DRAGONFLY consulting

Earthmill

New Maythorne Farm, Ingbirchworth

Wind Turbine Noise Assessment

DC1660–R1

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APPENDICES

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1.0 INTRODUCTION

Earthmill has appointed Dragonfly Consulting to carry out a noise assessment relating to the proposed installation of one wind turbine on land forming part of New Maythorne Farm, Ingbirchworth.

It is understood that the noise assessment is required to establish the noise levels at the nearest noise sensitive receptors due to the operation of the proposed turbine and to assess the impact of those noise levels against the requirements of ETSU-R-97, *"The Assessment and Rating of Noise from Wind Farms"*, and the requirements of the Local Authority. The assessment is to also consider the noise impact of the installation at nearby sensitive properties when considered in conjunction with any further proposed or existing turbines.

Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix A.

2.0 SITE DESCRIPTION

2.1 Site Conditions

It is proposed to install one 'EWT 500' 500kW wind turbine on land at New Maythorne Farm, Ingbirchworth. The turbine will be 50m high to the hub centre.

Sound Power levels (L_W) for the proposed turbine(s) have been taken from the document "Sound Power Level, Emergya Wind Technologies BV EWT500 " technical report (Ref: S-1005000) produced by Emergya Wind Technologies BV (Dated: 08/12/2010).

The third octave band data for this turbine is considered suitable for undertaking an assessment using ISO9613-2, Equation (9). All recommendations from Section 4.3 of the Good Practice Guide have been followed and, as the data is not warranted, the uncertainty corrections have been included as following the guidance in the IOA Good Practice Guide, using a maximum uncertainty value of 2dB.

From the manufacturer's noise data the 'EWT 500' 500kW Turbine has a Sound Power Level of 101.6dB L_W at a wind speed of 10m/s without the inclusion of any uncertainty corrections.

There are two potential sites for the proposed turbine location. These are shown in Appendix B and are hereby referred to as follows:

- Proposed Turbine (Site 1) – 'T1' (X: 419114, Y: 404932)
- Proposed Turbine (Site 2) – 'T1 Alt.' (X: 419303, Y: 405184)

The local authority has requested that cumulative noise impact be considered. A cumulative assessment is to consider the noise impact of the installation at nearby sensitive properties when considered in conjunction with any existing turbines in the vicinity of the proposed installation. From the information provided to Dragonfly Consulting for this proposal it is considered that there are twelve existing wind turbines in the vicinity of the proposed installation that are required to be considered as part of a cumulative assessment:

- Three existing 'Nordex N80' 2.5MW wind turbines, forming Blackstone Edge Wind Farm:
  - Existing Turbine 1 'ET1' (X: 419731, Y: 405458)
  - Existing Turbine 2 'ET2' (X: 419600, Y: 405179)
  - Existing Turbine 3 'ET3' (X: 419908, Y: 405189)

- Three existing 'Enercon E70' 2.3MW wind turbines, forming Spicer Hill Wind Farm:
  - Existing Turbine 4 'ET4' (X: 420444, Y: 404836)
  - Existing Turbine 5 'ET5' (X: 420622, Y: 405248)
  - Existing Turbine 6 'ET6' (X: 420802, Y: 404747)

- Three permitted 'Enercon E70' 2.3MW wind turbines, to be added to Spicer Hill Wind Farm (awaiting approval):
  - Existing Turbine 7 'ET7' (X: 420069, Y: 404880)
  - Existing Turbine 8 'ET8' (X: 420307, Y: 405157)
  - Existing Turbine 9 'ET9' (X: 420959, Y: 404721)

- Three existing 'RE Power MM82' 2.05MW wind turbines, forming Hazlehead Wind Farm:
  - Existing Turbine 10 'ET10'
  - Existing Turbine 11 'ET11'
  - Existing Turbine 12 'ET12'
  - In the absence of further information specific to the co-ordinates for each individual turbine Dragonfly Consulting has used the following co-ordinates (X: 417980, Y: 403846) to represent all three turbines at Hazlehead Wind Farm. These co-ordinates have been obtained from documents online pertaining to the planning application. It is assumed that the co-ordinates detail the closest turbine to the nearby residential properties and therefore represents a worst case scenario of the cumulative noise levels of these three turbines.

The existing turbine locations are shown in Appendix B.

2.2 Residential Properties

There are eight residential properties: one with financial interest (FI) and seven with no financial interest (Noise Sensitive Receptors – NSRs), situated closest to the proposed turbine location. The residential properties are located as follows and are shown in Appendix B:

Table 2.1
Coordinates of properties and distances to turbine (m)

	FI 'New Maythorne Farm'	NSR1 'Lower Maythorne Farm'	NSR2 'Upper Maythorne Farm'	NSR3 'Property on Pennine Edge'	NSR4 'Sledbrook Farm'	NSR5 'Brown's Edge Farm'	NSR6 'Spicer House'	NSR7 'Unnamed Property nr A616'
	X: 418943 Y: 405497	X: 418747 Y: 405578	X: 418536 Y: 405782	X: 418680 Y: 404630	X: 418424 Y: 404965	X: 420424 Y: 405749	X: 420448 Y: 405577	X: 418966 Y: 404322
T1	590m	740m	1025m	525m	690m	1540m	1480m	625m
T1 (ALT)	475m	680m	970m	830m	905m	1255m	1210m	925m
ET1	785m	990m	1235m	1335m	1395m	750m	725m	1365m
ET2	725m	940m	1220m	1070m	1195m	1000m	935m	1065m
ET3	1010m	1220m	1490m	1345m	1500m	760m	660m	1280m
ET4	1640m	1850m	2125m	1775m	2020m	910m	740m	1560m
ET5	1695m	1900m	2150m	2035m	2215m	535m	370m	1895m
ET6	2000m	2215m	2490m	2125m	2385m	1070m	900m	1880m
ET7	1280m	1490m	1775m	1410m	1645m	935m	790m	1235m
ET8	1405m	1615m	1875m	1710m	1890m	600m	440m	1575m
ET9	2160m	2370m	2645m	2280m	2545m	1155m	995m	2030m
ET10	1910m	1890m	2010m	1050m	1200m	3095m	3010m	1090m
ET11	1910m	1890m	2010m	1050m	1200m	3095m	3010m	1090m
ET12	1910m	1890m	2010m	1050m	1200m	3095m	3010m	1090m

3.0 GUIDANCE

Dragonfly Consulting considers that the guidance detailed in ETSU-R-97 should be taken as the appropriate guidance on the assessment of noise impact for a noise source of this type, also taking account of the latest guidance published by the Institute of Acoustics, *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*'.

The National Planning Policy Framework, published in March 2012, sets out the Government's objectives with respect to renewable energy sources for England. With respect to wind farm noise it states, in Section 97:

To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. They should:

- *have a positive strategy to promote energy from renewable and low carbon sources;*
- *design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;*
- *consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;**
- *support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning*
- *identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.*

**In assessing the likely impacts of potential wind energy development when identifying suitable areas, and in determining planning applications for such development, planning authorities should follow the approach set out in the National Policy Statement for Renewable Energy Infrastructure (read with the relevant sections of the Overarching National Policy Statement for Energy Infrastructure, including that on aviation impacts). Where plans identify areas as suitable for renewable and low-carbon energy development, they should make clear what criteria have determined their selection, including for what size of development the areas are considered suitable.*

The Overarching National Policy Statement for Energy Infrastructure (EN-1), published in July 2011, states in Section 5.11.6 (Noise and Vibration):

Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance.

Further information on assessment of particular noise sources may be contained in the technology-specific NPSs. In particular, for renewable (EN-3) and electricity networks (EN-5) there is assessment guidance for specific features of those technologies. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies.

The National Policy Statement for Renewable Energy Infrastructure (EN-3), published in July 2011, states in the following sections (Onshore Wind Farm Impacts – Noise and vibration):

Section 2.7.55

The method of assessing the impact of noise from a wind farm on nearby residents is described in the report, 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97). This was produced by the Working Group on Noise from Wind Turbines Final Report, September 1996 and the report recommends noise limits that seek to protect the amenity of wind farm neighbours. The noise levels recommended by ETSU-R-97 are determined by a combination of absolute noise limits and noise limits relative to the existing background noise levels around the site at different wind speeds.

Therefore noise limits will often influence the separation of wind turbines from residential properties.

Section 2.7.56

The applicant's assessment of noise from the operation of the wind turbines should use ETSU-R-97, taking account of the latest industry good practice.

This should include any guidance on best practice that the Government may from time to time publish.

The Secretary of State has indicated that the IOA Document '*A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*' should be considered as the relevant guidance for the consideration of calculating noise propagation from wind turbines

This provides clear guidance that the assessment of wind farm noise should reference only ETSU-R-97 and should take account of current best practice when undertaking assessments.

For the purposes of this desktop assessment it is assumed that the background noise levels are very low, and therefore the noise criteria for low noise environments are to be used. Noise source levels for the wind turbines should be taken from manufacturer's noise data.

3.1 ETSU-R-97

ETSU provides a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours.

ETSU recommends that noise levels at the nearest noise sensitive receptor should be limited to 5dB(A) above background noise levels.

For locations with very low noise levels, ETSU recommends that noise levels be limited to the range 35dB(A) to 40dB(A) during the daytime and 43dB(A) during the night time.

Where a single wind turbine is to be installed, or where there are very large separation distances between the turbines and the nearest noise sensitive property, ETSU considers that an absolute noise limit for the wind turbine of 35dB $L_{A90,\ 10min}$ offers sufficient protection to amenity such that no measurement of actual background noise is required. ETSU considers that for the purposes of calculation the $L_{A90,\ 10min}$ can be considered to be 1.5 to 2.5dB below the L_{Aeq} at the same position.

Where a property is under the ownership of persons considered to have a 'financial interest' in the development of the wind turbine the lower fixed limits at the property due to the operation of the

turbine can be increased to 45dB daytime and night time, with consideration given to higher limits above background noise level where the occupier has a financial involvement.

3.2 ISO 9613

The noise level predictions have been undertaken in accordance with the noise prediction framework set out in ISO 9613-2 *"Acoustics – attenuation of sound during propagation outdoors-Part 2 General method of calculation"*.

The noise prediction model assumes that wind turbines act as elevated spherical point sources, with the noise level reducing by 6dB for every doubling of distance from the noise source. The model takes into account the distance between the turbine and the receptors and the amount of attenuation due to ground effect and atmospheric absorption.

The model assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors and that the ground type is a combination of soft and hard ground (G=0.5) and a receptor height of 4m AGL has been used.

The assessment includes a number of variations from the methodology used in ISO9613-2. These variations are following the guidance detailed in the Institute of Acoustics document '*A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*' This document presents current good practice in the application of the ETSU-R-97 assessment methodology for all wind turbine developments above 50kW, which includes some variation from the propagation methodologies.

4.0 ASSESSMENT

4.1 Assessment of Noise from Proposed Wind Turbine

Predicted noise level calculations have been completed for the nearest noise sensitive receptors.

From the manufacturer's noise data the 'EWT 500' 500kW turbine sound power at 10m/s (including uncertainty) displayed as octave band noise levels is as follows:

Table 4.1
'EWT 500' Calculated Sound Power Levels at 10m/s (dB)

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level (dB_A)	85.0	91.0	95.0	99.0	97.0	94.0	92.0	86.0

Sound Power levels (L_W) for the existing Blackstone Edge Wind Farm turbines have been taken from the general specification report compiled and warranted by Nordex Ltd. This document details the inclusion of the addition of an uncertainty value of ±1dB to all sound power levels. This particular turbine has a Sound Power Level of 104.0dB L_W at a wind speed of 10m/s (including uncertainty), which is considered to be the highest noise level produced by this turbine.

Furthermore, from information provided to Dragonfly Consulting by Barnsley Metropolitan Borough Council, the following noise condition exists for Blackstone Edge Wind Farm:

"The noise level shall not exceed the following levels, measured as a 10 minute LA90 at the following properties: New Maythorne Farm Night 43dB, Day 35dB; Spicer House Night 43dB, Day 35 dB."

These limits have been applied specifically at these two properties within this report.

Sound Power levels (L_W) for the existing and permitted Spicer Hill Wind Farm turbines have been taken from the document "Sound Power Level, Enercon E-70" technical report (Ref: 1.1) produced by Repower Systems (Dated: 19/10/2005).

Furthermore, from information provided to Dragonfly Consulting by Barnsley Metropolitan Borough Council, the following noise condition exists for Spicer Hill Wind Farm:

"Maximum permitted noise levels 23-00h-0700h (LAF90, 10mins): Brown's Edge 45.3dB, Spicer House 45.3dB. Maximum permitted noise levels at all other times (LAF90, 10mins): Brown's Edge 44.5dB, Spicer House 45.0dB."

These limits have been applied specifically at these two properties within this report.

Sound Power levels (L_W) for the existing Hazlehead Wind Farm turbines have been taken from the document "Power Curve & Sound Power Level REpower MM82 [2050 kW]" technical report (Document No: SD-2.5-WT.PC.02-B-B-EN) produced by REpower Systems (Dated: 27/04/2009).

The resultant noise levels (L_{Aeq}) have been calculated following the guidance in ISO 9613 and the guidance from the IOA Good Practice Guide. The calculated noise levels and comparison with the ETSU guidance are therefore as follows:

Table 4.2
ETSU guidance Criteria

Receptor	ETSU Criteria		
	Daytime	Night time	Single Turbine ($L_{A90,10min}$)
FI	45	45	--
NSR	35-40	43	35

Table 4.3
Noise Levels from 'Proposed Turbine Site 1' (T1) – (L_{Aeq}), free-field, dB

Receptor	FI							
Frequency (Hz)	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Slant Distance Between Turbine and Receptor in m	592							
Distance Correction	66.4							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.06	0.24	0.59	1.12	2.18	5.72	19.35	69.03
L_{Aeq} at Receptor	36.3							
L_{90} at Receptor	34.3							
Receptor	**NSR1**							
Slant Distance Between Turbine and Receptor in m	741							
Distance Correction	68.4							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.07	0.30	0.74	1.41	2.74	7.18	24.27	86.58
L_{Aeq} at Receptor	34.0							
L_{90} at Receptor	32.0							
Receptor	**NSR2**							
Slant Distance Between Turbine and Receptor in m	1026							
Distance Correction	71.2							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.10	0.41	1.03	1.95	3.79	9.94	33.62	119.93
L_{Aeq} at Receptor	30.6							
L_{90} at Receptor	28.6							
Receptor	**NSR3**							
Slant Distance Between Turbine and Receptor in m	527							
Distance Correction	65.4							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.05	0.21	0.53	1.00	1.94	5.09	17.22	61.43
L_{Aeq} at Receptor	37.5							
L_{90} at Receptor	35.5							

Table 4.3 (continued)
Noise Levels from 'Proposed Turbine Site 1' (T1) – (L_{Aeq}), free-field, dB

Receptor	NSR4							
Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Slant Distance Between Turbine and Receptor in m	692							
Distance Correction	67.8							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.07	0.28	0.69	1.31	2.55	6.69	22.63	80.73
L_{Aeq} at Receptor	34.7							
L_{90} at Receptor	32.7							
Receptor	**NSR5**							
Slant Distance Between Turbine and Receptor in m	1541							
Distance Correction	74.8							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.15	0.62	1.54	2.93	5.70	14.94	50.51	180.18
L_{Aeq} at Receptor	26.0							
L_{90} at Receptor	24.0							
Receptor	**NSR6**							
Slant Distance Between Turbine and Receptor in m	1481							
Distance Correction	74.4							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.15	0.59	1.48	2.81	5.48	14.36	48.54	173.16
L_{Aeq} at Receptor	26.5							
L_{90} at Receptor	24.5							
Receptor	**NSR7**							
Slant Distance Between Turbine and Receptor in m	627							
Distance Correction	66.9							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.06	0.25	0.63	1.19	2.31	6.06	20.50	73.13
L_{Aeq} at Receptor	35.7							
L_{90} at Receptor	33.7							

Table 4.4
Noise Levels from 'Proposed Turbine Site 2' (T1 (Alt.)) – (L_{Aeq}), free-field, dB

Receptor	FI							
Frequency (Hz)	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Slant Distance Between Turbine and Receptor in m	477							
Distance Correction	64.6							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.05	0.19	0.48	0.90	1.76	4.61	15.58	55.58
L_{Aeq} at Receptor	38.5							
L_{90} at Receptor	36.5							
Receptor	**NSR1**							
Slant Distance Between Turbine and Receptor in m	682							
Distance Correction	67.7							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.07	0.27	0.68	1.29	2.52	6.60	22.30	79.56
L_{Aeq} at Receptor	34.9							
L_{90} at Receptor	32.9							
Receptor	**NSR2**							
Slant Distance Between Turbine and Receptor in m	971							
Distance Correction	70.7							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.10	0.39	0.97	1.84	3.59	9.41	31.82	113.49
L_{Aeq} at Receptor	31.2							
L_{90} at Receptor	29.2							
Receptor	**NSR3**							
Slant Distance Between Turbine and Receptor in m	831							
Distance Correction	69.4							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.08	0.33	0.83	1.58	3.07	8.05	27.22	97.11
L_{Aeq} at Receptor	32.8							
L_{90} at Receptor	30.8							

Table 4.4 (continued)
Noise Levels from 'Proposed Turbine Site 2' (T1 (Alt.)) – (L_{Aeq}), free-field, dB

Receptor	NSR4							
Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Slant Distance Between Turbine and Receptor in m	906							
Distance Correction	70.1							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.09	0.36	0.91	1.72	3.35	8.78	29.68	105.89
L_{Aeq} at Receptor	31.9							
L_{90} at Receptor	29.9							
Receptor	**NSR5**							
Slant Distance Between Turbine and Receptor in m	1256							
Distance Correction	73.0							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.13	0.50	1.26	2.38	4.64	12.17	41.16	146.84
L_{Aeq} at Receptor	28.3							
L_{90} at Receptor	26.3							
Receptor	**NSR6**							
Slant Distance Between Turbine and Receptor in m	1211							
Distance Correction	72.7							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.12	0.48	1.21	2.30	4.48	11.74	39.69	141.57
L_{Aeq} at Receptor	28.7							
L_{90} at Receptor	26.7							
Receptor	**NSR7**							
Slant Distance Between Turbine and Receptor in m	926							
Distance Correction	70.3							
Ground Effect	-3.00	-0.17	-0.48	-1.50	-1.50	-1.50	-1.50	-1.50
Atmospheric Absorption	0.09	0.37	0.93	1.76	3.42	8.97	30.34	108.23
L_{Aeq} at Receptor	31.7							
L_{90} at Receptor	29.7							

Table 4.5
Noise Levels from 'Existing Turbines' – (L_{Aeq}), free-field, dB

	Receptor	FI	NSR1	NSR2	NSR3	NSR4	NSR5	NSR6	NSR7
Blackstone Edge Wind Farm (ET1)	L_{Aeq} at Noise Sensitive Receptor	37.0*	35.1	32.9	32.1	31.7	37.7	37.0*	31.9
	L_{90} at Noise Sensitive Receptor	35.0*	33.1	30.9	30.1	29.7	35.7	35.0*	29.9
Blackstone Edge Wind Farm (ET2)	L_{Aeq} at Noise Sensitive Receptor	See above	35.6	33.0	34.3	33.2	35.0	See above	34.4
	L_{90} at Noise Sensitive Receptor	See above	33.6	31.0	32.3	31.2	33.0	See above	32.4
Blackstone Edge Wind Farm (ET3)	L_{Aeq} at Noise Sensitive Receptor	See above	33.0	31.0	32.1	31.0	37.6	See above	32.6
	L_{90} at Noise Sensitive Receptor	See above	31.0	29.0	30.1	29.0	35.6	See above	30.6
Spicer Hill Wind Farm (ET4)	L_{Aeq} at Noise Sensitive Receptor	32.6	31.3	29.8	31.7	30.4	44.5+	45.0+	33.1
	L_{90} at Noise Sensitive Receptor	30.6	29.3	27.8	29.7	28.4	42.5+	43.0+	31.1
Spicer Hill Wind Farm (ET5)	L_{Aeq} at Noise Sensitive Receptor	31.9	30.7	29.4	30.0	29.1	See above	See above	30.7
	L_{90} at Noise Sensitive Receptor	29.9	28.7	27.4	28.0	27.1	See above	See above	28.7
Spicer Hill Wind Farm (ET6)	L_{Aeq} at Noise Sensitive Receptor	30.2	29.1	27.8	29.5	28.3	See above	See above	30.8
	L_{90} at Noise Sensitive Receptor	28.2	27.1	25.8	27.5	26.3	See above	See above	28.8

*Represents the cumulative noise levels of all three Blackstone Edge Wind Farm turbines
+Represents the cumulative noise levels of all three existing Spicer Hill Wind Farm turbines

Table 4.5 (continued)
Noise Levels from 'Existing Turbines' – (L_{Aeq}), free-field, dB

	Receptor	FI	NSR1	NSR2	NSR3	NSR4	NSR5	NSR6	NSR7
Spicer Hill Wind Farm (ET7)	L_{Aeq} at Noise Sensitive Receptor	35.1	33.5	31.7	34.1	32.5	38.1	39.7	35.4
	L_{90} at Noise Sensitive Receptor	33.1	31.5	29.7	32.1	30.5	36.1	37.7	33.4
Spicer Hill Wind Farm (ET8)	L_{Aeq} at Noise Sensitive Receptor	33.8	32.4	30.9	31.8	30.8	41.9	44.7	32.7
	L_{90} at Noise Sensitive Receptor	31.8	30.4	28.9	29.8	28.8	39.9	42.7	30.7
Spicer Hill Wind Farm (ET9)	L_{Aeq} at Noise Sensitive Receptor	29.3	28.3	27.1	28.8	27.5	35.8	37.2	30.0
	L_{90} at Noise Sensitive Receptor	27.3	26.3	25.1	26.8	25.5	33.8	35.2	28.0
Hazlehead Wind Farm (ET10)	L_{Aeq} at Noise Sensitive Receptor	31.5	31.6	30.9	37.5	36.2	26.1	26.4	37.2
	L_{90} at Noise Sensitive Receptor	29.5	29.6	28.9	35.5	34.2	24.1	24.4	35.2
Hazlehead Wind Farm (ET11)	L_{Aeq} at Noise Sensitive Receptor	31.5	31.6	30.9	37.5	36.2	26.1	26.4	37.2
	L_{90} at Noise Sensitive Receptor	29.5	29.6	28.9	35.5	34.2	24.1	24.4	35.2
Hazlehead Wind Farm (ET12)	L_{Aeq} at Noise Sensitive Receptor	31.5	31.6	30.9	37.5	36.2	26.1	26.4	37.2
	L_{90} at Noise Sensitive Receptor	29.5	29.6	28.9	35.5	34.2	24.1	24.4	35.2

Table 4.6
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – FI, free-field, dB

Receptor	FI									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	36.3	37.0	32.6	31.9	30.2	35.1	33.8	29.3	31.5	31.5	31.5
L90 at Noise Sensitive Property	34.3	35.0	30.6	29.9	28.2	33.1	31.8	27.3	29.5	29.5	29.5
Combined Noise Level at FI (LAeq)	43.9									
Combined Noise Level at FI (L90)	41.9									

Table 4.7
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – FI, free-field, dB

Receptor	FI									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	38.5	37.0	32.6	31.9	30.2	35.1	33.8	29.3	31.5	31.5	31.5
L90 at Noise Sensitive Property	36.5	35.0	30.6	29.9	28.2	33.1	31.8	27.3	29.5	29.5	29.5
Combined Noise Level at FI (LAeq)	44.4									
Combined Noise Level at FI (L90)	42.4									

Table 4.8
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – NSR1, free-field, dB

Receptor	NSR1									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	34.0	39.5	31.3	30.7	29.1	33.5	32.4	28.3	31.6	31.6	31.6
L90 at Noise Sensitive Property	32.0	37.5	29.3	28.7	27.1	31.5	30.4	26.3	29.6	29.6	29.6
Combined Noise Level at NSR (LAeq)	43.8									
Combined Noise Level at NSR (L90)	41.8									

Table 4.9
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – NSR1, free-field, dB

Receptor	NSR1									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	34.9	39.5	31.3	30.7	29.1	33.5	32.4	28.3	31.6	31.6	31.6
L90 at Noise Sensitive Property	32.9	37.5	29.3	28.7	27.1	31.5	30.4	26.3	29.6	29.6	29.6
Combined Noise Level at NSR (LAeq)	43.9									
Combined Noise Level at NSR (L90)	41.9									

Table 4.10
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – NSR2, free-field, dB

Receptor	NSR2									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	30.6	37.2	29.8	29.4	27.8	31.7	30.9	27.1	30.9	30.9	30.9
L90 at Noise Sensitive Property	28.6	35.2	27.8	27.4	25.8	29.7	28.9	25.1	28.9	28.9	28.9
Combined Noise Level at NSR (LAeq)	42.0										
Combined Noise Level at NSR (L90)	40.0										

Table 4.11
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – NSR2, free-field, dB

Receptor	NSR2									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	31.2	37.2	29.8	29.4	27.8	31.7	30.9	27.1	30.9	30.9	30.9
L90 at Noise Sensitive Property	29.2	35.2	27.8	27.4	25.8	29.7	28.9	25.1	28.9	28.9	28.9
Combined Noise Level at NSR (LAeq)	42.0										
Combined Noise Level at NSR (L90)	40.0										

Table 4.12
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – NSR3, free-field, dB

Receptor	NSR3									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	37.5	37.7	31.7	30.0	29.5	34.1	31.8	28.8	37.5	37.5	37.5
L90 at Noise Sensitive Property	35.5	35.7	29.7	28.0	27.5	32.1	29.8	26.8	35.5	35.5	35.5
Combined Noise Level at NSR (LAeq)	45.6									
Combined Noise Level at NSR (L90)	43.6									

Table 4.13
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – NSR3, free-field, dB

Receptor	NSR3									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	32.8	37.7	31.7	30.0	29.5	34.1	31.8	28.8	37.5	37.5	37.5
L90 at Noise Sensitive Property	30.8	35.7	29.7	28.0	27.5	32.1	29.8	26.8	35.5	35.5	35.5
Combined Noise Level at NSR (LAeq)	45.2									
Combined Noise Level at NSR (L90)	43.2									

Table 4.14
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – NSR4, free-field, dB

Receptor	NSR4									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	34.7	36.8	30.4	29.1	28.3	32.5	30.8	27.5	36.2	36.2	36.2
L90 at Noise Sensitive Property	32.7	34.8	28.4	27.1	26.3	30.5	28.8	25.5	34.2	34.2	34.2
Combined Noise Level at NSR (LAeq)	44.2										
Combined Noise Level at NSR (L90)	42.2										

Table 4.15
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – NSR4, free-field, dB

Receptor	NSR4									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	31.9	36.8	30.4	29.1	28.3	32.5	30.8	27.5	36.2	36.2	36.2
L90 at Noise Sensitive Property	29.9	34.8	28.4	27.1	26.3	30.5	28.8	25.5	34.2	34.2	34.2
Combined Noise Level at NSR (LAeq)	44.0										
Combined Noise Level at NSR (L90)	42.0										

Table 4.16
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – NSR5, free-field, dB

Receptor	NSR5								
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing) (x3)	Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	26.0	41.7	44.5	38.1	41.9	35.8	26.1	26.1	26.1
L90 at Noise Sensitive Property	24.0	39.7	42.5	36.1	39.9	33.8	24.1	24.1	24.1
Combined Noise Level at NSR (LAeq)	48.5								
Combined Noise Level at NSR (L90)	46.5								

Table 4.17
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – NSR5, free-field, dB

Receptor	NSR5								
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing) (x3)	Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	28.3	41.7	44.5	38.1	41.9	35.8	26.1	26.1	26.1
L90 at Noise Sensitive Property	26.3	39.7	42.5	36.1	39.9	33.8	24.1	24.1	24.1
Combined Noise Level at NSR (LAeq)	48.5								
Combined Noise Level at NSR (L90)	46.5								

Table 4.18
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – NSR6, free-field, dB

Receptor	NSR6								
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing) (x3)	Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	26.5	37.0	45.0	39.7	44.7	37.2	26.4	26.4	26.4
L90 at Noise Sensitive Property	24.5	35.0	43.0	37.7	42.7	35.2	24.4	24.4	24.4
Combined Noise Level at NSR (LAeq)	49.2								
Combined Noise Level at NSR (L90)	47.2								

Table 4.19
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – NSR6, free-field, dB

Receptor	NSR6								
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing) (x3)	Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	28.7	37.0	45.0	39.7	44.7	37.2	26.4	26.4	26.4
L90 at Noise Sensitive Property	26.7	35.0	43.0	37.7	42.7	35.2	24.4	24.4	24.4
Combined Noise Level at NSR (LAeq)	49.2								
Combined Noise Level at NSR (L90)	47.2								

Table 4.20
Cumulative Noise Levels from all Wind Turbines: Site 1 (T1) – NSR7, free-field, dB

Receptor	NSR7									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	35.7	37.9	33.1	30.7	30.8	35.4	32.7	30.0	37.2	37.2	37.2
L90 at Noise Sensitive Property	33.7	35.9	31.1	28.7	28.8	33.4	30.7	28.0	35.2	35.2	35.2
Combined Noise Level at NSR (LAeq)	45.6										
Combined Noise Level at NSR (L90)	43.6										

Table 4.21
Cumulative Noise Levels from all Wind Turbines: Site 2 (T1 (Alt.)) – NSR7, free-field, dB

Receptor	NSR7									
Turbine Type	EWT 500	Nordex N80 (x3)	Enercon E70 (Existing)			Enercon E70 (Proposed)			RE Power MM82		
LAeq at Noise Sensitive Property	31.7	37.9	33.1	30.7	30.8	35.4	32.7	30.0	37.2	37.2	37.2
L90 at Noise Sensitive Property	29.7	35.9	31.1	28.7	28.8	33.4	30.7	28.0	35.2	35.2	35.2
Combined Noise Level at NSR (LAeq)	45.3										
Combined Noise Level at NSR (L90)	43.3										

The data displayed in Tables 4.6 to 4.21 is summarised in Table 4.22 below:

Table 4.22
Summary of Cumulative Noise Levels from all Wind Turbines – free field, dB

Receptor	Site 1 (T1)		Site 2 (T1 (Alt.))	
	Combined Noise Level (L_{Aeq})	Combined Noise Level (L_{90})	Combined Noise Level (L_{Aeq})	Combined Noise Level (L_{90})
FI	43.9	41.9	44.4	42.4
NSR1	43.8	41.8	43.9	41.9
NSR2	42.0	40.0	42.0	40.0
NSR3	45.6	43.6	45.2	43.2
NSR4	44.2	42.2	44.0	42.0
NSR5	48.5	46.5	48.5	46.5
NSR6	49.2	47.2	49.2	47.2
NSR7	45.6	43.6	45.3	43.3

For the Financially Interested Property (FI):

- The calculated turbine noise levels are below the daytime and night time noise criteria recommended by ETSU. It is therefore considered that the predicted noise levels from the proposed turbine will satisfy all of the noise limits specified by ETSU at this property.

For Noise Sensitive Receptor '1' (NSR1):

- The calculated turbine noise levels are above the daytime and below the night time noise criteria recommended by ETSU for both proposed locations. It is therefore considered that the predicted noise levels from the proposed turbine will not satisfy all of the noise limits specified by ETSU at this property.

- However, the L_{90} noise levels due to the existing turbines are such that, when considering a cumulative assessment for a 'noise sensitive' property, they fail to comply with the ETSU criteria using current best practice prediction methodologies in 2015. The cumulative L_{90} noise level for the existing turbines before inclusion of the proposed turbine is 41.3dB at this property and therefore, using 2015 best practice, would not be permitted for planning for noise.

- When assessed cumulatively, the proposed turbine is bound to fail to meet the cumulative criteria due to the presence of the existing turbines and their combined L_{90} noise level that is already above the noise criterion recommended by ETSU.

- As the predicted noise level of the proposed turbine is 9.7dB less ('T1') and 8.4dB less ('T1 Alt'), than the cumulative noise levels of the existing turbines, it is considered that any impact from the proposed turbine would be 'masked' by noise from the existing turbines at this property.

- It is further noted that, if the existing turbines ceased to operate, the proposed turbine would satisfy all of the noise limits specified by ETSU for this property for a single turbine installation (for both the 'T1' and 'T1 Alt' locations).

For Noise Sensitive Receptor '2' (NSR2):

- The calculated turbine noise levels are above the daytime and below the night time noise criteria recommended by ETSU for both proposed locations. It is therefore considered that the predicted noise levels from the proposed turbine will not satisfy all of the noise limits specified by ETSU at this property.

- However, the L_{90} noise levels due to the existing turbines are such that, when considering a cumulative assessment for a 'noise sensitive' property, they fail to comply with the ETSU criteria using current best practice prediction methodologies in 2015. The cumulative L_{90} noise level for the existing turbines before inclusion of the proposed turbine is 39.6dB at this property and therefore, using 2015 best practice, would not be permitted for planning for noise.

- When assessed cumulatively, the proposed turbine is bound to fail to meet the cumulative criteria due to the presence of the existing turbines and their combined L_{90} noise level that is already above the noise criterion recommended by ETSU.

- As the predicted noise level of the proposed turbine is 11.0dB less ('T1') and 10.4dB less ('T1 Alt'), than the cumulative noise levels of the existing turbines, it is considered that any impact from the proposed turbine would be 'masked' by noise from the existing turbines at this property.

- It is further noted that, if the existing turbines ceased to operate, the proposed turbine would satisfy all of the noise limits specified by ETSU for this property for a single turbine installation (for both the 'T1' and 'T1 Alt' locations).

For Noise Sensitive Receptor '3' (NSR3):

- The calculated turbine noise levels are above the daytime and night time noise criteria recommended by ETSU for both proposed locations. It is therefore considered that the predicted noise levels from the proposed turbine will not satisfy all of the noise limits specified by ETSU at this property.

- However, the L_{90} noise levels due to the existing turbines are such that, when considering a cumulative assessment for a 'noise sensitive' property, they fail to comply with the ETSU criteria using current best practice prediction methodologies in 2015. The cumulative L_{90} noise level for the existing turbines before inclusion of the proposed turbine is 42.9dB at this property and therefore, using 2015 best practice, would not be permitted for planning for noise.

- When assessed cumulatively, the proposed turbine is bound to fail to meet the cumulative criteria due to the presence of the existing turbines and their combined L_{90} noise level that is already above the noise criterion recommended by ETSU.

- As the predicted noise level of the proposed turbine is 8.4dB less ('T1') and 12.1dB less ('T1 Alt'), than the cumulative noise levels of the existing turbines, it is considered that any impact from the proposed turbine would be 'masked' by noise from the existing turbines at this property.

- It is also worthy of note that, if the existing turbines ceased to operate, the proposed turbine would satisfy all of the noise limits specified by ETSU for this property for a single turbine installation (for the 'T1 Alt' location).

For Noise Sensitive Receptor '4' (NSR4):

- The calculated turbine noise levels are above the daytime and below the night time noise criteria recommended by ETSU for both proposed locations. It is therefore considered that the predicted noise levels from the proposed turbine will not satisfy all of the noise limits specified by ETSU at this property.

- However, the L_{90} noise levels due to the existing turbines are such that, when considering a cumulative assessment for a 'noise sensitive' property, they fail to comply with the ETSU criteria using current best practice prediction methodologies in 2015. The cumulative L_{90} noise level for the existing turbines before inclusion of the proposed turbine is 41.7dB at this property and therefore, using 2015 best practice, would not be permitted for planning for noise.

- When assessed cumulatively, the proposed turbine is bound to fail to meet the cumulative criteria due to the presence of the existing turbines and their combined L_{90} noise level that is already above the noise criterion recommended by ETSU.

- As the predicted noise level of the proposed turbine is 9.0dB less ('T1') and 11.8dB less ('T1 Alt'), than the cumulative noise levels of the existing turbines, it is considered that any impact from the proposed turbine would be 'masked' by noise from the existing turbines at this property.

- It is also worthy of note that, if the existing turbines ceased to operate, the proposed turbine would satisfy all of the noise limits specified by ETSU for this property for a single turbine installation (for both the 'T1' and 'T1 Alt' locations).

For Noise Sensitive Receptor ‘5’ (NSR5):

- The calculated turbine noise levels are above the daytime and night time noise criteria recommended by ETSU for both proposed locations. It is therefore considered that the predicted noise levels from the proposed turbine will not satisfy all of the noise limits specified by ETSU at this property.

- However, the L_{90} noise levels due to the existing turbines are such that, when considering a cumulative assessment for a ‘noise sensitive’ property, they fail to comply with the ETSU criteria using current best practice prediction methodologies in 2015. The cumulative L_{90} noise level for the existing turbines before inclusion of the proposed turbine is 46.4dB at this property and therefore, using 2015 best practice, would not be permitted for planning for noise.

- When assessed cumulatively, the proposed turbine is bound to fail to meet the cumulative criteria due to the presence of the existing turbines and their combined L_{90} noise level that is already above the noise criterion recommended by ETSU.

- As the predicted noise level of the proposed turbine is 22.4dB less (‘T1’) and 20.1dB less (‘T1 Alt’), than the cumulative noise levels of the existing turbines, it is considered that any impact from the proposed turbine would be ‘masked’ by noise from the existing turbines at this property.

- It is also worthy of note that, if the existing turbines ceased to operate, the proposed turbine would satisfy all of the noise limits specified by ETSU for this property for a single turbine installation (for both the ’T1’ and ‘T1 Alt’ locations).

For Noise Sensitive Receptor '6' (NSR6):

- The calculated turbine noise levels are above the daytime and night time noise criteria recommended by ETSU for both proposed locations. It is therefore considered that the predicted noise levels from the proposed turbine will not satisfy all of the noise limits specified by ETSU at this property.

- However, the L_{90} noise levels due to the existing turbines are such that, when considering a cumulative assessment for a 'noise sensitive' property, they fail to comply with the ETSU criteria using current best practice prediction methodologies in 2015. The cumulative L_{90} noise level for the existing turbines before inclusion of the proposed turbine is 47.1dB at this property and therefore, using 2015 best practice, would not be permitted for planning for noise.

- When assessed cumulatively, the proposed turbine is bound to fail to meet the cumulative criteria due to the presence of the existing turbines and their combined L_{90} noise level that is already above the noise criterion recommended by ETSU.

- As the predicted noise level of the proposed turbine is 22.6dB less ('T1') and 20.4dB less ('T1 Alt'), than the cumulative noise levels of the existing turbines, it is considered that any impact from the proposed turbine would be 'masked' by noise from the existing turbines at this property.

- It is also worthy of note that, if the existing turbines ceased to operate, the proposed turbine would satisfy all of the noise limits specified by ETSU for this property for a single turbine installation (for both the 'T1' and 'T1 Alt' locations).

For Noise Sensitive Receptor '7' (NSR7):

- The calculated turbine noise levels are above the daytime and night time noise criteria recommended by ETSU for both proposed locations. It is therefore considered that the predicted noise levels from the proposed turbine will not satisfy all of the noise limits specified by ETSU at this property.

- However, the L_{90} noise levels due to the existing turbines are such that, when considering a cumulative assessment for a 'noise sensitive' property, they fail to comply with the ETSU criteria using current best practice prediction methodologies in 2015. The cumulative L_{90} noise level for the existing turbines before inclusion of the proposed turbine is 43.1dB at this property and therefore, using 2015 best practice, would not be permitted for planning for noise.

- When assessed cumulatively, the proposed turbine is bound to fail to meet the cumulative criteria due to the presence of the existing turbines and their combined L_{90} noise level that is already above the noise criterion recommended by ETSU.

- As the predicted noise level of the proposed turbine is 9.4dB less ('T1') and 13.4dB less ('T1 Alt'), than the cumulative noise levels of the existing turbines, it is considered that any impact from the proposed turbine would be 'masked' by noise from the existing turbines at this property.

- It is also worthy of note that, if the existing turbines ceased to operate, the proposed turbine would satisfy all of the noise limits specified by ETSU for this property for a single turbine installation (for both the 'T1' and 'T1 Alt' locations).

4.2 Uncertainty

There is an inherent uncertainty factor within noise propagation calculations as they are based upon assumptions as to the atmospheric and ground conditions, which may vary over time. The inherent uncertainty of the measurements completed has been assessed broadly following the procedure detailed in ISO 9613-2. This evaluation of the uncertainty estimates that the uncertainty of the calculations in this assessment will be +/- 1dB.

5.0 CONCLUSION

Earthmill has appointed Dragonfly Consulting to carry out a noise assessment relating to the proposed installation of one 50 metre high (to hub) wind turbine on land forming part of New Maythorne Farm, Ingbirchworth.

It is understood that the noise assessment is required to establish the noise levels at the nearest noise sensitive receptor due to the operation of the proposed turbine and to assess the impact of those noise levels against the requirements of ETSU-R-97, *"The Assessment and Rating of Noise from Wind Farms"*.

For the Financially Interested Property (FI) the calculated turbine noise levels are below the daytime and night time noise criteria recommended by ETSU. It is therefore considered that the predicted noise levels from the proposed turbine will satisfy all of the noise limits specified by ETSU at this property.

When NSR1-NSR7 are assessed cumulatively with the existing turbines the methodology breaks down due to non-compliance of the existing turbines using best practice assessment methodologies in 2015.

The predicted noise level of the proposed turbine is less than the cumulative noise levels of the existing turbines at NSR1-NSR7 for both 'T1' and 'T1 Alt' proposed locations. It is considered that any impact from the proposed turbine would be 'masked' by noise from the existing turbines at these properties using either of the proposed locations.

Therefore it is considered that there will be no perceptible change in noise levels at NSR1-NSR7 due to the proposed turbine.

6.0 CLOSURE

This report has been prepared by Dragonfly Consulting with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client.

Dragonfly Consulting disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Appendix A – Glossary of Terminology

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A-1
Sound Levels Commonly Found in the Environment

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

Acoustic Terminology

dB (decibel) The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$Pa).

dB(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

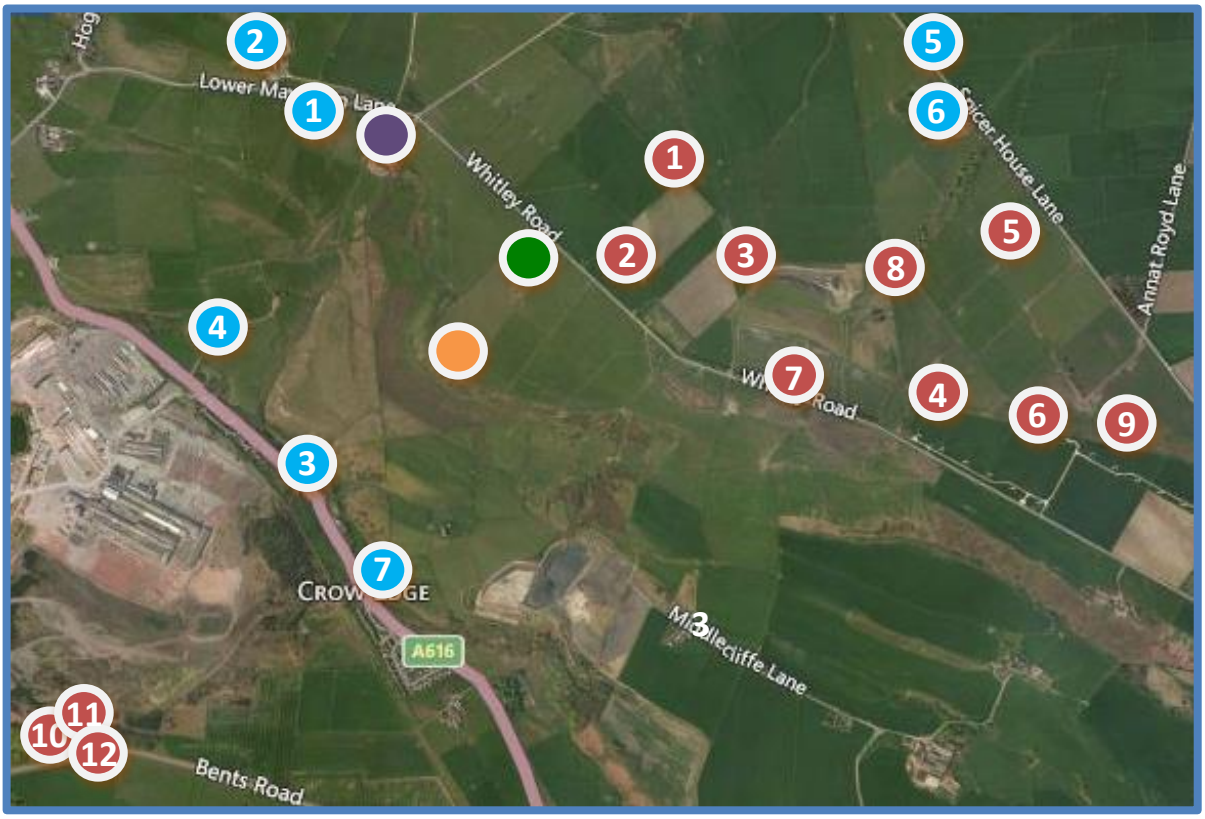
L_{Aeq} Defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{10} & L_{90} If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index when describing traffic noise.

L_{Amax} The maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment.

Appendix B – Turbine Locations

Figure B-1
Turbine Location Plan



Financially Interested Property (FI)

Nearest Noise Sensitive Receptors (NSRs)

Approximate proposed turbine location (T1)

Approximate alternative turbine location (T1 Alt.)

Approximate existing turbine location

Appendix C – Limitations to this Report

This entails a physical investigation of the site with a sufficient number of sample measurements to provide quantitative information concerning the type and degree of noise and vibration affecting the site. The objectives of the investigation have been limited to establishing sources of noise and vibration material to carrying out an appropriate assessment.

The number and duration of noise and vibration measurements have been chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements have been restricted to the areas unoccupied by building(s) that are easily accessible without undue risk to our staff.

As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of “hotspots” where noise or vibration levels may be significantly higher than those actually measured due to previously unknown or unrecognised noise or vibration emitters. Furthermore, noise or vibration sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration.