Annex 6 – Summary of Wind Turbine Noise Source Data

Noise data for the Siemens and Enercon turbines has not been included due to data confidentiality. Detailed noise data would be available upon request following the signing of the appropriate Non Disclosure Agreement

A summary of the noise data modelled for the other wind turbines has been provided within the table below. Full turbine noise reports can be provided upon request.

TNEI SUMMARY ANALYSIS OF NOISE DATA FOR : C&F-CF15-Generic blade-Full mode-15hub

Turbine identification:	
Manufacturer:	C&F
Model Name:	CF15
Blade Type/Name:	Generic
Operational Mode:	Full
Hub Height:	15

Available Noise Document(s) Considered in the analysis of this turbine:

	Doc. Date	Doc. Name
Manufacturer doc:	18/06/2012	See test report 2 below. This is the latest report so use this one as a reference.
Test Report1:	28/01/2011	Summary of Acoustic Measurements V1.0 by STROMA Technology
Test Report2:	18/06/2012	Summary report for CF15 tested at Ballyspellan(Ireland) by Intertek. Additionnal testing, Section 4 "Acoustic" states this is for a new Gendrive Inverter (previous v
Test Report3:		

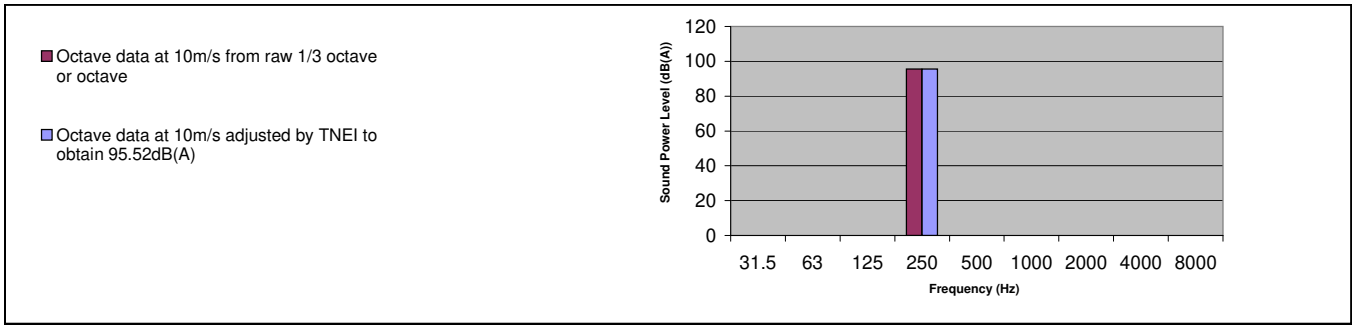
Summary of Sound Power Levels(Lw_{Aeq}) at various wind speeds:

Wind Speed (standardised 10m)	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Manufacturer Lw raw as found in document	78.4	80.2	82.0	83.7	85.5	87.2	89.0	90.8	92.5	94.3	96.0
Manufacturer specified Lw +Manufacturer Uc+TNEI Uc (used for modeling by TNEI)	81.4	83.2	85.0	86.7	88.5	90.2	92.0	93.8	95.5	97.3	99.0
Comment: Added +3dB overall to the test report measufred Lw. This is comnposed of +1.5dB(1.645*0.9) for uncertainty and +1.5dB for not having octave data available.											

Summary of Octave Data (LwA_{eq}) used for modelling:

Octave data is from Test Report at 10m/s										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	Overall
Octave data at 10m/s from raw 1/3 octave or octave	0.0	0.0	0.0	95.5	0.0	0.0	0.0	0.0	0.0	95.5
Octave data at 10m/s adjusted by TNEI to obtain 95.52dB(A)	0.0	0.0	0.0	95.5	0.0	0.0	0.0	0.0	0.0	95.5
Comment: No octave data avaialable so use the sound power levels modelled at 10m/s simulated as the octrave at 250Hz.										

Plot of Octave Data



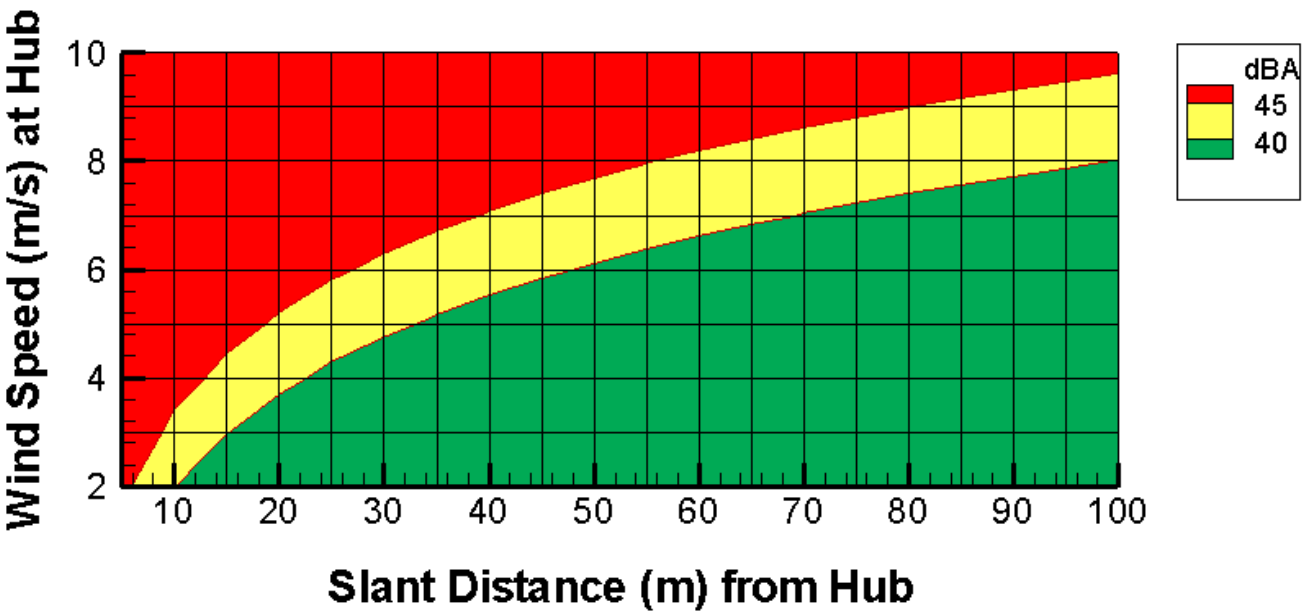
Additional Comment:

Data analysed in accordance with the guidance from the IOA GPG May 2013.

Acoustic Noise Levels

Turbine Make:	C&F Green Energy	**Model**	CF15

NOISE EMISSION LEVEL				**NOISE PENALTY**
Sound Power $L_{Wd,8m/s}$	**87.9 dB(A)**	Noise Slope (dB/m/s)	**3.1**	**NO**



STROMA	C&F Test Site, Galway	Issued by Stroma Technology February 2011

TNEI SUMMARY ANALYSIS OF NOISE DATA FOR : Eoltech-Scirocco-Generic blade-Full mode-15hub

Turbine identification:	
Manufacturer:	Eoltech
Model Name:	Scirocco
Blade Type/Name:	Generic
Operational Mode:	Full
Hub Height:	15

Available Noise Document(s) Considered in the analysis of this turbine:

	Doc. Date	Doc. Name
Manufacturer doc:	15/03/2011	Narec: 1580/04
Test Report1:	10/04/2007	HM:1820/R1
Test Report2:		
Test Report3:		

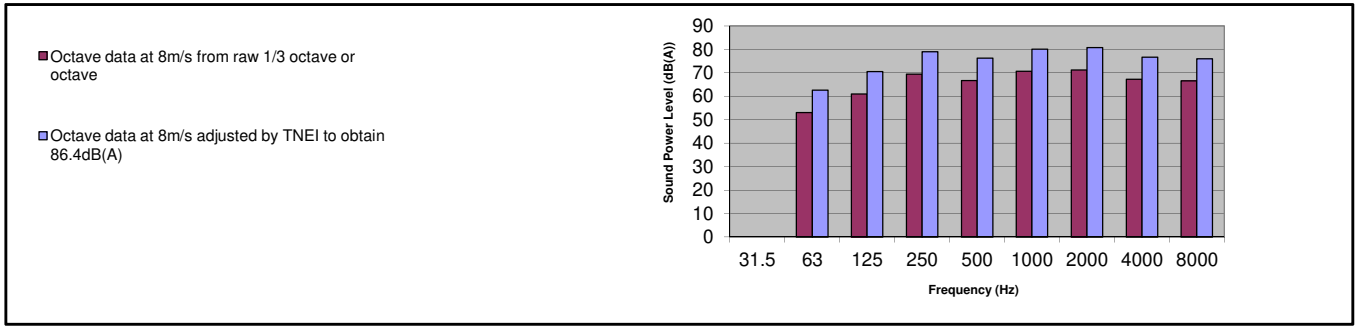
Summary of Sound Power Levels(Lw_{Aeq}) at various wind speeds:

Wind Speed (standardised 10m)	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Manufacturer Lw raw as found in document		75.6	77.7	79.9	82.1	84.2	86.4	88.6	90.7	92.9	95.1
Manufacturer specified Lw +Manufacturer Uc+TNEI Uc (used for modeling by TNEI)		75.6	77.7	79.9	82.1	84.2	86.4	88.6	90.7	92.9	95.1
Comment: No Uc added as reports have accounted enough											

Summary of Octave Data (LwA_{eq}) used for modelling:

Octave data is from Test Report1 at 8m/s										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	Overall
Octave data at 8m/s from raw 1/3 octave or octave	0.0	53.1	61.0	69.4	66.7	70.6	71.2	67.2	66.5	76.9
Octave data at 8m/s adjusted by TNEI to obtain 86.4dB(A)	0.0	62.6	70.5	78.9	76.2	80.1	80.7	76.7	76.0	86.4
Comment: Used 1/3 Octave data from Hayes Mckenzie report HM:1820/R1										

Plot of Octave Data



Additional Comment:

Data analysed in accordance with the guidance from the IOA GPG May 2013.

Narec Development Services Limited
Eddie Ferguson House
Ridley Street, Blyth, Northumberland NE24 3AG
Tel: +44 (0)1670 359 555 Fax: +44 (0)1670 359 666

email: info@narec.co.uk web: www.narec.co.uk

Summary Test Report For

Eoltec Scirocco E5.6-6 Horizontal Axis Wind Turbine

Ref. No. 1580/04

Date : 15/03/2011

Version : 1.1

Narec Development Services Limited
Eddie Ferguson House
Ridley Street, Blyth, Northumberland NE24 3AG
Tel: +44 (0)1670 359 555 Fax: +44 (0)1670 359 666

email: info@narec.co.uk web: www.narec.co.uk

8.1 Immission Noise Map

In accordance with section 3.1.4 of the BWEA standard, the immission noise map for the Eoltec Scirocco E5.6-6 is shown in Figure 5 below;

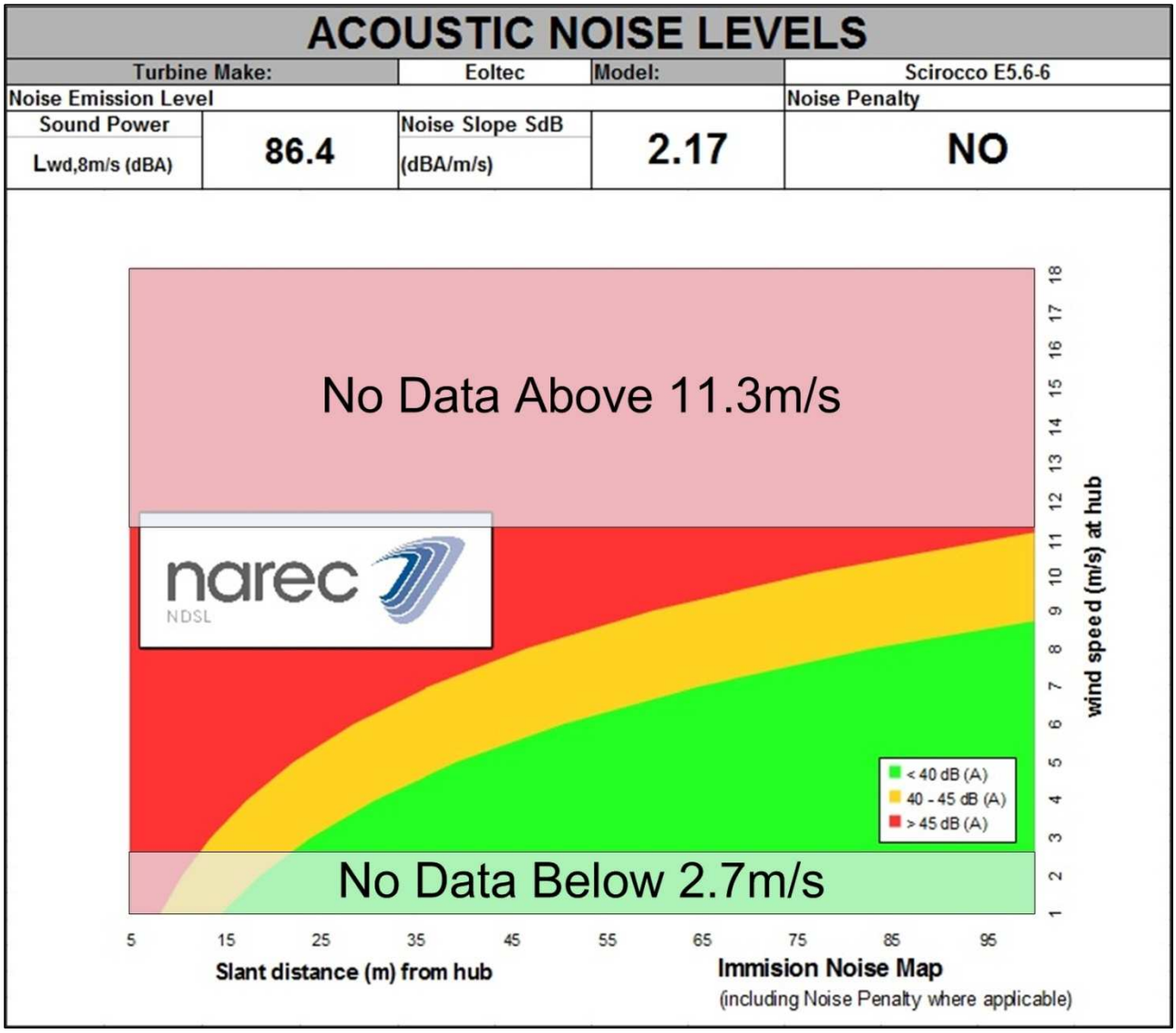


Figure 5 - Immission Noise Map – Eoltec Scirocco E5.6-6

TNEI SUMMARY ANALYSIS OF NOISE DATA FOR : Evance-R9000-Generic blade-Full mode-10hub

Turbine identification:	
Manufacturer:	Evance
Model Name:	R9000
Blade Type/Name:	Generic
Operational Mode:	Full
Hub Height:	10

Available Noise Document(s) Considered in the analysis of this turbine:

	Doc. Date	Doc. Name
Manufacturer doc:	12/08/2010	Evance R9000 UK MCS Certification Summary
Test Report1:		
Test Report2:		
Test Report3:		

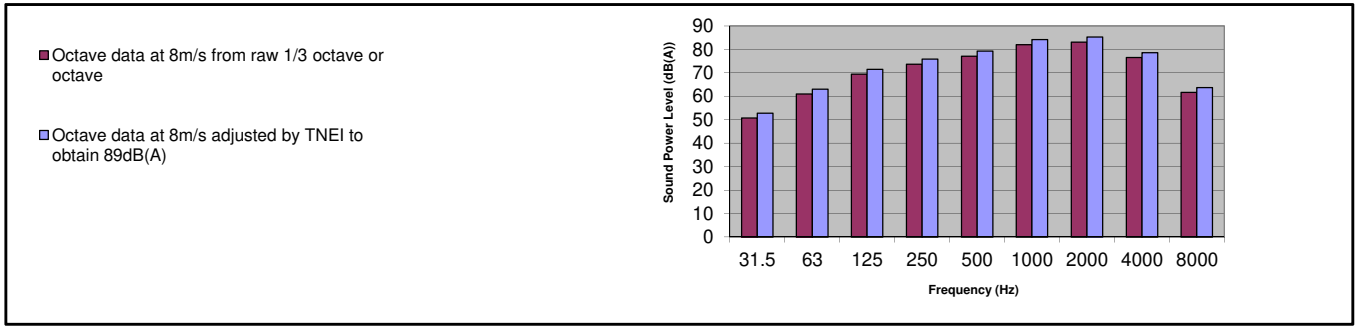
Summary of Sound Power Levels(Lw_{Aeq}) at various wind speeds:

Wind Speed (standardised 10m)	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Manufacturer Lw raw as found in document		78.5	80.6	82.7	84.8	86.9	89.0	91.1	93.2	95.3	97.4
Manufacturer specified Lw +Manufacturer Uc+TNEI Uc (used for modeling by TNEI)		78.5	80.6	82.7	84.8	86.9	89.0	91.1	93.2	95.3	97.4
Comment: No additional Uc as accounted for enough. See summary on left.											

Summary of Octave Data (LwA_{eq}) used for modelling:

Octave data is from Test Report1 at 8m/s										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	Overall
Octave data at 8m/s from raw 1/3 octave or octave	50.7	60.9	69.4	73.7	77.1	82.0	83.1	76.5	61.6	86.9
Octave data at 8m/s adjusted by TNEI to obtain 89dB(A)	52.8	63.0	71.5	75.8	79.2	84.1	85.2	78.6	63.7	89.0
Comment: See comments to left										

Plot of Octave Data



Additional Comment:

Data analysed in accordance with the guidance from the IOA GPG May 2013.

1. Introduction

This document presents the results of an acoustic sound test conducted on an Evance R9000, in accordance with BS EN 61400-11[1] and with the additional guidance stated in BWEA Performance and Safety standard[2].

A summary of the report is shown below in Figure 1. The key results are the Declared Apparent Emission Sound Power Level, $L_{Wd,8m/s}$, at 8m/s hub height wind speed and noise immission predictions for a range of slant distances and hub height wind speeds.

2. Test Summary

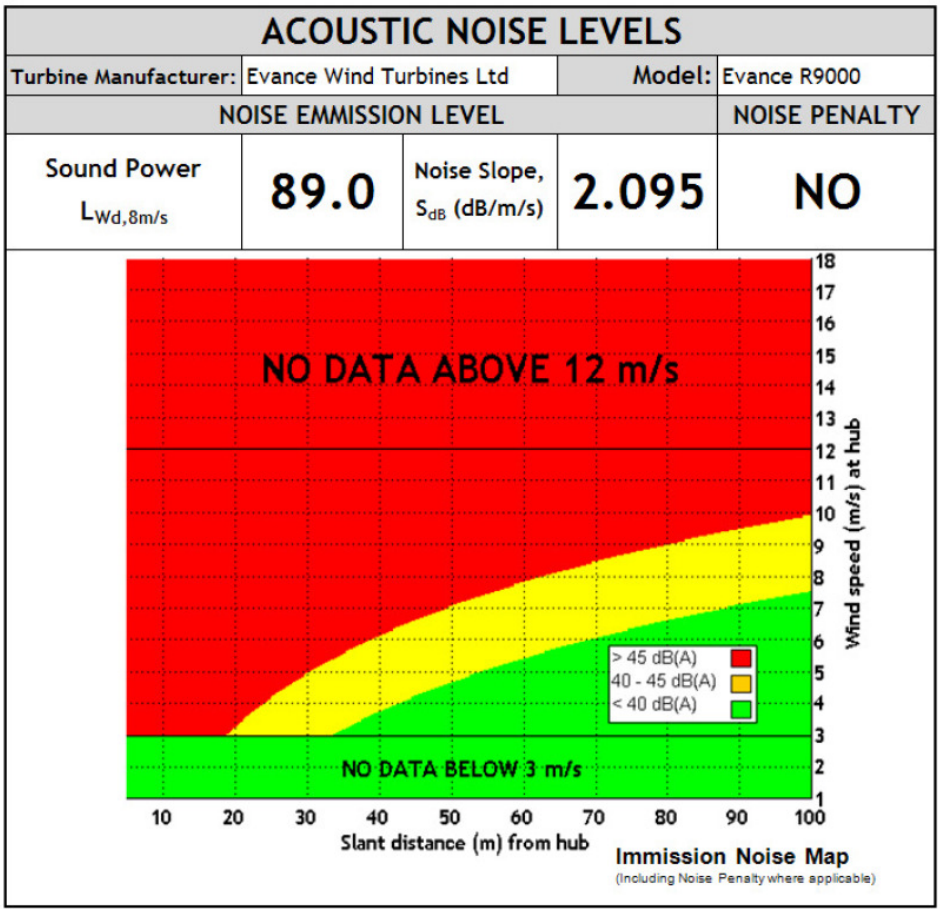


FIGURE 1 – NOISE LABEL

No measurements of directivity were undertaken but the turbine was subjectively much quieter in the plane of the blades (perpendicular to wind direction) than the measured downwind location.

The assessment established the turbine should not be declared as 'tonal' and therefore no penalty should be applied.

The BWEA Reference Sound Levels at 25m and 60m at an 8m/s hub height wind speed are:

$$L_{p,25m} = 53dB(A)$$
$$L_{p,60m} = 45.5dB(A)$$

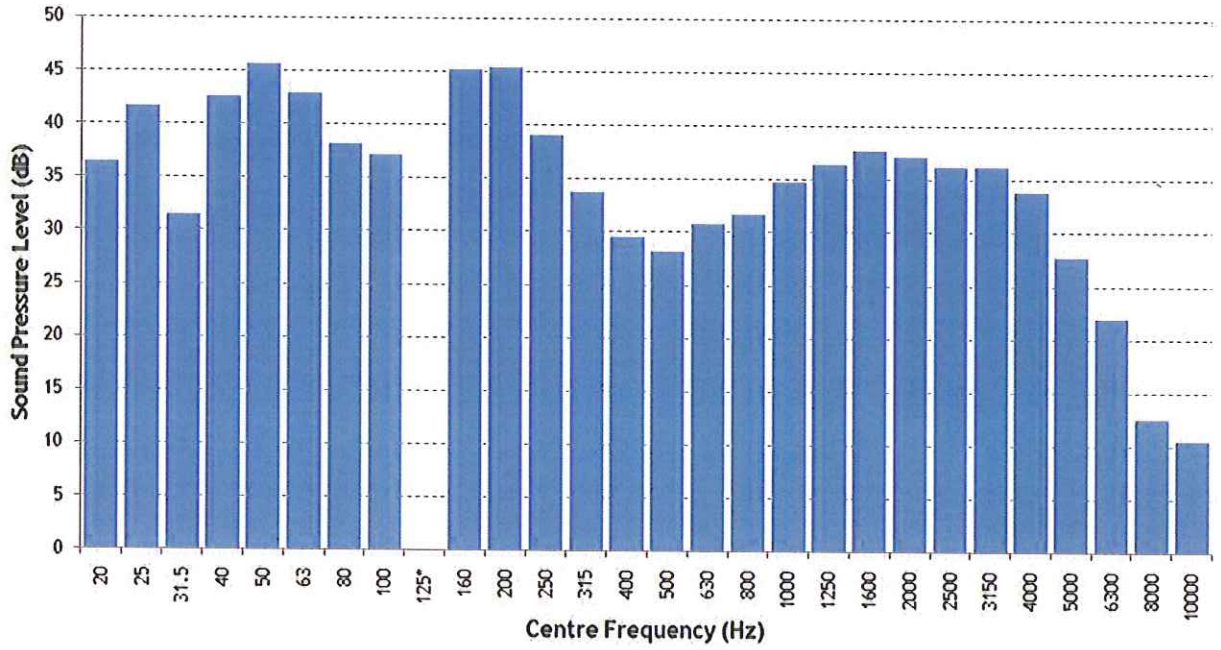


FIGURE 9 - UNWEIGHTED 1/3RD OCTAVE BAND FREQUENCY SPECTRUM FOR 2.82M/S AT A SLANT DISTANCE OF 19.85M

The 125Hz band in Figure 9 was not measureable because the background noise at 125Hz was louder than when the turbine was running. The dB(Lin), dB(A) and dB(C) for the spectrum was 53.4,44.9 and 52.9 respectively.

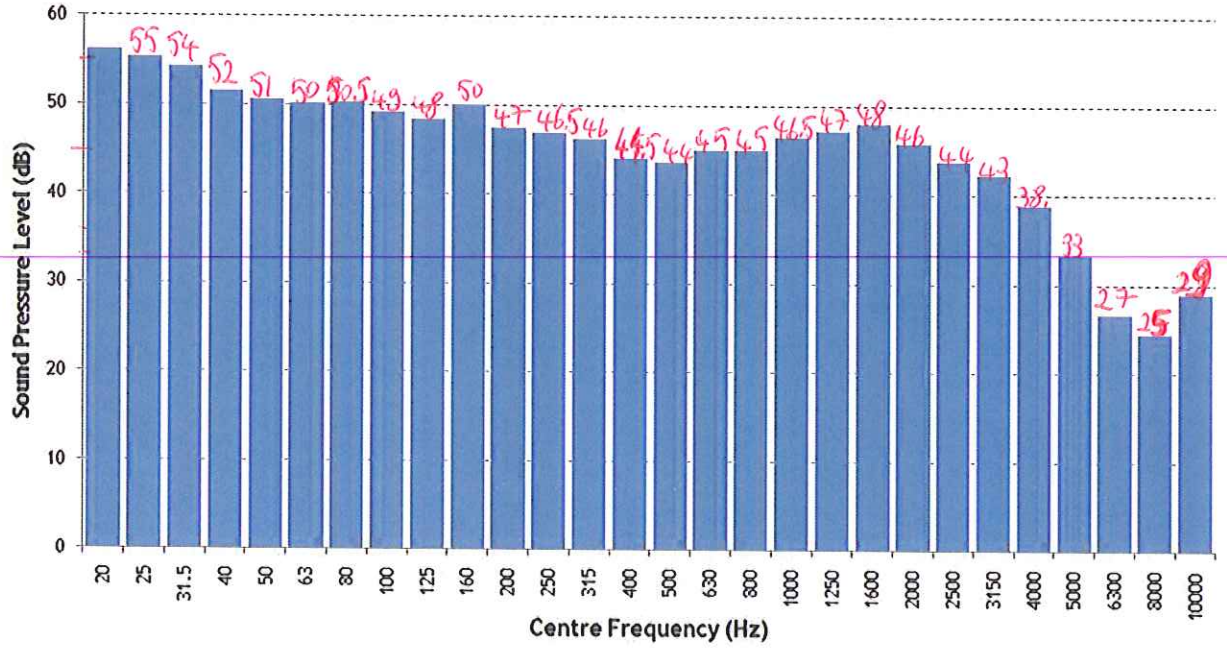


FIGURE 10 - UNWEIGHTED 1/3RD OCTAVE BAND FREQUENCY SPECTRUM FOR 7.99M/S AT A SLANT DISTANCE OF 19.85M

The dB(Lin), dB(A) and dB(C) for the 7.99m/s spectrum was 63.5, 54.2 and 61.6 respectively.

TNEI SUMMARY ANALYSIS OF NOISE DATA FOR : Kingspan Wind-KW15-Generic blade-Full mode-15hub

Turbine identification:	
Manufacturer:	Kingspan Wind
Model Name:	KW15
Blade Type/Name:	Generic
Operational Mode:	Full
Hub Height:	15

Available Noise Document(s) Considered in the analysis of this turbine:

	Doc. Date	Doc. Name
Manufacturer doc:	01/07/2013	KS-KW15-Full-Planning-Pack
Test Report1:		
Test Report2:		
Test Report3:		

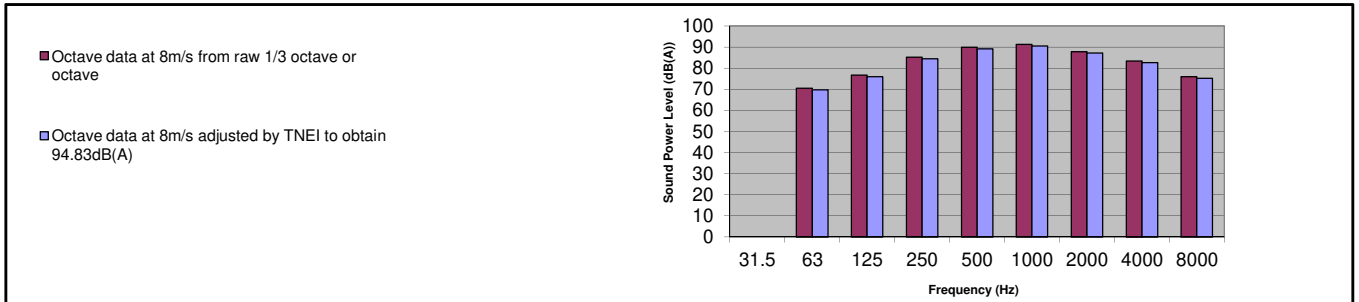
Summary of Sound Power Levels(Lw_{Aeq}) at various wind speeds:

Wind Speed (standardised 10m)	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Manufacturer Lw raw as found in document	69.9	73.8	77.6	81.4	85.2	89.0	92.8	96.6	100.4	104.2	108.0
Manufacturer specified Lw +Manufacturer Uc+TNEI Uc (used for modeling by TNEI)	72.0	75.8	79.6	83.4	87.2	91.0	94.8	98.6	102.5	106.3	110.1
Comment:											

Summary of Octave Data (LwA_{eq}) used for modelling:

Octave data is from Test Report1 at 8m/s										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	Overall
Octave data at 8m/s from raw 1/3 octave or octave	0.0	70.4	76.6	85.1	89.8	91.2	87.8	83.3	75.9	95.5
Octave data at 8m/s adjusted by TNEI to obtain 94.83dB(A)	0.0	69.7	75.9	84.4	89.1	90.5	87.1	82.6	75.2	94.8
Comment: Octave data taken from Manufacturer data above										

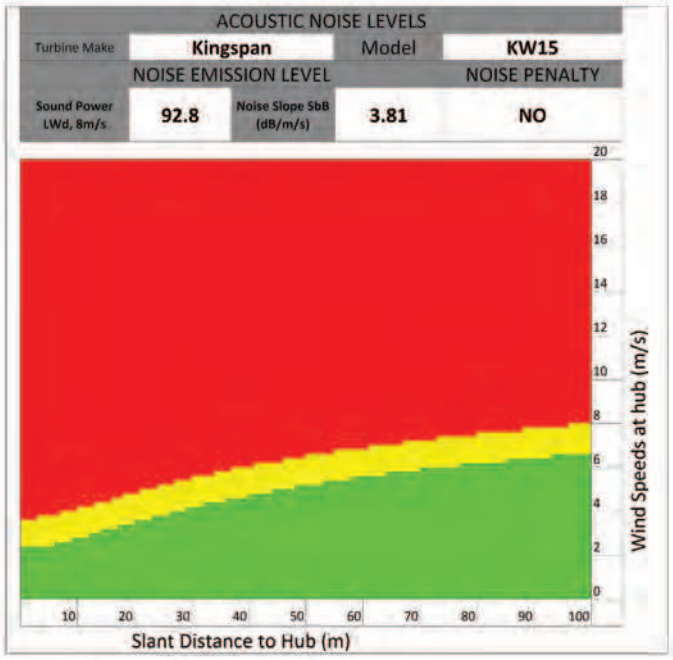
Plot of Octave Data



Additional Comment:

Data analysed in accordance with the guidance from the IOA GPG May 2013. Only 8m/s SPL given, with slope of 3.81. Measurement report data is therefore based upon the slope, with no flatlining at any windspeed.

ACOUSTIC DATA



ISO 9613-2 GENERAL METHOD OF CALCULATION

This method of calculation is widely used in the UK for measuring wind turbine noise propagation over a distance. It can be applied to obtain realistic predictions of noise from on-shore wind turbines during worst case propagation scenarios.

The algorithm takes into account the following physical effects:

- Geometrical divergence
- Atmospheric absorption
- Ground effect
- Reflection from surfaces
- Screening by obstacles

The following details should be inputted to your ISO 9613-2 model:

Frequency	Ls (dBA)
63	70.4
125	76.6
250	85.1
500	89.8
1000	91.2
2000	87.8
4000	83.3
8000	75.9

Uncertainty = 2.03dBA

The turbine is not considered tonal

TNEI SUMMARY ANALYSIS OF NOISE DATA FOR : Proven-6KW-Generic blade-Full mode-15hub

Turbine identification:	
Manufacturer:	Proven
Model Name:	6KW
Blade Type/Name:	Generic
Operational Mode:	Full
Hub Height:	15

Available Noise Document(s) Considered in the analysis of this turbine:

	Doc. Date	Doc. Name
Manufacturer doc:		No manufacturer data used. Used measufred level from test report1 + 1.5dB (1.645*0.9)
Test Report1:	01/04/2007	6kW 15m Noise Sgurr 2007 test report.
Test Report2:		
Test Report3:		

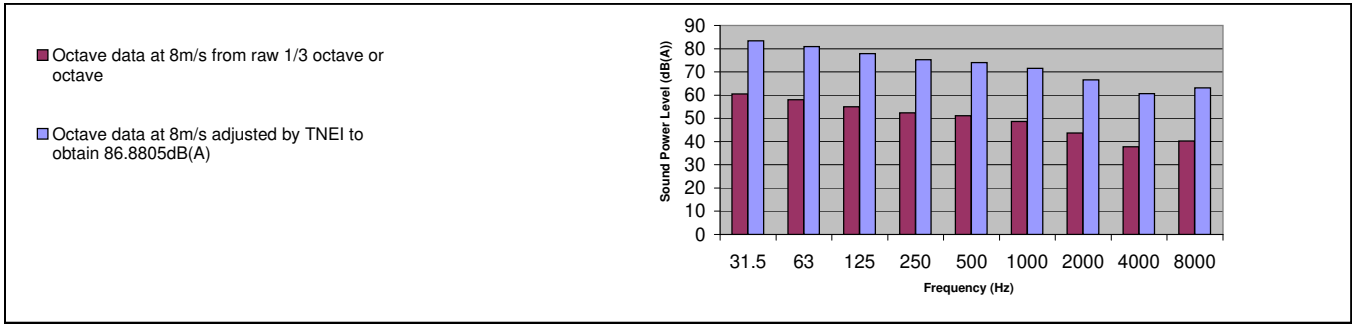
Summary of Sound Power Levels(Lw_{Aeq}) at various wind speeds:

Wind Speed (standardised 10m)	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Manufacturer Lw raw as found in document											
Manufacturer specified Lw +Manufacturer Uc+TNEI Uc (used for modeling by TNEI)			77.9	80.2	82.4	84.7	86.9	89.1	91.4	93.6	95.9
Comment: No manufacturer data used. Used measufred level from test report1 + 1.5dB (1.645*0.9)											

Summary of Octave Data (LwA_{eq}) used for modelling:

Octave data is from Test Report1 at 8m/s										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	Overall
Octave data at 8m/s from raw 1/3 octave or octave	60.5	58.0	55.0	52.4	51.2	48.6	43.7	37.7	40.2	64.0
Octave data at 8m/s adjusted by TNEI to obtain 86.8805dB(A)	83.4	80.9	77.9	75.3	74.1	71.5	66.6	60.6	63.1	86.8
Comment: 1/3 octave data from "6kW 15m Sgurr additional Freq Graphs.pdf"										

Plot of Octave Data



Additional Comment:

Data analysed in accordance with the guidance from the IOA GPG May 2013.

79 Coplaw street, Glasgow, G42 7JG
Telephone: +44 (0) 141 433 4646
www.sgurrenergy.com

Proven Energy

6kW WTGS at Neilston Noise Survey

SUMMARY:

A noise survey has been conducted on an installed Proven 6kW wind turbine generator system (WTGS) for the purposes of characterising its noise emissions. The WTGS had been installed to provide electricity to a consumer and the site was not entirely suitable for a survey where all the parameters of interest could be fully controlled. Notwithstanding this, and although there is not yet a recognised standard by which noise emissions from small WTGS can be measured, a procedure was designed and the noise emissions were characterised in accord with the procedure.

CLIENT: **Proven Energy**

Contact: Jonathan Nowill

DISTRIBUTION :

Client: **SgurrEnergy:** Adam Spearey

	Name	Job Title	Signature
Prepared by	Jim Clive	Principal Noise Consultant	
Checked by	Adam Spearey	Renewable Energy Consultant	
Authorised by	Ian Irvine	Technical Director	
Date of Issue	April 2007	**Classification:**	Confidential

9002/000/SF/04/023 B4

7 RESULTS

7.1 Measurements

The results of the noise survey are shown in the attached Figure 1. The best fit second order polynomials drawn through the data scatter are very close to the first order polynomials through the same scatters.

7.2 Calculations

The symbols and units are the same as in Reference 1.

Ro	= 10m
H	= 15m
R_1	= 18m
SPL of ambient noise at a 10m high wind speed of 8ms^{-1}	= 55.5dB(A)
SPL of residual noise at a 10m high wind speed of 8ms^{-1}	= 42.5dB(A)
SPL attributable to WTGS operation at 10m high wind speed of 8ms^{-1}	= 55.3dB(A)
SWL of WTGS at a 10m high wind speed of 8ms^{-1}	= 85.4dB(A)
Coefficient of Regression	= 2.24dB/ms^{-1}

8 DISCUSSION OF RESULTS

It should be noted that the conditions under which the survey was conducted were unavoidably removed from the ideal case that would have prevailed if the WTGS had been installed at a suitable test site. The sound power level and the coefficient of regression obtained should be treated as provisional until a test under properly controlled conditions is conducted.

The measured one third octave spectra were examined for evidence of prominent tones that would attract a correction to the measured apparent sound power level when assessed in accord with an appropriate criterion. No such prominent tone occurred at the measurement point under the conditions prevailing in the survey.

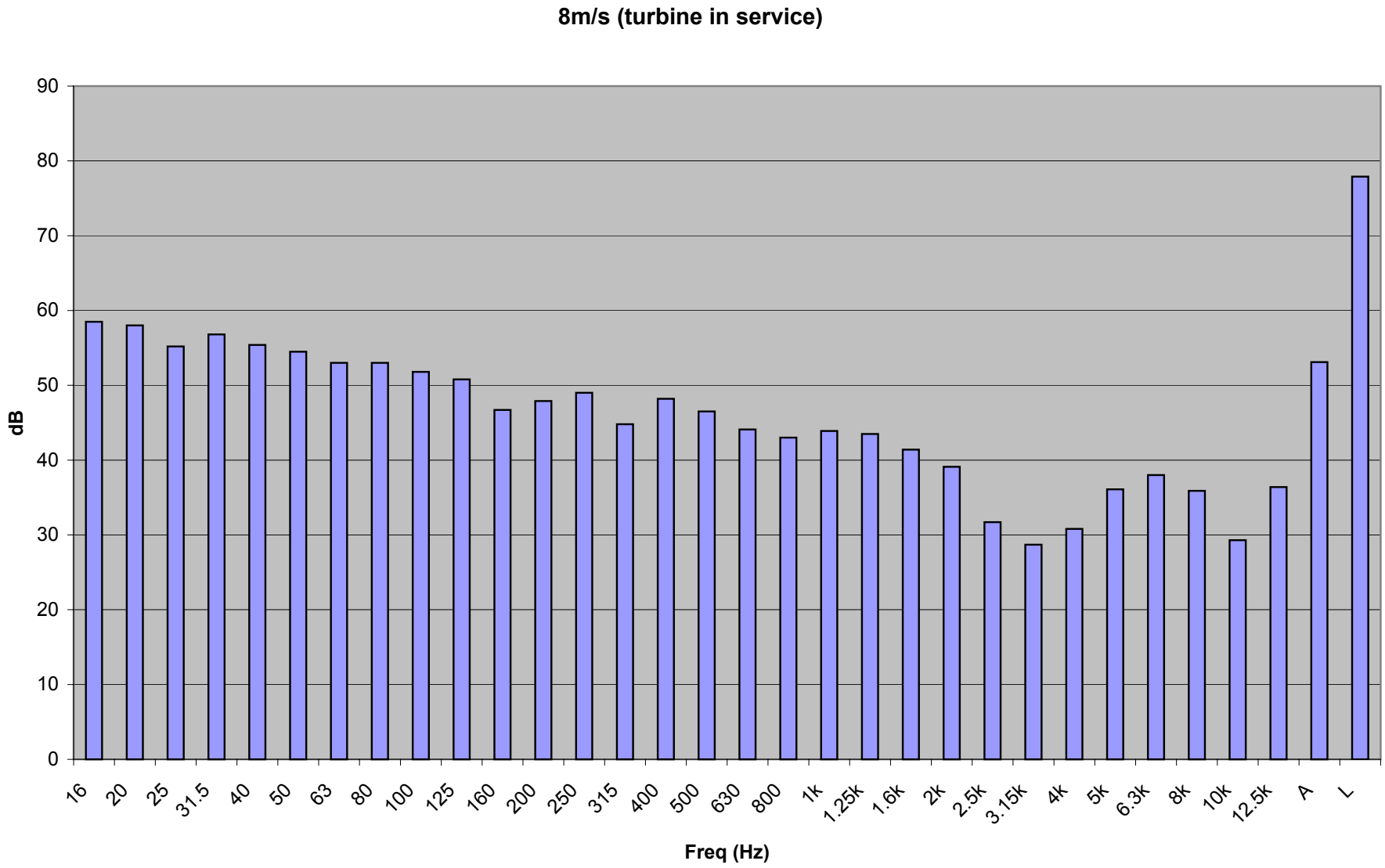
9 CONCLUSIONS

9.1 The sound power level of a 6kW Proven WTGS has been estimated from a survey conducted on such a WTGS previously installed at an existing site for the purposes of supplying power to an electricity consumer.

9.2 The site at which the WTGS was installed was not ideal with regard to topographical, wind direction and other requirements.

9.3 The sound power level measured for a 10m height wind speed of 8ms^{-1} was 85.4dB(A) with a coefficient of regression of 2.24dB/ms^{-1}. These values should be treated as provisional until a test under suitably controlled conditions can be performed.

9.4 The sound pressure level attributable to the WTGS at a horizontal distance of 10m from the base of the tower was measured as 55.3dB(A) (for a 10m height wind speed of 8ms^{-1}). Figure 2 shows how the SPL attributable to the WTGS varies with distance. These values should be treated as provisional until a test under suitably controlled conditions can be performed.


8m/s (turbine in service)
dB
90
80
70
60
50
40
30
20
10
0
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1k
1.25k
1.6k
2k
2.5k
3.15k
4k
5k
6.3k
8k
10k
12.5k
A
L
Freq (Hz)

TNEI SUMMARY ANALYSIS OF NOISE DATA FOR : Proven-P35-2-Generic blade-Full mode-15hub

Turbine identification:	
Manufacturer:	Proven
Model Name:	P35-2
Blade Type/Name:	Generic
Operational Mode:	Full
Hub Height:	15

Available Noise Document(s) Considered in the analysis of this turbine:

	Doc. Date	Doc. Name
Manufacturer doc:		
Test Report1:	28/09/2010	Proven P35-2 Wind Turbine Noise Performance Test (Report HM:2264/R1)
Test Report2:		
Test Report3:		

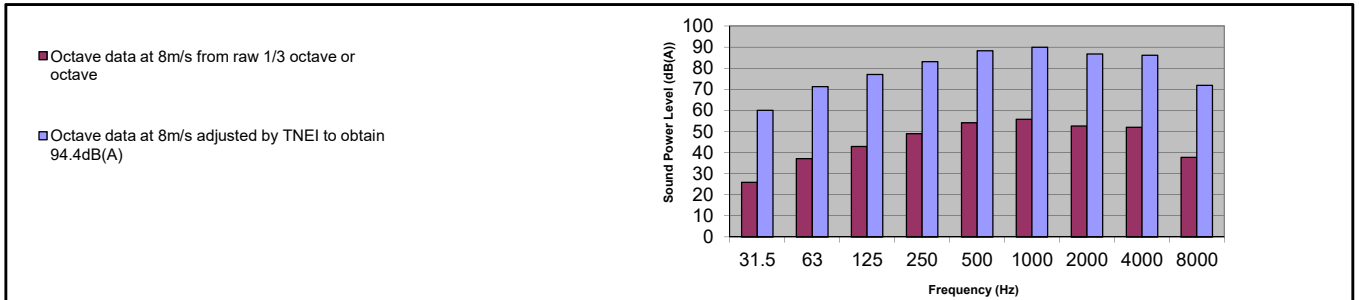
Summary of Sound Power Levels(Lw_{Aeq}) at various wind speeds:

Wind Speed (standardised 10m)	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Manufacturer Lw raw as found in document											
Manufacturer specified Lw +Manufacturer Uc+TNEI Uc (used for modeling by TNEI)				86.4	89.1	91.8	94.4	97.1	99.8	103.4	104.3
Comment: Added 2.4dB uncertainty as per the test report											

Summary of Octave Data (LwA_{eq}) used for modelling:

Octave data is from Test Report1 at 8m/s										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	Overall
Octave data at 8m/s from raw 1/3 octave or octave	25.9	37.1	42.9	48.9	54.1	55.7	52.6	51.9	37.7	60.3
Octave data at 8m/s adjusted by TNEI to obtain 94.4dB(A)	60.0	71.2	77.0	83.0	88.2	89.8	86.7	86.0	71.8	94.4
Comment: 1/3 octave data from HM:2284/R1 Appendix										

Plot of Octave Data



Additional Comment:

Data analysed in accordance with the guidance from the IOA GPG May 2013.

6.8 In line with [1] two separate linear regressions were also fitted to the data ranging from 5 to 10 m/s and 11 to 17 m/s at rotor centre height. The results are shown in Table 6 below. The declared Apparent Emission Sound Power Level for the reference height wind speed of 8 m/s $L_{Wd,8m/s}$ is calculated from this linear regression line.

Table 6: Apparent Sound Power Level for both measurement days according to BWEA standard

Reference height wind speed (m/s)	**5**	**6**	**7**	**8**	**9**	**10**	
Apparent Sound Power Level, $L_{WA,k}$ (dB L_{WA} re 1 pW)	84.0	86.7	89.4	92.0	94.7	97.4	
Reference height wind speed (m/s)	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Apparent Sound Power Level, $L_{WA,k}$ (dB L_{WA} re 1 pW)	101.0	101.9	102.7	103.6	104.5	105.3	106.2

1/3 Octave Band Data

6.9 The four 1-minute average periods closest to the reference height wind speed of 8 m/s for the measurement on 27/07/2010 have been used to calculate the energy average 1/3 octave band spectra between 20 and 8 kHz as measured at the Reference Position for the first measurement day. The linear, A-weighted and C-weighted results are shown in Appendix D. As mentioned above, it was not necessary to correct the data for the influence of background noise.

6.10 As there were only 2 values close to the reference height wind speed of 8 m/s measured on the second measurement day, the energy average 1/3 octave band spectra between 20 and 8 kHz has been calculated for a reference height wind speed of 9 m/s. The linear, A-weighted and C-weighted results are also shown in Appendix D. No background correction was carried out.

Tonality

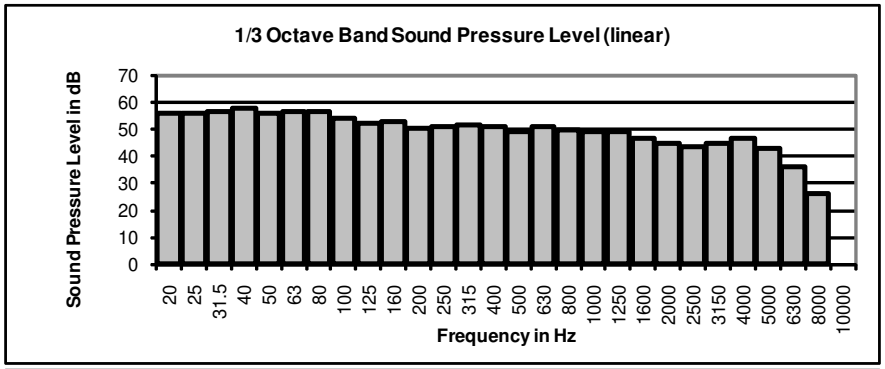
6.11 The tonality assessment was carried out according to the method specified in ISO 1996-2: 2007 Annex D [3], as suggested in [1].

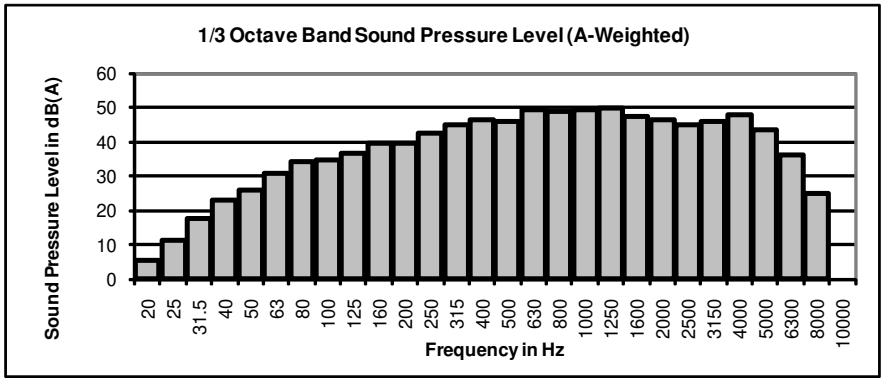
6.12 The turbine is declared tonal if any 1/3 octave band is higher than its adjacent bands by:

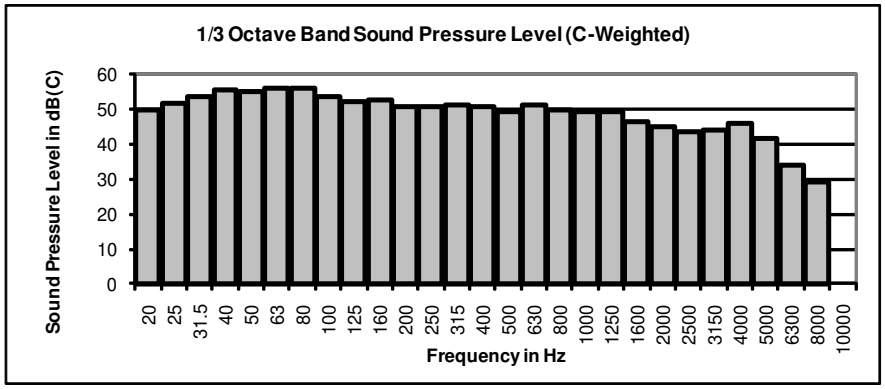
- 15 dB in the low frequency bands (50 to 125 Hz)
- 8 dB in the mid-frequency bands (160 to 400 Hz)
- 5 dB in the high frequency bands (500 to 10000 Hz).

1/3 Octave Band Levels - Sound Pressure Level for a wind speed of 8 m/s at rotor centre height (Measurement Date 29/07/2010)

f (Hz)	$L_{W,1/3\ Octave}$ (dB(lin))	$L_{W,1/3\ Octave}$ (dB(A))	$L_{W,1/3\ Octave}$ (dB(C))
20	54.2	6.8	3.7
25	54.4	12.1	9.7
31.5	55.1	18.7	15.7
40	55.8	24.7	21.2
50	54.7	26.9	24.5
63	55.4	31.1	29.2
80	54.9	35.3	32.4
100	52.3	35.9	33.2
125	51.1	36.8	35.0
160	51.4	40.3	38.0
200	49.0	40.6	38.1
250	49.2	43.4	40.6
315	49.5	46.5	42.9
400	48.9	48.0	44.1
500	47.2	48.1	44.0
630	48.9	51.1	47.0
800	47.5	50.8	46.7
1000	47.2	50.9	47.2
1250	47.4	51.2	48.0
1600	44.7	48.9	45.7
2000	43.2	47.8	44.4
2500	41.7	46.5	43.0
3150	43.0	47.0	44.2
4000	45.1	48.6	46.1
5000	41.3	45.1	41.8
6300	34.3	37.4	34.2
8000	24.9	25.3	23.8
10000			







TNEI SUMMARY ANALYSIS OF NOISE DATA FOR : Westwind-20KW-Generic blade-Full mode-15hub

Turbine identification:	
Manufacturer:	Westwind
Model Name:	20KW
Blade Type/Name:	Generic
Operational Mode:	Full
Hub Height:	15

Available Noise Document(s) Considered in the analysis of this turbine:

	Doc. Date	Doc. Name
Manufacturer doc:		
Test Report1:	19/02/2009	Noise Measurment report from F. R Mark for Westwind Wind Turbine
Test Report2:		
Test Report3:		

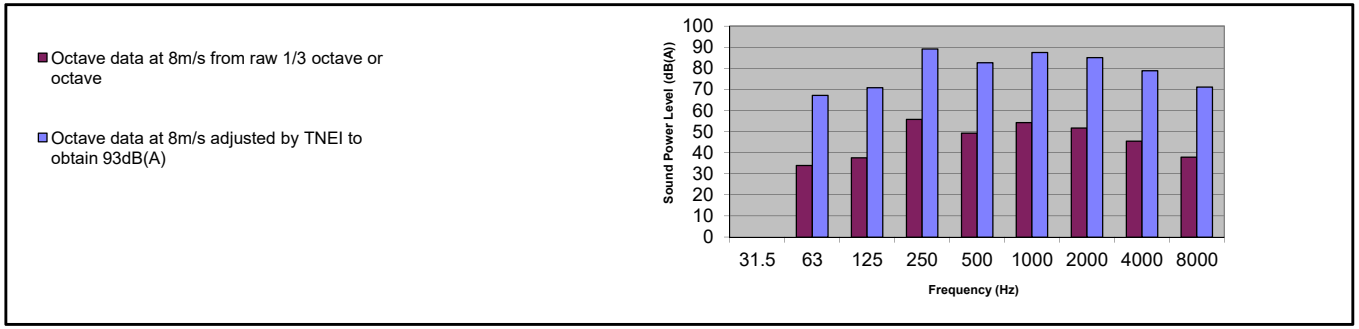
Summary of Sound Power Levels(Lw_{Aeq}) at various wind speeds:

Wind Speed (standardised 10m)	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Manufacturer Lw raw as found in document											
Manufacturer specified Lw +Manufacturer Uc+TNEI Uc (used for modeling by TNEI)			87.1	88.6	90.1	91.5	93.0	94.5	95.9	97.4	98.9
Comment: Uncertainty is added as per F.R Mark & Associates report to calculate the Declared Apparent Emissiojn Sound Power Level. It is basically 2.4dB uncertainty * 1.645 which is 4dB. We therefore add 2.3dB uncertainty above the apparent sound power level											

Summary of Octave Data (LwA_{eq}) used for modelling:

Octave data is from Test Report1 at 8m/s										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	Overall
Octave data at 8m/s from raw 1/3 octave or octave	0.0	33.9	37.5	55.8	49.3	54.2	51.7	45.5	37.8	59.7
Octave data at 8m/s adjusted by TNEI to obtain 93dB(A)	0.0	67.2	70.8	89.1	82.6	87.5	85.0	78.8	71.1	93.0
Comment: One third octave data detailed in report.										

Plot of Octave Data



Additional Comment:

Data analysed in accordance with the guidance from the IOA GPG May 2013.

Wind Turbine Noise Performance Test

Westwind 20kW

November 2011

F.R.Mark

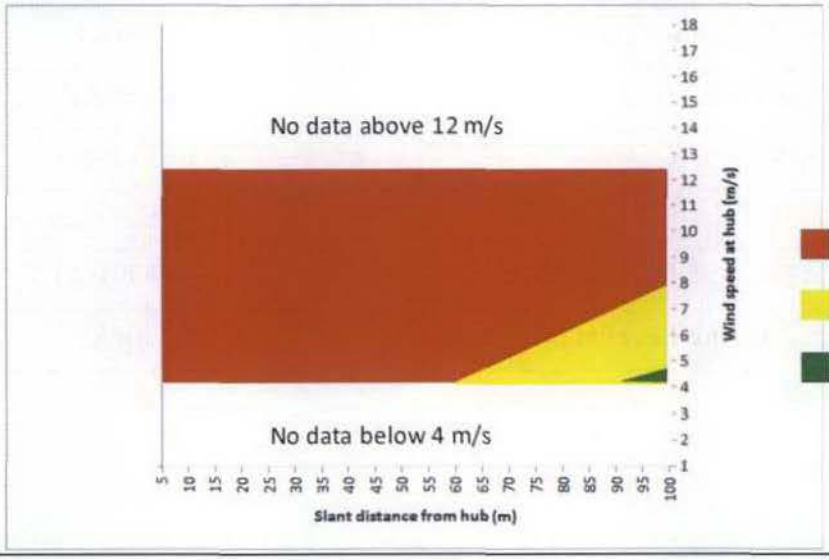
SOUTH AYRSHIRE COUNCIL

Approved under the Town and Country Planning (Scotland) Act, 1997 (As Amended), in accordance with the plans submitted and subject to any conditions that may be specified in the notification of this decision by South Ayrshire.

F.R.Mark & Associate
155 Bloomfield Avenu
Belfast, BT5 5AI
Tel:028 9045721
www.frmark.co

7.4 Noise Label

ACOUSTIC NOISE LEVELS				
Turbine Make	Westwind	**Model**		20kW
NOISE EMISSION LEVEL				**PENALTY**
Sound Power $L_{Wd,8m/s}$ (dB(A))	93	**Noise Slope, S_{dB} (dB/m/s)**	1.47	NO



Immission Noise Map
Including Penalty where applicable

Wind Turbine Data Analyser

Turbine identification and TNEI internal validation details

TNEI Wind Turbine Analyser Document Reference:	TNEI-WTDA-NOISE-CF11 No Octave-15.6Hub-8.5.2013
TNEI Turbine ID (Click here to find it):	
Model long name(Manufacturer Model Operation Mode):	CF11 No Octave
Hub Height (m):	15.6
Rated Capacity (KW):	11
Content of this worksheet fillled in by (initials):	MC
Content of this worksheet checked by (initials):	
This WT analysis was done on (dd/mm/yyyy):	08/05/2013

Comment Box:

MC 08/05/2013: Created file and used 97dB at 8m/s plus slope of 2.52dB/m/s. No octave yet (I have requested some) so used 97dB at 500Hz.
MC 16/09/2013: Does not need +2dB uncertainty, it is already in BWEA stuff. Need be model on mixed ground though.

Tonal Audibility at various wind speeds:

Wind Speed	2	3	4	5	6	7	8	9	10	11	12
Tonal Audibility ($\Delta L_{a,k}$)											
Tonal Penalty (K_T)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary of Sound Power Levels(LwA_{eq}) at various wind speeds used by TNEI for modelling:

Wind Speed	2	3	4	5	6	7	8	9	10	11	12
Lw Manufacturer+Uc	81.6	84.2	86.8	89.3	91.9	94.4	97.0	99.6	102.1	104.7	107.2
Lw Manufacturer+Uc+Tonal Penalty	81.6	84.2	86.8	89.3	91.9	94.4	97.0	99.6	102.1	104.7	107.2
Variation from octave data reference (8m/s)	-15.4	-12.8	-10.2	-7.7	-5.1	-2.6	0.0	2.6	5.1	7.7	10.2

This data is selected from data analysed in page 2 of this turbine analyser

97 dB(A) is the Warrantied Lw at 8 m/s (including uncertainty and penalty)

97.0 dB(A) is the Overall Noise from Octave data at 8 m/s

0.0 dB difference

Measured Octave or 1/3 Octave data (LwA_{eq}) at ref. wind speed of 8 m/s

Reference Report is: Report1:not available

Frequency	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630
Measured Lw as in mes. Report											97.00				
Adjusted Lw to obtain 97dB(A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.0	0.0	0.0	0.0	0.0
Frequency	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000
Measured Lw as in mes. Report															
Adjusted Lw to obtain 97dB(A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Summary of Octave Data (LwA_{eq}) used by TNEI for modelling:

Frequency	31.5	63	125	250	500	1000	2000	4000	8000	Broad.
Measured Lw as in mes. Report	0.0	0.0	0.0	97.0	0.0	0.0	0.0	0.0	0.0	97.0
Modelled Lw by TNEI	0.0	0.0	0.0	97.0	0.0	0.0	0.0	0.0	0.0	97.0

Calculated Distances for a single turbine:

Distance 35dB on Hard:	1388	,on semi-soft:	948
Distance 43dB on Hard:	497	,on semi-soft:	370

Annex 7 – Topographical Corrections and Wind Turbine Summary

Table 1 - Noise Prediction Adjustment Table (-2 when no line of sight and +3 when concave profile. Other corrections may apply.)

Date: 15/10/2018
Initials: JB
Layout: 1

Notes/Comments

a
b
c
d
e

Wind Farm	Eastings	Northings	Hub	T ID	Assessment Locations																										
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Viking 01	439200	1159693	95	1	3	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	3	3	-2	-2	0	-2	0	3	3	-2	-2	3	3	3	0	3
Viking 02	439331	1159224	95	2	3	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	3	3	-2	-2	0	-2	0	3	3	-2	-2	3	3	0	0	0
Viking 03	439334	1158729	95	3	3	-2	-2	-2	-2	-2	-2	3	-2	0	0	-2	-2	3	3	-2	3	0	-2	3	3	3	-2	-2	3	3	3	0	3
Viking 04	439057	1158289	95	4	3	-2	-2	-2	-2	-2	-2	3	0	0	0	-2	-2	3	3	-2	3	3	-2	0	3	3	-2	-2	3	3	3	3	3
Viking 05	438876	1158772	95	5	3	-2	-2	-2	-2	-2	-2	3	-2	0	0	-2	-2	3	3	-2	3	3	0	0	3	3	-2	-2	3	3	3	3	3
Viking 06	438563	1158245	95	6	0	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	3	3	-2	3	3	-2	-2	3	3	-2	-2	3	3	3	3	0
Viking 07	438313	1157780	95	7	0	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	3	3	-2	3	3	-2	-2	0	3	-2	-2	3	3	3	0	0
Viking 08	438270	1158616	95	8	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	3	-2	3	0	-2	-2	-2	0	-2	-2	3	3	3	0	0
Viking 09	438785	1157856	95	9	0	-2	-2	-2	-2	-2	-2	0	-2	-2	0	-2	-2	3	3	-2	3	0	-2	-2	0	0	-2	-2	3	3	3	0	0
Viking 10	439404	1158000	95	10	0	-2	-2	-2	-2	-2	-2	3	-2	0	0	-2	-2	0	0	-2	-2	0	0	3	3	3	-2	-2	3	3	-2	-2	-2
Viking 11	439561	1157442	95	11	3	-2	-2	-2	-2	-2	3	3	0	0	3	-2	-2	0	0	-2	-2	0	-2	3	3	3	-2	-2	3	3	0	-2	0
Viking 12	439101	1157308	95	12	3	-2	-2	-2	-2	-2	3	3	0	0	3	-2	-2	3	3	-2	3	3	-2	0	3	3	-2	-2	3	3	3	3	3
Viking 13	438962	1156847	95	13	0	-2	-2	-2	-2	-2	-2	3	0	0	0	-2	-2	3	3	0	3	3	-2	0	3	3	-2	-2	3	3	3	0	0
Viking 14	438632	1157104	95	14	3	-2	-2	-2	-2	-2	-2	3	0	0	0	-2	-2	3	3	3	3	3	-2	-2	3	3	-2	-2	3	3	3	3	3
Viking 15	438491	1156615	95	15	0	-2	-2	-2	-2	-2	-2	3	0	0	0	-2	-2	3	3	3	3	3	-2	-2	3	3	-2	-2	3	3	3	3	3
Viking 16	439489	1156742	95	16	0	-2	-2	-2	-2	-2	3	3	3	3	3	-2	-2	3	3	-2	0	0	-2	0	3	3	-2	-2	3	3	0	0	-2
Viking 17	438999	1156347	95	17	0	-2	-2	-2	-2	-2	3	3	3	0	0	-2	-2	3	3	0	0	3	-2	-2	0	3	-2	-2	3	3	0	0	-2
Viking 18	439398	1156236	95	18	0	-2	-2	-2	-2	-2	3	3	3	3	3	-2	-2	3	3	-2	0	0	-2	0	3	3	-2	-2	3	3	0	0	-2
Viking 19	438654	1155671	95	19	-2	-2	-2	-2	-2	-2	-2	0	0	-2	0	-2	-2	0	0	0	0	0	-2	-2	-2	3	-2	-2	3	0	0	-2	-2
Viking 20	438208	1155282	95	20	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	0	-2	-2	3	3	0	-2	0
Viking 21	438100	1154776	95	21	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	0	-2	-2	3	3	0	-2	0
Viking 22	437621	1154621	95	22	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	0	-2	-2	3	3	0	-2	0
Viking 23	437312	1154199	95	23	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	-2	-2	-2	3	3	0	-2	3
Viking 24	436798	1154695	95	24	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	0	-2	-2	-2	-2	-2	-2	-2	3	0	0	-2	3
Viking 25	436790	1155360	95	25	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	0	-2	-2	-2	-2	-2	-2	-2	0	0	0	-2	0
Viking 26	436872	1156166	95	26	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	-2	-2	-2	0	0	0	-2	0
Viking 27	437266	1155282	95	27	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	0	-2	-2	3	3	0	-2	0
Viking 28	437141	1155852	95	28	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	0	3	-2	-2	-2	0	-2	-2	3	3	0	-2	3
Viking 29	437342	1156409	95	29	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	0	3	-2	-2	-2	0	-2	-2	3	3	0	-2	0
Viking 30	437608	1156020	95	30	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	0	-2	-2	3	3	0	-2	0
Viking 31	438014	1154128	95	31	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	-2	0	0	0	0	0	-2	-2	-2	3	-2	-2	3	3	0	-2	3
Viking 32	437905	1153627	95	32	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	-2	0	0	0	-2	0	-2	-2	-2	3	-2	-2	3	3	0	-2	3
Viking 33	437434	1153720	95	33	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	-2	3	3	0	0	-2	-2	-2	-2	-2	-2	-2	3	3	0	-2	3
Viking 34	437817	1152764	95	34	-2	-2	-2	-2	-2	-2	3	3	-2	-2	-2	-2	-2	0	0	0	0	-2	-2	-2	-2	-2	-2	-2	3	3	0	-2	3
Viking 35	437356	1152817	95	35	-2	-2	-2	-2	-2	-2	3	3	-2	-2	-2	0	-2	3	3	0	0	-2	-2	-2	-2	-2	-2	-2	3	3	0	-2	3
Viking 36	440776	1160883	95	36	0	-2	-2	-2	-2	-2	-2	0	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2	-2
Viking 37	440772	1160385	95	37	3	-2	-2	-2	-2	-2	-2	0	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	0	-2	-2	-2
Viking 38	440854	1159914	95	38	3	-2	-2	-2	-2	-2	-2	0	3	0	3	-2	-2	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	-2	-2	-2	-2
Viking 39	440900	1159430	95	39	0	-2	-2	-2	-2	-2	-2	0	3	3	3	-2	-2	0	-2	-2	-2	-2	-2	0	0	0	-2	-2	-2	-2	-2	-2	-2
Viking 40	440933	1158934	95	40	0	-2	-2	-2	-2	-2	-2	0	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	-2	-2	-2	-2	-2	-2	-2
Viking 41	440988	1158452	95	41	0	-2	-2	-2	-2	-2	-2	0	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	0	0	0	-2	-2	-2	0	-2	-2	-2
Viking 42	441035	1157978	95	42	0	-2	-2	-2	-2	-2	0	3	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	0	0	3	-2	-2	3	-2	-2	-2	-2
Viking 43	441080	1157495	95	43	0	-2	-2	-2	-2	-2	0	3	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	3	-2	-2	3	-2	-2	-2	-2
Viking 44	1156994	95	44	0	-2	-2	-2	-2	-2	-2	0	3	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	3	-2	-2	-2	-2	-2	-2	-2
Viking 45	441013	1156498	95	45	-2	-2	-2	-2	-2	-2	0	3	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	3	-2	-2	-2	-2	-2	-2	-2
Viking 46	440965	1155996	95	46	-2	-2	-2	-2	-2	-2	0	3	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	3	-2	-2	-2	0	-2	-2	-2
Viking 47	441852	1160764	95	47	0	-2	-2	-2	-2	-2	-2	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	0	3	-2	-2	-2	-2	-2	-2	-2	-2
Viking 48	441915	1161255	95	48	0	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	0
Viking 49	442257	1161670	95	49	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 50	442691	1161878	95	50	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 51	442916	1162371	95	51	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0
Viking 52	443200	1161794	95	52	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 53	443433	1162282	95	53	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0
Viking 54	443943	1162196	95	54	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 55	443735	1161713	95	55	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0
Viking 56	443806	1161179	95	56	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 57	444086	1161553	95	57	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 58	442098	1160426	95	58	0	-2	-2	-2	-2	-2	-2	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2
Viking 59	442442	1160143	95	59	0	-2	-2	-2	-2	-2	-2	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2
Viking 60	442621	1160660	95	60	3	-2	-2	-2	-2	-2	-2	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	3
Viking 61	442333	1160948	95	61	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 62	442620	1161400	95	62	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	3
Viking 63	443093	1160969	95	63	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0
Viking 64	441689	1160100	95	64	0	-2	-2	-2	-2	-2	-2	3	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	0	3	-2	-2	-2	-2	-2	-2	-2	-2
Viking 65	442006	1159772	95	65	0	-2	-2	-2	-2	-2	-2	3	3	0	0	-2	-2	-2	-2	-2	-2	-2	-2	0	3	0	-2	-2	-2	-2	-2	-2	-2
Viking 66	442271	1159384	95	66	0	-2	-2	-2	-2	-2	-2	0	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 67	442108	1158903	95	67	3	-2	0	-2	-2	-2	0	3	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	3	3	0	-2	-2	-2	3	-2	-2	-2
Viking 68	442458	1156070	95	68	-2	-2	-2	-2	-2	-2	0	0	3	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	3	-2	-2	-2	-2	-2	-2
Viking 69	442688	1155652	95	69	-2	-2	-2	-2	-2	-2	0	0	3	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	3	-2	-2	-2	-2	-2	-2
Viking 70	442884	1155239	95	70	-2	-2	0	-2	-2	-2	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	-2	-2
Viking 71	443239	1156095	95	71	-2	-2	0	-2	-2	-2	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	-2	-2
Viking 72	443721	1155951	95	72	-2	-2	0	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	0	-2	-2	-2	-2	-2	-2
Viking 73	443562	1155460	95	73	-2	-2	-2	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	-2	-2
Viking 74	443208	1156783	95	74	-2	-2	0	-2	-2	-2	0	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 75	443652	1156725	95	75	-2	-2	0	-2	-2	-2	0	0	3	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	3	3	-2	-2	-2	-2	-2	-2
Viking 76	444080	1157082	95	76	-2	-2	0	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 77	444204	1157575	95	77	-2	-2	0	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 78	443752	1157787	95	78	-2	-2	0	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 79	443509	1157280	95	79	-2	-2	0	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 80	443835	1158308	95	80	-2	-2	0	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 81	444294	1158559	95	81	-2	-2	0	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 82	444792	1158632	95	82	-2	-2	0	0	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 83	444013	1158919	95	83	0	-2	0	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 84	444469	1159061	95	84	-2	-2	0	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 85	444829	1159527	95	85	-2	-2	0	0	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	0
Viking 86	444960	1159141	95	86	-2	-2	0	0	3	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 87	444681	1157604	95	87	-2	-2	0	0	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 88	444612	1157115	95	88	-2	-2	3	0	0	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	-2	-2
Viking 89	444316	1156655	95	89	-2	-2	0	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	-2	-2
Viking 90	444225	1156040	95	90	-2	-2	0	-2	-2	-2	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Viking 91	444806	1156649	95	91	-2	-2	0	0	-2	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 92	445073	1158295	95	92	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 93	444570	1158179	95	93	-2	-2	0	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	0	-2	-2	-2	-2	-2	-2
Viking 94	445257	1158832	95	94	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Viking 95	445562	1158314	95	95	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 96	446086	1158412	95	96	-2	-2	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 97	445302	1157718	95	97	-2	-2	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 98	445595	1157383	95	98	-2	-2	0	0	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 99	445766	1156959	95	99	-2	-2	0	3	0	0	3	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	-2	-2
Viking 100	446130	1157523	95	100	-2	-2	3	3	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 101	445828	1157861	95	101	-2	-2	3	3	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 102	446380	1157963	95	102	-2	-2	0	3	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2
Viking 103	445315	1156780	95	103	-2	-2	0	0	-2	0	0	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2

Wind Farm	Eastings	Northings	Hub	T ID	Assessment Locations																										
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Luggies Knowe	446337	1145644	80	104	-2	-2	-2	-2	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	-2	-2
Luggies Knowe	445990	1145293	80	105	-2	-2	-2	-2	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	-2	-2
Luggies Knowe	446349	1145229	80	106	-2	-2	-2	-2	3	3	3	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	3	-2	-2	-2	-2	-2	-2	-2
Norgaet	440725	1167500	15	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East of Norbrek	441015	1164056	15	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mid Town	434701	1153694	15	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dury	445673	1160685	15	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Garden	432297	1152774	15	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pund	445046	1153077	15	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pund	445088	1153059	15	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pund	445180	1153110	15	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wirliegert	435087	1155441	15	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Southlea	434316	1154092	15	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Southlee	434297	1154074	15	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cole	435985	1161997	15	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cole	435997	1162074	15	119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lwr Langaskule	433294	1153246	15	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lwr Langaskule	433286	1153193	15	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parkhead	440725	1152099	15	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Lynn	436391	1165829	15	123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Lynn	436376	1165851	15	124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Lynn	436360	1165877	15	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moars Park	438176	1149992	15	126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aithness	433434	1158456	9	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Langaskule	433225	1153299	15	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fairview	448330	1164784	15	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vallayre	447927	1164981	15	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kirkhouse	432578	1153301	15	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sandyburn	448793	1163170	12	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Knowes	432801	1153962	15	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kirkhouse	432593	1153208	15	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West of Lower Biggins	433929	1155945	15	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bixter Public Hall	433241	1152491	15	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Tarrant	445058	1162896	15	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lunnasting Primary School	448065	1165742	11	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brattahild	448839	1166414	11	139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greenmeadow	447554	1165000	11	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stavaberg	448830	1163444	12	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Nesting Public Hall	446778	1153480	11	142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brunt Hamarsland	444473	1151830	38	143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Hamarsland	443906	1148316	15	144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whiteness and Weisdale Public Hall	438985	1147943	15	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pouster	431260	1151427	15	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annsfield	434806	1148339	15	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annsfield	434853	1148302	15	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annsfield	434851	1148257	15	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parkhead	431246	1157452	18	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haa	430578	1157783	15	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vementry Farm	431046	1159730	15	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hill of Wethersta	436881	1165961	15	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hill of Wethersta	436859	1165975	15	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hill of Wethersta	436837	1165984	15	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hill of Wethersta	436819	1166001	15	156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilsa	433080	1163435	15	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aith Pier	434720	1156034	0	158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2 - Cumulative Wind Turbines

ID	Name	X	Y	Turbine Model
104	Luggies Knowe	446337	1145644	Enercon E82, 3MW
105	Luggies Knowe	445990	1145293	Enercon E82, 3MW
106	Luggies Knowe	446349	1145229	Enercon E82, 3MW
107	Norgaet	440725	1167500	CF 11KW
108	East of Norbrek	441015	1164056	Evance R9000
109	Mid Town	434701	1153694	Kingspan KW6
110	Dury	445673	1160685	Kingspan KW6
111	Garden	432297	1152774	Evance R9000
112	Pund	445046	1153077	Kingspan KW6
113	Pund	445088	1153059	Kingspan KW6
114	Pund	445180	1153110	Kingspan KW6
115	Wirliegert	435087	1155441	Kingspan KW15
116	Southlea	434316	1154092	Kingspan KW6
117	Southlee	434297	1154074	Kingspan KW15
118	Cole	435985	1161997	Kingspan KW6
119	Cole	435997	1162074	Kingspan KW6
120	Lwr Langaskule	433294	1153246	Evance 9000
121	Lwr Langaskule	433286	1153193	Evance 9000
122	Parkhead	440725	1152099	Kingspan KW15
123	East Lynn	436391	1165829	Kingspan KW6
124	East Lynn	436376	1165851	Kingspan KW6
125	East Lynn	436360	1165877	Kingspan KW6
126	Moars Park	438176	1149992	Evance R9000
127	Aithness	433434	1158456	Kingspan KW6
128	Lower Langaskule	433225	1153299	5kW Evance
129	Fairview	448330	1164784	5kW Evance
130	Vallayre	447927	1164981	5kW Evance
131	Kirkhouse	432578	1153301	C&F11kW
132	Sandyburn	448793	1163170	6.1kW Eoltec Scirocco 5.6-6
133	Knowes	432801	1153962	C&F 11
134	Kirkhouse	432593	1153208	C&F11kW
135	West of Lower Biggins	433929	1155945	C&F15kW
136	Bixter Public Hall	433241	1152491	Westwind 20kW
137	Lower Tarrarit	445058	1162896	Evance R9000
138	Lunnasting Primary School	448065	1165742	6kW Proven P11
139	Brattahild	448839	1166414	6kW Kingspan KW6
140	Greenmeadow	447554	1165000	6kW Proven P11
141	Stavaberg	448830	1163444	6.1kW Eoltec Scirocco 5.6-6
142	South Nesting Public Hall	446778	1153480	6kW Proven
143	Brunt Hamarsland	444473	1151830	11.5kW Proven P35-2
144	North Hamarsland	443906	1148316	6kW Kingspan KW6
145	Whiteness and Weisdale Public Hall	438985	1147943	5kW Evance
146	Pouster	431260	1151427	5kW Evance
147	Annsfield	434806	1148339	6kW Kingspan
148	Annsfield	434853	1148302	6kW Kingspan
149	Annsfield	434851	1148257	6kW Kingspan
150	Parkhead	431246	1157452	15kW Proven
151	Haa	430578	1157783	5kW Iskra Evance R9000
152	Vementry Farm	431046	1159730	6kW Kingspan
153	Hill of Wethersta	436881	1165961	6kW Kingspan KW6
154	Hill of Wethersta	436859	1165975	6kW Kingspan KW6
155	Hill of Wethersta	436837	1165984	6kW Kingspan KW6
156	Hill of Wethersta	436819	1166001	6kW Kingspan KW6
157	Gilsa	433080	1163435	5kW Evance
158	Aith Pier	434720	1156034	6kW Kingspan KW6

Annex 8 – Noise Conditions

Noise

1) The rating level of noise immissions from the combined effects of the wind turbines hereby permitted (including the application of any tonal penalty), when determined in accordance with the attached Guidance Notes, shall not exceed the values for the relevant integer wind speeds set out in or derived from Tables 1 and 2 attached to these conditions and:

    A) Prior to the operation of the wind farm, the wind farm operator shall submit to the Local Authority for written approval a list of proposed independent consultants who may undertake compliance measurements in accordance with this condition. Amendments to the list of approved consultants shall be made only with the prior written approval of the Local Authority.

    B) Within 21 days from receipt of a written request of the Local Authority, following a complaint to it alleging noise disturbance at a dwelling, the wind farm operator shall, at its expense, employ an independent consultant approved by the Local Authority to assess the level of noise immissions from the wind farm at the complainant's property (or a suitable alternative location agreed in writing with the Local Authority) in accordance with the procedures described in the attached Guidance Notes. The written request from the Local Authority shall set out at least the date, time and location that the complaint relates to. Within 14 days of receipt of the written request of the Local Authority made under this paragraph (B), the wind farm operator shall provide the information relevant to the complaint logged in accordance with paragraph (H) to the Local Authority in the format set out in Guidance Note 1(e).

    C) Where there is more than one property at a location specified in Tables 1 and 2 attached to this condition, the noise limits set for that location shall apply to all dwellings at that location. Where a dwelling to which a complaint is related is not identified by name or location in the Tables attached to these conditions, the wind farm operator shall submit to the Local Authority for written approval proposed noise limits to be adopted at the complainant's dwelling for compliance checking purposes. The proposed noise limits are to be those limits selected from the Tables specified for a listed location which the independent consultant considers as being likely to experience the most similar background noise environment to that experienced at the complainant's dwelling. The submission of the proposed noise limits to the Local Authority shall include a written justification of the choice of the representative background noise environment provided by the independent consultant. The rating level of noise immissions resulting from the combined effects of the wind turbines when determined in accordance with the attached Guidance Notes shall not exceed the noise limits approved in writing by the Local Authority for the complainant's dwelling.

    D) Prior to the commencement of any measurements by the independent consultant to be undertaken in accordance with these conditions, the wind farm operator shall submit to the Local Authority for written approval the proposed measurement location identified in accordance with the Guidance Notes where measurements for compliance checking purposes shall be undertaken. Where the proposed measurement location is close to the wind turbines, rather than at the complainants property (to improve the signal to noise ratio), then the operators submission shall include a method to calculate the noise level from the wind turbines at the

Comment [JM1]: This condition follows a similar format to the example suggested in current good practice (the IOA GPG). Please note that the paragraph references [e.g. A), B) etc] and the guidance note references [e.g. Note 1a)] used in this condition are used to enable (extensive) cross referencing so extreme care should be taken when making any amendments.

complainants property based on the noise levels measured at the agreed location (the alternative method). Details of the alternative method together with any associated guidance notes deemed necessary, shall be submitted to and agreed in writing by the Local Authority prior to the commencement of any measurements. Measurements to assess compliance with the noise limits set out in the Tables attached to these conditions or approved by the Local Authority pursuant to paragraph (C) of this condition shall be undertaken at the measurement location approved in writing by the Local Authority.

E) Prior to the submission of the independent consultant's assessment of the rating level of noise immissions pursuant to paragraph (F) of this condition, the wind farm operator shall submit to the Local Authority for written approval a proposed assessment protocol setting out the following:

i) the range of meteorological and operational conditions (the range of wind speeds, wind directions, power generation and times of day) to determine the assessment of rating level of noise immissions.

ii) a reasoned assessment as to whether the noise giving rise to the complaint contains or is likely to contain a tonal component.

The proposed range of conditions shall be those which prevailed during times when the complainant alleges there was disturbance due to noise, having regard to the information provided in the written request of the Local Authority under paragraph (B), and such others as the independent consultant considers necessary to fully assess the noise at the complainant's property. The assessment of the rating level of noise immissions shall be undertaken in accordance with the assessment protocol approved in writing by the Local Authority and the attached Guidance Notes.

F) The wind farm operator shall provide to the Local Authority the independent consultant's assessment of the rating level of noise immissions undertaken in accordance with the Guidance Notes within 2 months of the date of the written request of the Local Authority made under paragraph (B) of this condition unless the time limit is extended in writing by the Local Authority. The assessment shall include all data collected for the purposes of undertaking the compliance measurements, such data to be provided in the format set out in Guidance Note 1(e) of the Guidance Notes. The instrumentation used to undertake the measurements shall be calibrated in accordance with Guidance Note 1(a) and certificates of calibration shall be submitted to the Local Authority with the independent consultant's assessment of the rating level of noise immissions.

G) Where a further assessment of the rating level of noise immissions from the wind farm is required pursuant to Guidance Note 4(c) of the attached Guidance Notes, the wind farm operator shall submit a copy of the further assessment within 21 days of submission of the independent consultant's assessment pursuant to paragraph (F) above unless the time limit for the submission of the further assessment has been extended in writing by the Local Authority.

H) The wind farm operator shall continuously log power production, wind speed and wind direction, all in accordance with Guidance Note 1(d) of the attached Guidance Notes. The data shall be retained for a period of not less than 24 months. The wind

Comment [JM2]: To provide additional context, an example template protocol has also been provided. The final protocol to be used would need to be drafted by the appointed independent consultant considering the complaints received.

farm operator shall provide this information in the format set out in Guidance Note 1(e) of the attached Guidance Notes to the Local Authority on its request within 14 days of receipt in writing of such a request.

Note: For the purposes of this condition, a "dwelling" is a building within Use Classes 7, 8 and 9 of the Town and Country Planning (Use Classes) (Scotland) Order 1997 which lawfully exists or had planning permission at the date of this permission.

Table 1 - Between 07:00 and 23:00 - Noise level dB $L_{A90, 10\text{-minute}}$

Location (easting, northing grid coordinates)	Standardised wind speed at 10 metres height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
	L_{A90} Decibel Levels											
Glenlea (444322, 1163627)	35	35	35	35	35	35	35	35.3	36.8	38.3	39.8	41.4
Taratet (445001,1162940)	35	35	35	35	35	34.9	30	30	30	30	30	31.4
Grunnafirth (445947, 1159638)	35	35	35	35	35	35	35	36.6	38.8	40.9	42.6	43.9
New House at Dury (445673, 1160441)	35	35	35	35	35	35	35	36.6	38.8	40.3	42	43.4
Hamelea (448170, 1157574)	35	35	35	35	35	35	35	36.6	39.7	42.8	45.5	47.9
Whinnia Lee (446682, 1155852)	35	35	35	35	35	35	35	35	36.5	38.7	40.6	42.2
Hollydell (443843, 1154352)	35	35	35	35	35	36.1	38.7	41.3	43.9	46.2	48.3	49.9
Sandwater (441732, 1155184)	35	35	35	35	35	35.7	38.1	40.6	43.1	45.5	47.7	49.5
Setter House (439705, 1154796)	35	35	35	35	35	35	35	35.6	37.7	40	42.5	45
Millhouse (439460, 1153086)	35	35	35	35	35	35	35	35.7	37.5	39.6	41.9	44.4
Koopins (439511, 1152903)	35	35	35	35	35	35	35	35.7	37.5	39.6	41.9	44.4
Dykeside (436370, 1151231)	35	35	35	35	35	35	35	36.4	38.3	40.3	42.4	44.6
Breckenlea (435463, 1151606)	35	35	35	35	35	35	35	36.4	38.3	40.3	42.4	44.6
Gruids (434765, 1153921)	35	35	35	35	35	35	35	35	35.1	30.4	31.6	42.3
Mid Town (434695, 1153637)	35	35	35	35	35	35	35	30	30	30	31.6	35.5
Valhalla (436728, 1157749)	35	35	35	35	35	35	35	35.2	37.7	40.7	44.1	48
Whitelaw Road (434911, 1155664)	35	35	35	35	35	35	35	35.2	32.7	30.7	34.1	42.7
Roadside (436191, 1157714)	35	35	35	35	35	35	35	35.2	37.7	40.7	44.1	48

Comment [JM3]: Please note that two versions of Table 1 are included here to reflect the two options included in the noise assessment submitted with the variation application, one based on a day time fixed minimum limit of 35 dB and another based on 40 dB. The final noise conditions **should include just one Table 1** and this can be recalculated, if necessary to consider an alternative number in the range of 35 – 40 dB.

Hoddins (437135, 1161516)	35	35	35	35	35	35	35	35.1	36.9	39.2	42	45.3
Rocklea (439858, 1162158)	35	35	35	35	35	35	35	36	37.6	39.4	41.6	44.1

Table 1 - Between 07:00 and 23:00 - Noise level dB $L_{A90, 10\text{-minute}}$

Location (easting, northing grid coordinates)	**Standardised wind speed at 10 metres height (m/s) within the site averaged over 10-minute periods**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	L_{A90} Decibel Levels											
Glenlea (444322, 1163627)	40	40	40	40	40	40	40	40	40	40	40	41.4
Taratet (445001,1162940)	40	40	40	40	40	34.9	30	30	30	30	30	31.4
Grunnafirth (445947, 1159638)	40	40	40	40	40	40	40	40	40	40.9	42.6	43.9
New House at Dury (445673, 1160441)	40	40	40	40	40	40	40	40	40	40.3	42	43.4
Hamelea (448170, 1157574)	40	40	40	40	40	40	40	40	40	42.8	45.5	47.9
Whinnia Lee (446682, 1155852)	40	40	40	40	40	40	40	40	40	40	40.6	42.2
Hollydell (443843, 1154352)	40	40	40	40	40	40	40	41.3	43.9	46.2	48.3	49.9
Sandwater (441732, 1155184)	40	40	40	40	40	40	40	40.6	43.1	45.5	47.7	49.5
Setter House (439705, 1154796)	40	40	40	40	40	40	40	40	40	40	42.5	45
Millhouse (439460, 1153086)	40	40	40	40	40	40	40	40	40	40	41.9	44.4
Koopins (439511, 1152903)	40	40	40	40	40	40	40	40	40	40	41.9	44.4
Dykeside (436370, 1151231)	40	40	40	40	40	40	40	40	40	40.3	42.4	44.6
Breckenlea (435463, 1151606)	40	40	40	40	40	40	40	40	40	40.3	42.4	44.6
Gruids (434765, 1153921)	40	40	40	40	40	40	39.5	38.9	37.6	30.4	31.6	42.3
Mid Town (434695, 1153637)	40	40	40	40	40	38	35.5	30	30	30	31.6	35.5
Valhalla (436728, 1157749)	40	40	40	40	40	40	40	40	40	40.7	44.1	48
Whitelaw Road (434911, 1155664)	40	40	40	40	40	40	39.3	38.1	32.7	30.7	34.1	42.7
Roadside (436191, 1157714)	40	40	40	40	40	40	40	40	40	40.7	44.1	48
Hoddins (437135, 1161516)	40	40	40	40	40	40	40	40	40	40	42	45.3

Comment [JM4]: Please note that two versions of Table 1 are included here to reflect the two options included in the noise assessment submitted with the variation application, one based on a day time fixed minimum limit of 35 dB and another based on 40 dB. The final noise conditions **should include just one Table 1** and this can be recalculated, if necessary to consider an alternative number in the range of 35 – 40 dB.

Rocklea (439858, 1162158)	40	40	40	40	40	40	40	40	40	40	41.6	44.1

Table 2 - Between 23:00 and 07:00 - Noise level dB $L_{A90, 10\text{-minute}}$

Location (easting, northing grid coordinates)	Standardised wind speed at 10 metres height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
	L_{A90} Decibel Levels											
Glenlea (444322, 1163627)	43	43	43	43	43	43	43	43	43	43	43	43
Taratet (445001,1162940)	43	43	43	43	43	41.2	39.1	33	33	33	33	33
Grunnafirth (445947, 1159638)	43	43	43	43	43	43	43	43	43	43	43	43.4
New House at Dury (445673, 1160441)	43	43	43	43	43	43	43	43	43	43	42.4	42.9
Hamelea (448170, 1157574)	43	43	43	43	43	43	43	43	43	43	45	49.7
Whinnia Lee (446682, 1155852)	43	43	43	43	43	43	43	43	43	43	43	45.4
Hollydell (443843, 1154352)	43	43	43	43	43	43	43	43	43	43	44.9	46.1
Sandwater (441732, 1155184)	43	43	43	43	43	43	43	43	43	43	45.8	48.6
Setter House (439705, 1154796)	43	43	43	43	43	43	43	43	43	43	43	43
Millhouse (439460, 1153086)	43	43	43	43	43	43	43	43	43	43	43	43
Koopins (439511, 1152903)	43	43	43	43	43	43	43	43	43	43	43	43
Dykeside (436370, 1151231)	43	43	43	43	43	43	43	43	43	43	43	44.6
Breckenlea (435463, 1151606)	43	43	43	43	43	43	43	43	43	43	43	44.6
Gruids (434765, 1153921)	43	43	43	43	43	43	43	42.5	42	40.4	33	33
Mid Town (434695, 1153637)	43	43	43	43	43	42.1	41.3	39.7	33	33	33	33
Valhalla (436728, 1157749)	43	43	43	43	43	43	43	43	43	43	43	43
Whitelaw Road (434911, 1155664)	43	43	43	43	43	43	43	42.1	40.7	33	33	33
Roadside (436191, 1157714)	43	43	43	43	43	43	43	43	43	43	43	43
Hoddins (437135, 1161516)	43	43	43	43	43	43	43	43	43	43	43	43.7
Rocklea (439858, 1162158)	43	43	43	43	43	43	43	43	43	43	43	43

Note 1 to Tables 1 2: The geographical coordinates references set out in these tables are provided for the purpose of identifying the general location of dwellings to which a given set of noise limits applies. The standardised wind speed at 10 metres height within the site refers to wind speed at 10 metres height derived from those at hub height, calculated in accordance with the method given in the Guidance Notes.

Note 2 to Tables 1 2: The noise limits detailed in the Tables assume that none of occupiers of the properties have a financial involvement with the development hereby consented or any of the nearby wind turbines which are consented or operational at the date of this consent. The noise limits also assume that all existing / consented turbines are constructed and that they remain operational for the lifetime of this consent and that their noise immissions are as per the levels detailed in Chapter 6 of the ES. The noise limits detailed in this condition can be recalculated, if necessary to consider any differences in financially involved or turbine operation, using the same methodology adopted in Chapter 6 of the ES dated October 2018 and submitted with the application APP/XXX). Any update to the noise limits shall be submitted to and approved in writing by, the Local Authority. The development shall operate in accordance with the limits contained in this Condition unless the Local Authority gives it written consent to an updated set of noise limits.

Comment [c5]: This will need to be updated once application reference known

Guidance Notes for Noise Condition

These notes are to be read with and form part of the noise condition. They further explain the condition and specify the methods to be employed in the assessment of complaints about noise immissions from the wind farm. The rating level at each integer wind speed is the arithmetic sum of the wind farm noise level as determined from the best-fit curve described in Note 2 of these Guidance Notes and any tonal penalty applied in accordance with Note 3 with any necessary correction for residual background noise levels in accordance with Note 4. Reference to ETSU-R-97 refers to the publication entitled "The Assessment and Rating of Noise from Wind Farms" (1997) published by the Energy Technology Support unit (ETSU) for the Department of Trade and Industry (DTI).

Note 1

(a) Values of the $L_{A90,10\text{-}minute}$ noise statistic should be measured at the complainant's property (or an approved alternative representative location as detailed in Note 1(b)), using a sound level meter of EN 60651/BS EN 60804 Type 1, or BS EN 61672 Class 1 quality (or the equivalent UK adopted standard in force at the time of the measurements) set to measure using the fast time weighted response as specified in BS EN 60651/BS EN 60804 or BS EN 61672-1 (or the equivalent UK adopted standard in force at the time of the measurements). This should be calibrated before and after each set of measurements, using a calibrator meeting BS EN 60945:2003 "Electroacoustics – sound calibrators" Class 1 with PTB Type Approval (or the equivalent UK adopted standard in force at the time of the measurements) and the results shall be recorded. Measurements shall be undertaken in such a manner to enable a tonal penalty to be calculated and applied in accordance with Guidance Note 3.

(b) The microphone shall be mounted at 1.2 - 1.5 metres above ground level, fitted with a two-layer windshield or suitable equivalent approved in writing by the Local Authority, and placed outside the complainant's dwelling. Measurements should be made in "free field" conditions. To achieve this, the microphone shall be placed at least 3.5 metres away from the building facade or any reflecting surface except the ground at the approved measurement location. In the event that the consent of the complainant for access to his or her property to undertake compliance measurements is withheld, the wind farm operator shall submit for the written approval of the Local Authority details of the proposed alternative representative measurement location prior to the commencement of measurements and the measurements shall be undertaken at the approved alternative representative measurement location.

(c) The $L_{A90,10\text{-}minute}$ measurements should be synchronised with measurements of the 10-minute arithmetic mean wind speed and wind direction data and with operational data logged in accordance with Guidance Note 1(d) and rain data logged in accordance with Note 1(f).

(d) To enable compliance with the conditions to be evaluated, the wind farm operator shall continuously log arithmetic mean wind speed in metres per second (m/s) and arithmetic mean wind direction in degrees from north in each successive 10-minutes period in a manner to be agreed in writing with the planning authority. Each 10 minute arithmetic average mean wind speed data as measured or calculated at turbine hub height shall be 'standardised' to a reference height of 10 metres as described in ETSU-R-97 at page 120 using a reference roughness length of 0.05 metres. It is this standardised 10 metre height wind speed data which is correlated with the noise measurements determined as valid in accordance with Note 2(b), such correlation to be undertaken in the manner described in Note 2(c). All 10-minute periods shall commence on the hour and in 10-minute increments thereafter synchronised with Greenwich Mean Time and adjusted to British Summer Time where necessary.

(e) Data provided to the Local Authority in accordance with paragraphs (E) (F) (G) and (H) of the noise condition shall be provided in comma separated values in electronic format with the exception of data collected to asses tonal noise (if required) which shall be provided in a format to be agreed in writing with the Local Authority.

(f) A data logging rain gauge shall be installed in the course of the independent consultant undertaking an assessment of the level of noise immissions. The gauge shall record over successive 10-minute periods synchronised with the periods of data recorded in accordance with Note 1(d).

Note 2

(a) The noise measurements should be made so as to provide not less than 20 valid data points as defined in Note 2 paragraph (b).

(b) Valid data points are those measured during the conditions set out in the assessment protocol approved by the Local Authority under paragraph (E) of the noise condition but excluding any periods of rainfall measured in accordance with Note 1(f).

(c) Values of the $L_{A90,10\text{-}minute}$ noise measurements and corresponding values of the 10-minute standardised ten metre height wind speed for those data points considered valid in accordance with Note 2(b) shall be plotted on an XY chart with noise level on the Y-axis and wind speed on the X-axis. A least squares, "best fit" curve of an order deemed appropriate by the independent consultant (but which may not be higher than a fourth order) shall be fitted to the data points to define the wind farm noise level at each integer speed.

Note 3

(a) Where, in accordance with the approved assessment protocol under paragraph (E) of the noise condition, noise immissions at the location or locations where compliance measurements are being undertaken contain or are likely to contain a tonal component, a tonal penalty shall be calculated and applied using the following rating procedure.

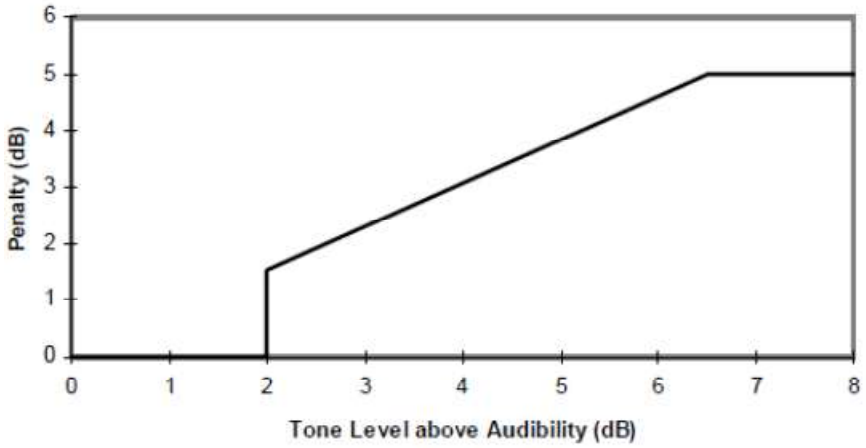
(b) For each 10-minute interval for which $L_{A90,10\text{-}minute}$ data have been determined as valid in accordance with Note 2, a tonal assessment shall be performed on noise immissions during 2-minutes of each 10-minute period. The 2-minute periods should be spaced at 10-minute intervals provided that uninterrupted uncorrupted data are available ("the standard procedure"). Where uncorrupted data are not available, the first available uninterrupted clean 2-minute period out of the affected overall 10-minute period shall be selected. Any such deviations from the standard procedure shall be reported.

(c) For each of the 2-minute samples the tone level above audibility shall be calculated by comparison with the audibility criterion given in Section 2.1 on pages 104 -109 of ETSU-R-97.

(d) The tone level above audibility shall be plotted against wind speed for each of the 2-minute samples. Samples for which the tones were below the audibility criterion or no tone was identified, a value of zero audibility shall be substituted.

(e) A least squares "best fit" linear regression shall then be performed to establish the average tone level above audibility for each integer wind speed derived from the value of the "best fit" line fitted to values within ± 0.5m/s of each integer wind speed. If there is no apparent trend with wind speed then a simple arithmetic mean shall be used. This process shall be repeated for each integer wind speed for which there is an assessment of overall levels in Note 2.

(f) The tonal penalty is derived from the margin above audibility of the tone according to the figure below derived from the average tone level above audibility for each integer wind speed.



Note 4

(a) If a tonal penalty is to be applied in accordance with Note 3 the rating level of the turbine noise at each wind speed is the arithmetic sum of the measured noise level as determined from the best fit curve described in Note 2 and the penalty for tonal noise as derived in accordance with Note 3 at each integer wind speed within the range set out in the approved assessment protocol under paragraph (E) of the noise condition.

(b) If no tonal penalty is to be applied then the rating level of the turbine noise at each wind speed is equal to the measured noise level as determined from the best fit curve described in Note 2.

(c) If the rating level at any integer wind speed lies at or below the values set out in the Tables attached to the conditions or at or below the noise limits approved by the Local Authority for a complainant's dwelling in accordance with paragraph (C) of the noise condition then no further action is necessary. In the event that the rating level is above the limit(s) set out in the Tables attached to the noise conditions or the noise limits for a complainant's dwelling approved in accordance with paragraph (C) of the noise condition, the independent consultant shall undertake a further assessment of the rating level to correct for background noise so that the rating level relates to wind turbine noise immission only.

(d) The wind farm operator shall ensure that all the wind turbines in the development are turned off for such period as the independent consultant requires to undertake the further assessment. The further assessment shall be undertaken in accordance with the following steps:

i. Repeating the steps in Note 2, with the wind farm switched off, and determining the background noise (L_3) at each integer wind speed within the range set out in the approved noise assessment protocol under paragraph (E) of this condition.

ii. The wind farm noise (L_1) at this speed shall then be calculated as follows where L_2 is the measured level with turbines running but without the addition of any tonal penalty:

$$L_1 = 10\log\left[10^{L_2/10} - 10^{L_3/10}\right]$$

iii. The rating level shall be re-calculated by adding the tonal penalty (if any is applied in accordance with Note 3) to the derived wind farm noise L_1 at that integer wind speed.

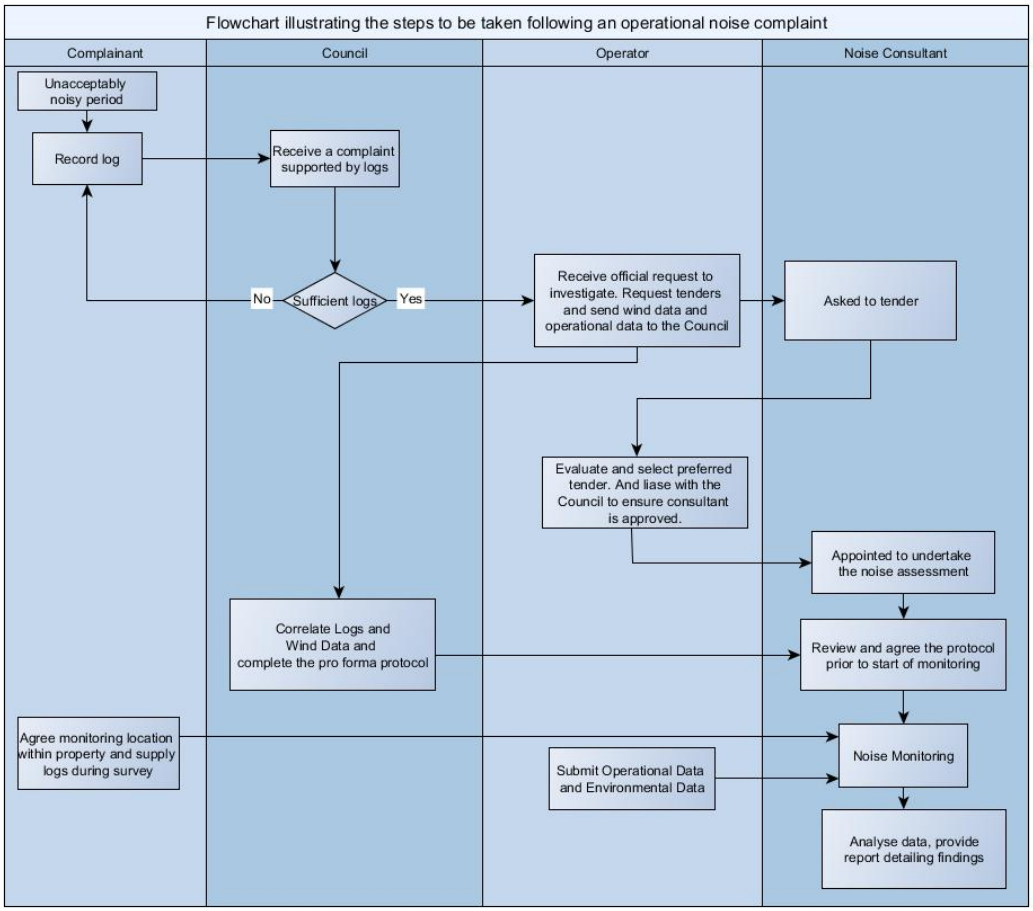
iv. If the rating level after adjustment for background noise contribution and adjustment for tonal penalty (if required in accordance with note (iii) above) at any integer wind speed lies at or below the values set out in the Tables attached to the conditions or at or below the noise limits approved by the Local Authority for a complainant's dwelling in accordance with paragraph (C) of the noise condition then no further action is necessary. If the rating level at any integer wind speed exceeds the values set out in the Tables attached to the conditions or the noise limits approved by the Local Authority for a complainant's dwelling in accordance with paragraph (C) of the noise condition then the development fails to comply with the conditions.

The planning condition (in paragraph E) details that, in the event of a complaint, the wind farm operator shall submit an assessment protocol to provide further details of how compliance testing will be undertaken. In the event that this is required the protocol will be drafted with input from the approved independent consultant appointed to undertake the assessment and with due regard to the specific details of the complaint (e.g. wind speeds / directions, the requirement for a tonal assessment etc); it is therefore not possible to agree the protocol in advance. Nevertheless, for completeness an example protocol is provided below which outlines some of the information that may be included. The example protocol has been included to provide the Council with a more complete picture of how the conditions would be implemented in practice whilst its future use (in whole or in part) would enable the operator to respond quickly to complaints should they occur.

Operational Noise Monitoring and Assessment Protocol

The Protocol contains a number of blank fields which need to be populated based on information specific to the complaint(s). It is recommended that the final wording should be agreed between the Independent Noise Consultant and the Local Authority prior to the commencement of any noise survey.

This Protocol should be used in the event of a complaint relating to the operational noise from Viking Wind Farm. A flow chart is included below to illustrate all the steps to be undertaken by the complainant(s), the Local Authority, the Operator and the independent noise consultant prior to and during the operational noise survey.



The following two timescales shall be observed:

- Within 21 days from receipt of a written request from the Local Authority following an operational noise complaint from an occupant of a dwelling alleging noise disturbance at that dwelling, the wind farm operator shall, at its expense, employ a consultant approved by the Local Authority to assess the level of noise immission from the wind farm at the complainant's property in accordance with the procedures described below. The written request from the Local Authority shall set out at least the date, time and location that the

complaint relates to and any identified atmospheric conditions, including wind direction, and include a statement as to whether, in the opinion of the Local Authority, the noise giving rise to the complaint contains or is likely to contain a tonal component.

- The wind farm operator shall provide to the Local Authority the independent consultant's assessment of the rating level of noise immission undertaken in accordance with the procedures described below within 2 months of the date of the written request of the Local Planning Authority, unless the time limit is extended in writing by the Local Authority.

Following the written request from the Local Authority, it has been established that complaints attributed to operational noise levels from the wind farm were received from local resident(s) at property(ies), hereafter referred to Noise Monitoring Locations (NML). The NMLs to be investigated are:

- NML01: _____(Property Name)
- NML02: _____(Property Name)
- NML03: _____(Property Name)
- NML04: _____(Property Name)
- NML05: _____(Property Name)
- *add/delete as appropriate*

This Operational Noise Monitoring and Assessment Protocol sets out the steps required to determine whether operational wind turbine noise levels at the complainant(s) properties comply with the criteria contained within Tables 1 and 2 detailed within Planning Condition XX. Table 1 and Table 2 of Condition XX (reproduced below) detail the limits relevant to assess the wind turbine noise rating from the development under investigation operating on its own.

Comment [JM6]: TBC

Comment [JM7]: Referred to as the Site Specific Noise Limits in the ES.

Table 1- Day time noise limits for development under investigation operating on its own

Location (easting, northing grid coordinates)	Standardised wind speed at 10 metres height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
TBC												

Table 2- Night time noise limits for development under investigation operating on its own

Location (easting, northing grid coordinates)	Standardised wind speed at 10 metres height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
TBC												

Table 3 and Table 4 below detail the Total ETSU-R-97 Noise Limits which were agreed as part of the original noise assessment, and are relevant to assess cumulative wind turbine noise e.g. all wind farms / turbines.

Table 3- Total ETSU-R-97 Daytime Noise Limits

Location	Standardised wind speed at 10 metres height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
TBC												

Table 4- Total ETSU-R-97 Night Time Noise Limits

Location	Standardised wind speed at 10 metres height (m/s) within the site averaged over 10-minute periods											
	1	2	3	4	5	6	7	8	9	10	11	12
TBC												

Note to Tables 1, 2, 3, and 4: The noise limits detailed in the Tables within the planning conditions assumed that none of the nearby properties have a financially involvement with the development hereby consented or any of the nearby wind turbines. The noise limits also assumed that all existing / consented turbines were constructed that they remained operational for the lifetime of the consent. The planning conditions included a mechanism for the limits to be updated the Tables above are [based on the original noise limits] [the updated noise limits agreed with the Local Authority on DD/MM/YYYY].

Depending on the location of the complainant's property, the most representative set of limits must be selected. The selected parameters for the complaint investigation are as follows:

- NML01: Noise Limits from _____ (Location name in Table 1 to 4).
- NML02: Noise Limits from _____ (Location name in Table 1 to 4).
- NML03: Noise Limits from _____ (Location name in Table 1 to 4).
- NML04: Noise Limits from _____ (Location name in Table 1 to 4).
- NML05: Noise Limits from _____ (Location name in Table 1 to 4).
- *add/delete as appropriate*

The operational data from the development has been correlated with complaint logs to determine the *"meteorological conditions in which the complaints occurred"* (ETSU-R-97 page 102). Following a detailed analysis of the resident logs and the operational and meteorological 10 minute averaged data measured at the time of the logs, the wind conditions to be investigated for each property have been agreed as detailed below.

- NML01: _____° to _____°and _____m/s to _____m/s.
- NML02: _____° to _____°and _____m/s to _____m/s.
- NML03: _____° to _____°and _____m/s to _____m/s.
- NML04: _____° to _____°and _____m/s to _____m/s.
- NML05: _____° to _____°and _____m/s to _____m/s.
- *add/delete as appropriate*

Noise data will be correlated with rain, wind speed and operational data from the wind farm. The wind speed measurements for this noise complaint investigation will be based on (measured or extrapolated) XXX m (the wind turbine hub height) wind speeds which will be standardised to 10m height.

At least 20 valid data points will need to be collected at each property during the wind conditions outlined above. Valid data points are those within the time periods considered (Day time or Night Time or depending on the complaints logs) and where no rain was recorded.

Class 1 sound level meters, fitted with XXX wind shields will be installed at the complainant property(ies). These will be set to record at least L_{A90}, 10min noise levels. A tonal noise assessment [has been] [has not been] requested and therefore, .wav file audio recording [will be][will not be] recorded.

The assessment of the "Rating Level" based on the measured data can be split into two stages, as follows:

- Stage 1 "Total Noise Rating Level":
  - Establish the Rating Level from measurements in the range of wind speed and directions outlined above without a correction for background noise.
  - The Rating Level at this stage is inclusive of all noise measured (only includes periods when all turbines are operational) and therefore, includes background noise as well as wind turbine noise.
  - If the noise is judged to be tonal an appropriate analysis will be undertaken to establish a tonal penalty which (if appropriate) will be added to the Total Noise Rating Level.
  - This rating level is compared to the noise limits from Table 3 and Table 4 as a first test.
- Stage 2 "Specific Wind Turbine Noise Rating Level":
  - If an exceedance is found in Stage 1, the Specific Wind Turbine Noise Rating Level needs to be established (referred to as 'Lw' in ETSU-R-97 page 103).
  - This involves a correction for background noise, to consider the specific wind turbine noise from the development under investigation and this is determined by logarithmically subtracting the Rating Level from Stage 1 (Lc in ETSU-R-97) minus background noise (Lb in ETSU-R-97).
  - Such a correction requires that Lb is collected when all the wind turbines from the development under investigation are OFF.
  - Due to the presence of nearby other wind turbines (other than the development under investigation) it is noted that Lb may be composed of background noise and nearby wind turbine noise; however the results of subtracting logarithmically Lc minus Lb will still enable the calculation of the specific noise from the development under investigation.
  - The resulting Lw rating for this stage should be compared to the limits from Table 1 and Table 2.

It may be appropriate to complete the Stage 1 analysis first to determine whether a Stage 2 is necessary. Representative background noise data may have been collected during the pre construction noise assessment. Alternatively, if required, the sound level meters could be redeployed

for a period of targeted monitoring with wind turbines OFF (for the development under investigation) for locations and wind conditions which exceeded the limits during the Stage 1 assessment.

In cases where Lc (measurements with turbine on) is equal to or below Lb (measurements with turbine off) then the calculation of Lw (in Stage 2) is not possible as it indicates that Lb on its own is the dominant noise source. Such a scenario would demonstrate that wind turbine noise from the development under investigation is having a negligible contribution to the recorded noise levels and it can be concluded that the specific noise from the development under investigation must be at least 10dB below the measured levels. In such circumstances it may be appropriate to conclude that the development under investigation is not the cause of the exceedance. Since Lb will be composed of background and potentially turbine noise from other developments in the area, it may be necessary to include comments about nearby turbines which may have influenced the measurements during the noise survey.

If the limit(s) are exceeded at Stage 2, a short term operational solution will need to be implemented within 2 months of submission of the report to bring operation within the noise limits. This may include switching off immediately the wind turbine(s) likely to cause the breach. A longer term solution may be designed and implemented afterwards. The operator will be required to inform the Local Authority and the complainants of all implemented short term and long term solutions. The long term solutions may be designed based on noise predictions (with adjustments to account for the rating levels from stage 2) and the use of low noise modes for particular wind speed and wind directions.

This Noise Measurement and Assessment Scheme has been agreed prior to the start of the noise survey. Signatures of relevant parties are below:

The Appointed Noise Consultant [_____]

Represented by (Name and Job Title) _____

Signature Date

The Operator [_____]

Represented by (Name and Job Title) _____

Signature Date

The Local Authority [_____]

Represented by (Name and Job Title) _____

Signature Date