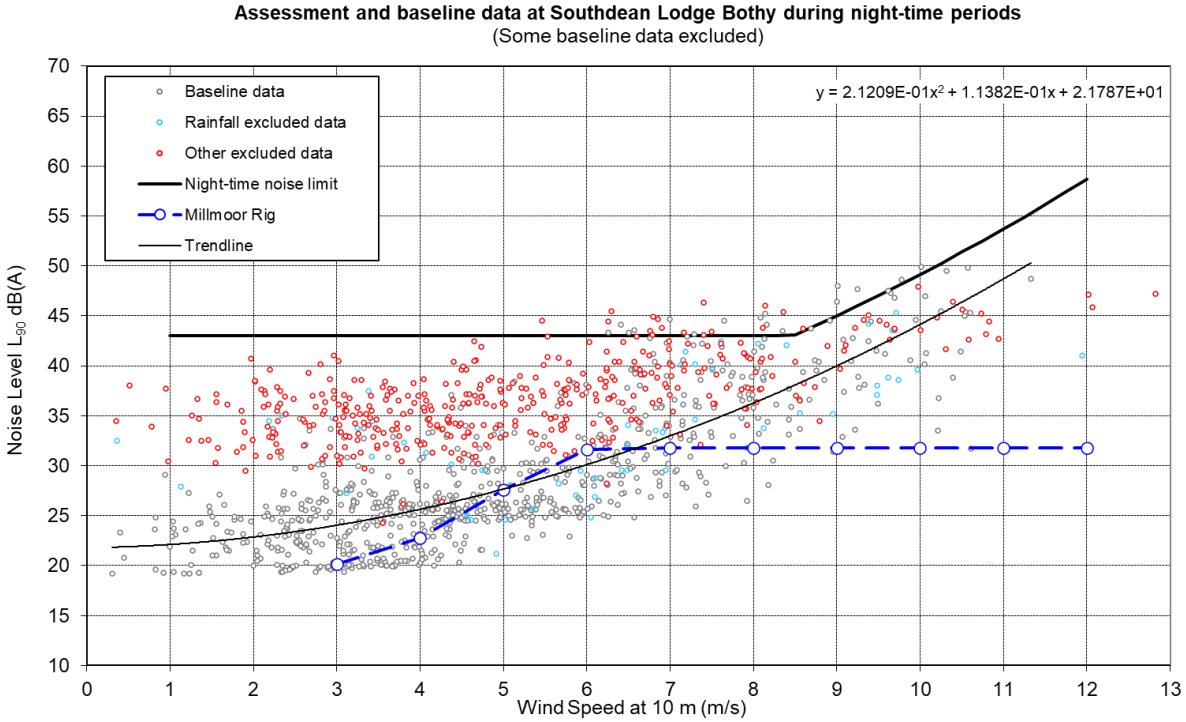


Figure E3 Chart of background noise levels against wind speeds, the best fit curve to the data, the derived noise limit curve for Dykeraw Farmhouse during quiet day time periods. Predicted immission noise levels are also shown for the proposed Development.

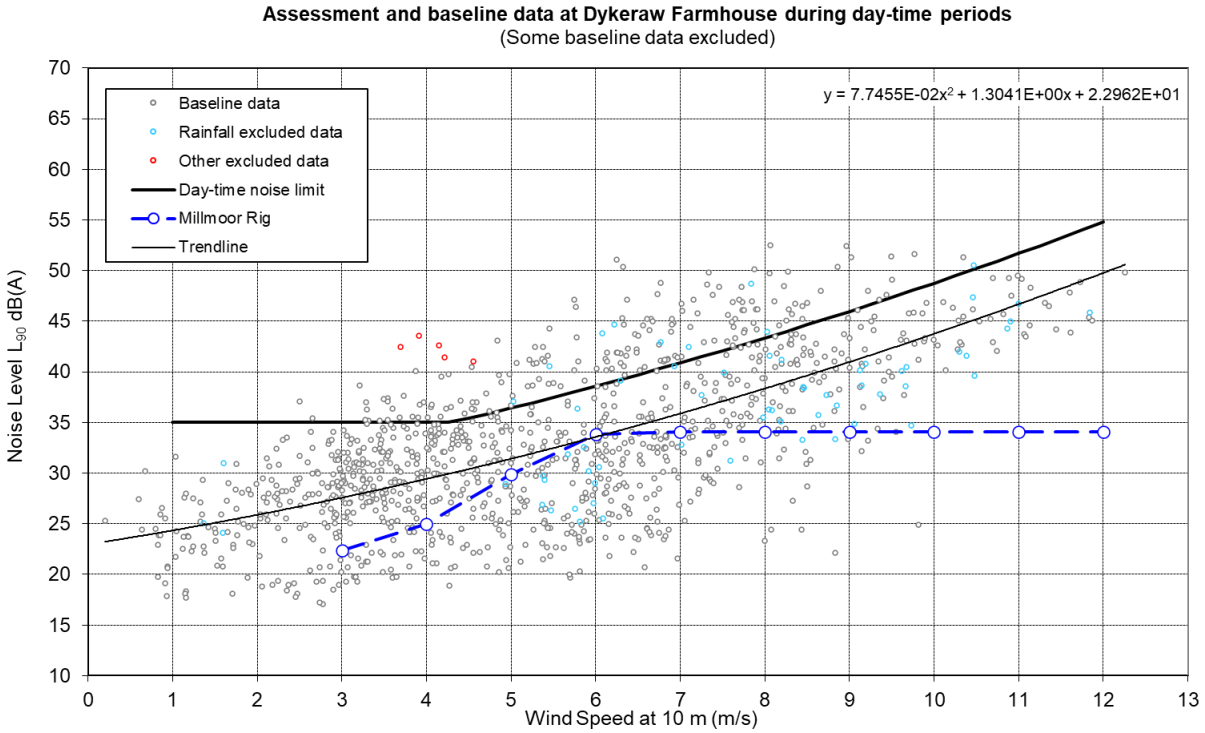


Figure E4 Chart of background noise levels against wind speeds, the best fit curve to the data, the derived noise limit curve for Dykeraw Farmhouse during nighttime periods. Predicted immission noise levels are also shown for the proposed Development.

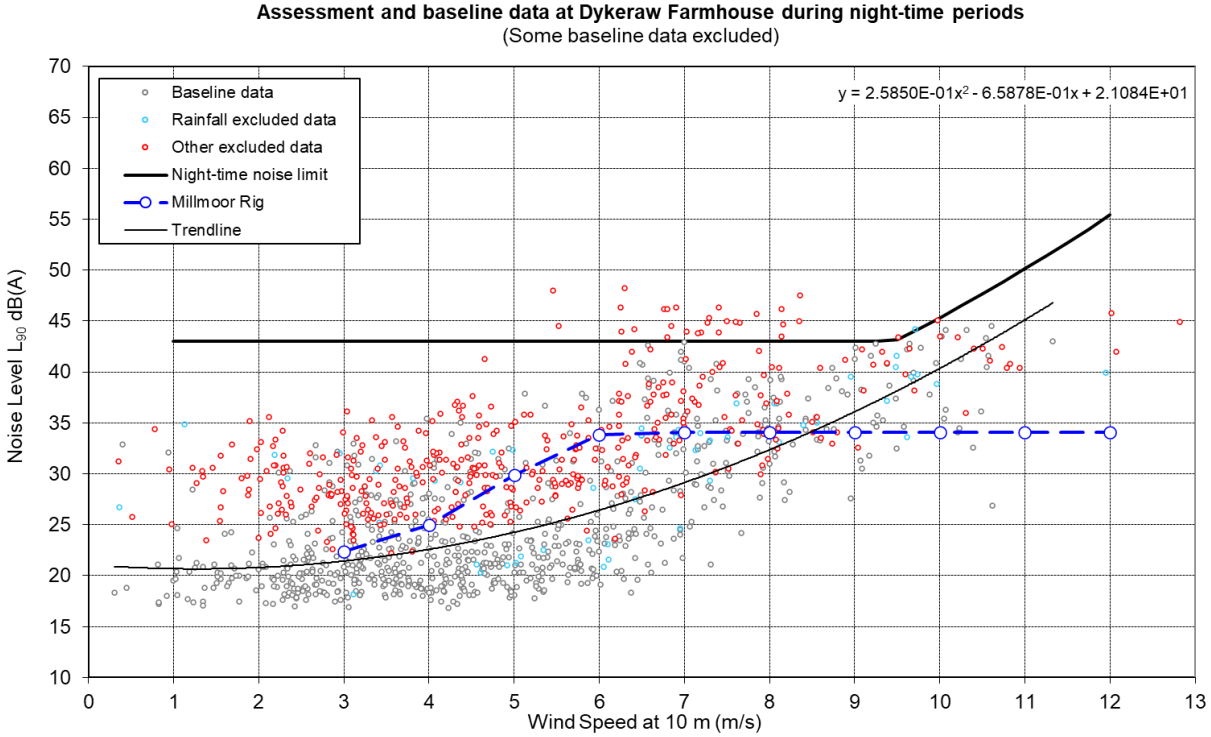


Figure E5 Chart of background noise levels against wind speeds, the best fit curve to the data, the derived noise limit curve for Hyndlee during quiet day time periods. Predicted immission noise levels are also shown for the proposed Development.

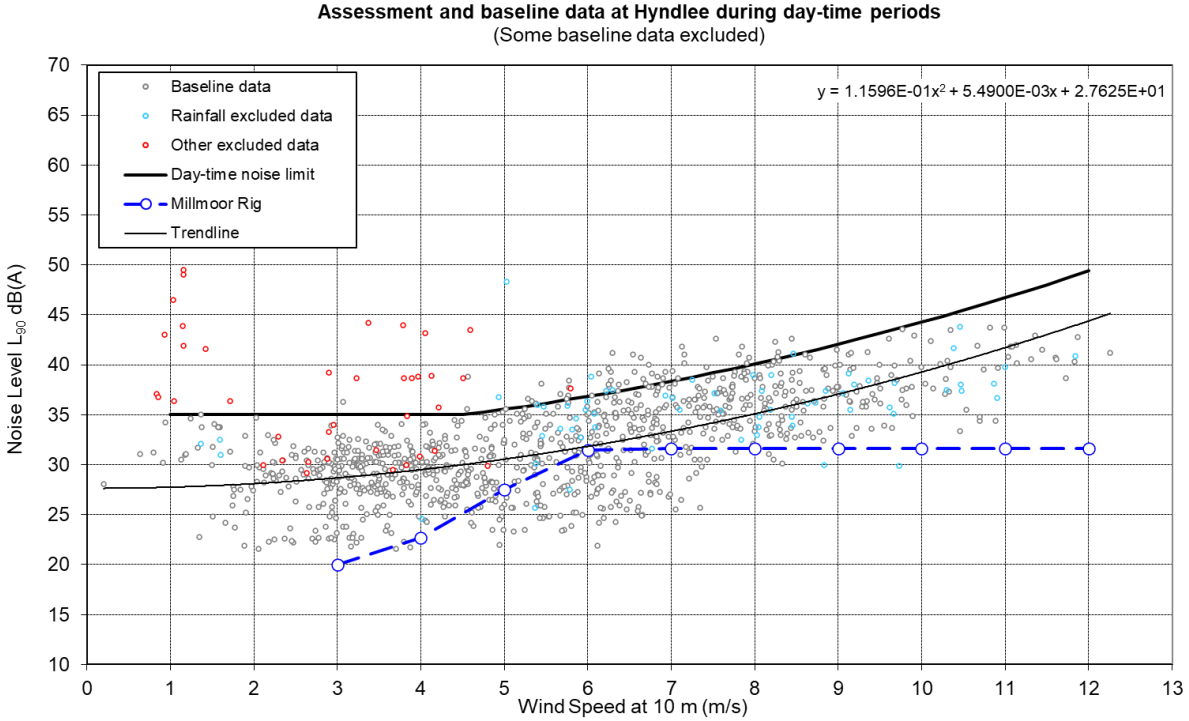
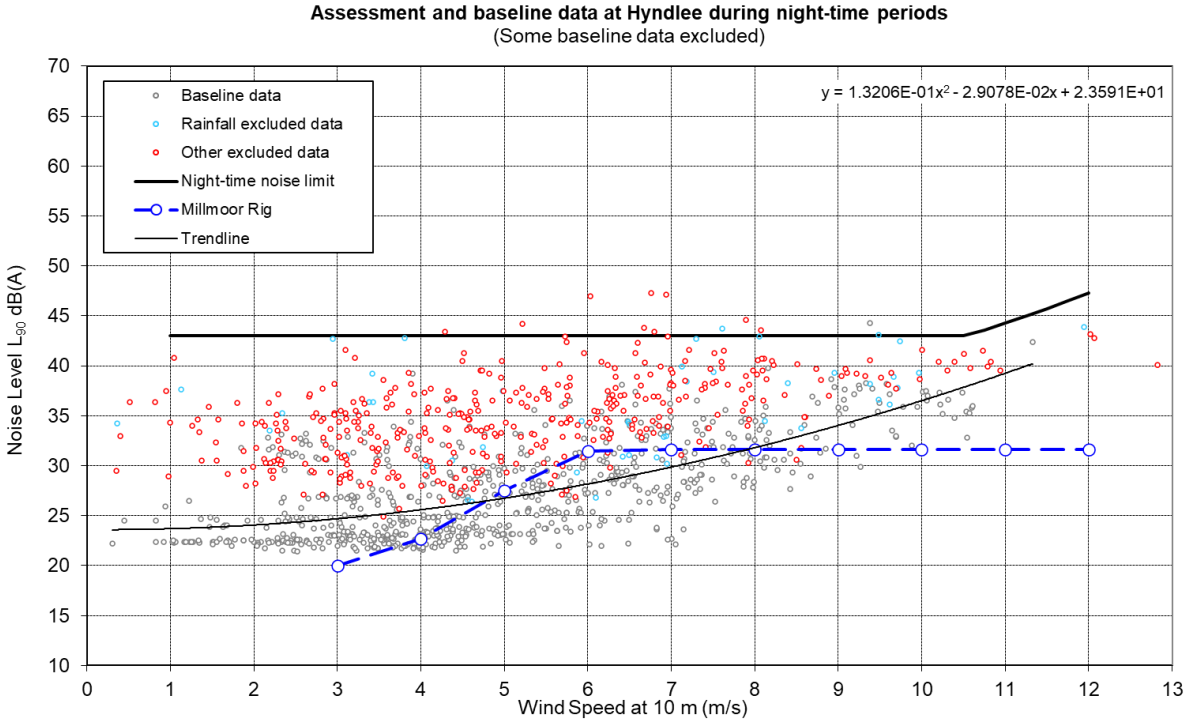


Figure E6 Chart of background noise levels against wind speeds, the best fit curve to the data, the derived noise limit curve for Hyndlee during nighttime periods. Predicted immission noise levels are also shown for the proposed Development.



Annex F – Wind Speed Calculations

F.1 The IOA GPG[7] requires that noise data recorded every 10 minutes are related to standardised ten metre wind speeds experienced at the hub height of the turbines, at a location on the wind farm representative of the wind farm. These wind speeds can be either measured directly at the turbine hub height or derived by calculation from measurements at two heights, with measurements at the upper height not less than 60% of the turbine hub height and measurements at least 15 metres below that. These are referred to as 'Method A' or 'Method B' in the IOA GPG which describes these as the preferred methods to use. IOA GPG SGN4[8] provides additional guidance on these methods.

F.2 The site of the Proposed Development has a temporary SODAR remote sensing measuring system installed which measured wind conditions at various heights averaged over 10-minute periods as follows:

- 40, 60, 80, 100, 120, 140 & 160 metre wind speed heights
- 40, 60, 80, 100, 120, 140 & 160 metre wind direction heights

F.3 The SODAR was installed on 13/05/2022 at a location within the site area (Easting / Northing 362446, 607052), located in a clearfell forestry location.

F.4 These measurement heights meet the requirements of the IOA GPG: the upper 140 m measurement height being within at least 60% of the maximum proposed candidate hub height of 148.5 metres and the lower 120 m height reading being at least 15 metres lower than the upper measurement.

F.5 Wind speed data were used to perform a calculation of the shear exponent found between the two wind speed measurement heights for every ten-minute period, by using Equation 3 of IOA GPG SGN4. Where wind speeds were the same at both heights or lower at greater height, the shear exponent was assumed to be zero. The shear exponent so calculated for every ten-minute period was then used to calculate the hub height wind speed using Equation 2 of SGN4 for each ten-minute period. Equation 1 of SGN4 was then used to calculate a standardised ten-metre height wind speed from the hub height wind speed every ten minutes assuming the reference roughness length of 0.05 metres.

F.6 Wind speeds are standardised to a height of ten metres assuming a reference ground roughness length of 0.05 metres as described in the IOA GPG. This approach is of the same form as that given in BS EN 61400-11:2003[9] for calculating ten metre wind speeds related to hub height wind speeds when providing source noise emission data for wind turbines.

F.7 By using this method, measured background noise levels were correlated to ten metre wind speeds calculated from wind speeds at hub height. Any likely difference in the shear profile during the 24 hours of the day will be accounted for within the method and be reflected in the resulting standardised ten metre wind speed data. The method used to calculate ten metre wind speeds from those at hub height is the same as that used when deriving noise emission data for the turbines. Because the same method has been used, direct comparison of background noise levels, noise limits and predicted turbine noise immission levels may be undertaken. This method is consistent with guidance published in the IOA GPG.

7 A Good Practice Guide to the Application of ETSU R 97 for the Assessment and Rating of Wind Turbine Noise, M. Cand, R. Davis, C. Jordan, M. Hayes, R. Perkins, Institute of Acoustics, May 2013.
8 A Good Practice Guide to the Application of ETSU R 97 for the Assessment and Rating of Wind Turbine Noise - Supplementary Guidance Note 4: Wind Shear, M. Cand, R. Davis, C. Jordan, M. Hayes, R. Perkins, Institute of Acoustics, July 2014.
9 IEC 61400 11:2003 Wind turbine generator systems - Part 11: Acoustic noise measurement techniques.

HOARE LEA

RYLAN NORCROSS
ACOUSTICS ENGINEER

+44 1454 806 668
rylannorcross@hoarelea.com

HOARELEA.COM

155 Aztec West
Almondsbury
Bristol
BS32 4UB
England