

**E.ON Climate and
Renewables**

**Blackstone Edge
Wind Farm**

Planning Statement

June 2009

Entec UK Limited

Report for

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Doc Reg No. 22846GY016

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Certificate No. FS 13881



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Document Revisions

No.	Details	Date

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Appendix A Environmental Statement Chapter 6: Noise

1. Introduction

1.1 Purpose of this report

This planning statement has been prepared by Entec UK Ltd on behalf of E.ON Climate and Renewables in support of an application to vary Condition 21 on the recently approved Blackstone Edge Wind Farm application 2008/0171.

It provides a short summary of the history of the site, the purpose of the application, a list of the relevant energy and planning policies along with other significant material considerations and summarises how the application accords with these.

1.2 Recent Planning History

The site was granted planning permission (ref:2008/0171) on 26 May 2009 for:

'Erection of a 3 turbine wind farm with a height of 101m to blade top, including substation building, anemometer mast and ancillary infrastructure at Land between Browns Road and Whitley Road, known as Blackstone Edge, Crow Edge, Barnsley'.

This permission is subject to 27 conditions.

1.3 The Extant Planning Permission

Condition 21 of the extant planning permission relates to noise levels and states:

"The noise level shall not exceed the following levels, measured as a 10 minute L_{A90} at the following properties:

<i>Location</i>	<i>Maximum Noise level Permitted (L_{A90}, 10 mins)</i>	
<i>Spicer House</i>	<i>Night 43</i>	<i>Day 35</i>
<i>New Maythorn Farm</i>	<i>Night 43</i>	<i>Day 35</i>

(where day time is defined as 07.00-23.00 hours; within that, quiet day-time periods are defined as 18.00-23.00hours Mon-Fri, 13.00-23.00 Sat, and 07.00-23.00hours Sun. Night-time is defined as 23.00-7.00hours.)

Noise monitoring shall be undertaken immediately prior to commissioning and annually and the results submitted to the LPA. Any noise issues shall be resolved within 3 months of identification. All measurements shall be made by a competent person using a calibrated noise level meter of type II or better".

This condition would have significant restrictions on energy output and it is our assertion that the wording of Condition 21 is not in accordance with the ETSU-R-97 report¹ which PPS22: Renewable Energy states '*should be used to assess and rate noise from wind energy development*'².

This application is therefore submitted in order to seek to vary this condition so that the noise levels predicted in the Environmental Statement (Copy provided in Appendix A) are permissible, as in accordance with the ETSU-R-97 report.

¹ '*The Assessment and rating of noise from Windfarms*' ETSU for the DTI

² Pg 13, PPS22: Renewable Energy, ODPM 2004

2. Planning Policy & Guidance

As the principle of the proposed development of the application site has already been established the energy and planning policy summary focuses on aspects relating to noise and wind energy.

2.1 National Energy and Planning Policy

Planning Policy Statement 22: Renewable Energy

PPS22: Renewable Energy states that Local Planning Authorities should ensure that renewable energy developments have been located and designed in such a way as to minimise increases in ambient noise levels. It also states that the 1997 report by ETSU for the Department of Trade and Industry (ETSU-R-97) should be used to assess appropriate noise levels from wind energy development.

Planning for Renewable Energy: A Companion Guide to PPS22

The Companion Guide provides advice on noise levels generated from wind turbines and provides a table comparing them to other every-day activities, shown below.

Table 2.1 Noise generated by wind turbines compared with other everyday activities

Source/Activity	Indicative Noise Level dB(A)
Threshold of Pain	140
Jet aircraft at 250m	105
Pneumatic drill at 7m	95
Truck at 30 mph at 100m	65
Busy general office	60
Car at 40 mph at 100m	55
Wind Farm at 350m	35-45
Quiet bedroom	20
Rural night-time background	20-40
Threshold of hearing	0

Source: pg 168 Planning for Renewable Energy: A Companion Guide to PPS22

The Companion Guide acknowledges that wind-generated background noises increase with wind speed, and at a faster rate than the wind turbine noise increases with wind speed. It states that the difference between the noise of the wind farm and the background noise is therefore liable to be greatest at low wind speeds. It goes on to say that the ETSU-R-97 report '*describes a framework for the measurement of wind farm noise and gives indicative noise levels*

calculated to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or planning authorities...This methodology overcomes some of the disadvantages of BS 4142 when assessing the noise effects of windfarms, and should be used by planning authorities when assessing and rating noise from wind energy developments³.

ETSU-R-97 The Assessment and Rating of Noise from Windfarms

The report recommends that noise limits should be set relative to the background noise at the nearest noise-sensitive properties and the limits should reflect the variation in both turbine source noise and background noise with wind speed. Therefore, it suggests separate limits are given for day time and night time.

The report also recommends that in low noise environments an absolute minimum noise limit should be between 35-40dB(A) during the daytime; the specific level within that range being dependent upon several factors: the number of dwellings in the neighbourhood; the effect of the noise limits on kWh generated, and; the duration and level of exposure. The minimum fixed limit for night time is recommended to be 43dB(A). The report recommends that these limits should be increased to 5dB(A) above background noise at a particular wind speed for both day and night time, subject to the minimum noise limits described above.

Daytime noise limits are based upon background noise levels measured during: all evenings from 6pm to 11pm; Saturday afternoon from 1pm to 6pm, and; all day Sunday, 7am to 6pm. Night-time is defined as 11pm to 7am.

2.2 Local Planning Policy

Barnsley Unitary Development Plan

The Barnsley Unitary Development Plan (UDP) was adopted in 2000 and under the provisions of the 2004 Planning and Compulsory Purchase Act many policies have been 'saved' until the adoption of the Local Development Framework (LDF).

Relevant to this application is policy ES12 Wind Generation which states:

Proposals for wind energy will be assessed with regard to the following factors:

- B. The impact on residential amenity with particular reference to noise, visual outlook, and shadow flicker and flashing from the turbine blades.*

³ Pg 169 *Planning for Renewable Energy: A Companion Guide to PPS22*, ODPM 2004

3. Planning Assessment

3.1 Key Issues and Considerations

The acceptable limits for wind turbine operational noise are defined in ETSU-R-97, as discussed above. The test for operational noise is therefore whether or not the calculated wind turbine noise levels at receptor properties lie below the noise limits derived in accordance with ETSU-R-97. This has been acknowledged in the Planning Officers committee report for the main application.

In low noise environments (i.e. where background noise levels are less than 30-35dB(A)) ETSU-R-97 recommends that wind farm noise for quiet daytime periods should be limited to a lower fixed level within the range $L_{A90, 10min}$ 35-40dB(A) or 5dB(A) above the prevailing background, whichever is the greater. The most conservative, 35dB(A) is considered to be the appropriate lower fixed limit for Blackstone Edge wind farm; reflecting the small size of the scheme.

The night time noise limit is derived from background noise data measured during the night time 23:00 to 07:00 every day. For night time periods, the recommended ETSU-R-97 limits are $L_{A90, 10min}$ 43dB(A) or 5dB(A) above prevailing background, whichever is the greater.

The nearest properties to the proposed Blackstone Edge Wind Farm are New Maythorn Farm and Spicer House and therefore noise monitoring has been undertaken at these properties as part of the Environmental Impact Assessment and the results were recorded within the Noise chapter of the Environmental Statement which can be found in Appendix A.

Table 3.1 and 3.2 below show the predicted background and turbine noises at each property and detail the margin by which the turbine noise meets the noise limit. These estimates are based on the noise monitoring at each property and the procedure outlined within the ETSU-R-97 report. Figures 6.3 and 6.4 in Appendix A represent these graphically.

Table 3.1 Noise Assessment Results - Daytime

Wind Speed V10 (ms^{-1})	3	4	5	6	7	8	9	10
New Maythorn								
Background Noise Curve	32.6	34.3	36.1	37.8	39.5	41.2	43.0	44.7
ETSU-R-97 derived noise limit	37.6	39.3	41.1	42.8	44.5	46.2	48.0	49.7
Predicted turbine noise*	26.7	31.5	37.7	39.7	40.5	41.6	42.6	43.2
Margin under noise limit [#]	-11.0	-7.9	-3.4	-3.1	-4	-4.6	-5.4	-6.5
Spicer House								
Background Curve Noise	30.5	32.1	33.8	35.5	37.1	38.8	40.5	42.1
ETSU-R-97 derived noise limit	35.5	37.1	38.8	40.5	42.1	43.8	45.5	47.1

Predicted turbine noise*	25.2	29.4	37.7	39.1	39.8	40.7	41.5	42.1
Margin under noise limit [#]	-10.3	-7.7	-1.1	-1.4	-2.3	-3.1	-3.9	-5.0

Noise levels are dB L_{A90}, 10min

*Includes contribution from Hazelhead and Royd Moor turbines

[#]Negative values indicate the predicted turbine noise lies under noise limit

Table 3.2 Noise Assessment Results – Night Time

Wind Speed V10 (ms-1)	3	4	5	6	7	8	9	10
New Maythorn								
Background Noise Curve	29.5	31.4	33.3	35.2	37.1	39.0	40.8	42.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.0	45.8	47.7
Predicted turbine noise*	26.7	31.5	37.7	39.7	40.5	41.6	42.6	43.2
Margin under noise limit [#]	-16.3	-11.5	-5.3	-3.3	-2.5	-2.3	-3.3	-4.5
Spicer House								
Background Curve Noise	27.5	29.3	31.1	32.9	34.6	36.4	38.2	40.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.2	45.0
Predicted turbine noise*	25.2	29.4	37.7	39.1	39.8	40.7	41.5	42.1
Margin under noise limit [#]	-17.5	-13.6	-5.3	-3.9	-3.2	-2.3	-1.7	-2.9

Noise levels are dB L_{A90}, 10min

*Includes contribution from Hazelhead and Royd Moor turbines

[#]Negative values indicate the predicted turbine noise lies under noise limit

The margins indicate that the worst-case noise levels predicted remain within the limits set out in the ETSU-R-97 guidance.

Condition 21 on the Blackstone Planning Permission 2008/0171 places maximum noise level restrictions relating to the minimum limits the ETSU-R-97 report recommends; 35dB(A) in the daytime and 43dB(A) in the night time. It therefore does not take into consideration the varying background noise levels at differing wind speeds. The ETSU-R-97 report recommends these levels as a minimum limit in areas with low background noise levels to ensure that there is reasonable protection to neighbouring properties whilst not imposing unreasonable restrictions on wind farm developers. To impose the limits set out within Condition 21 would not be in accordance with the principles of the ETSU-R-97 report.

Given that the worst-case noise levels predicted are comfortably within the limits set out in the ETSU-R-97 report, to vary the wording of Condition 21 to allow operation of the turbines at these predicted noise levels, within the limits derived in accordance with the ETSU-R-97 report, is considered to be in accordance with the aims of PPS22 and Policy ES12 of the Barnsley UDP.

3.2 Suggested Condition

We are applying to vary the wording of Condition 21 to take into consideration the varying background noise levels and we would welcome the opportunity for discussions with the Environmental Health Officer to agree an appropriate form of words for the condition that conform with the ETSU-R-97 report, PPS22 guidance and the council's own requirements.

We propose that the wording of the condition and informatives could be as follows:

Condition 21: Noise

The Rating Noise Levels from the combined effects of the wind turbine generators on the development hereby approved shall not at any time exceed the levels shown in Table 1 and Table 2 below. Rating Noise Levels will be derived from levels measured, and corrected if necessary for tonal quality, in accordance with procedures in the Schedule of Noise Guidance Notes attached to this decision:

Table 1 - Maximum permitted noise levels 23:00 - 07:00 (dB L_{Af90,10min})

Location	Wind speed at 10m above ground level (m/s)									
	3	4	5	6	7	8	9	10	11	12
New Maythorn	43.0	43.0	43.0	43.0	43.0	44.0	45.8	47.7	49.6	51.5
Spicer House	43.0	43.0	43.0	43.0	43.0	43.0	43.2	45.0	46.8	48.6

Table 2 - Maximum permitted noise levels all other times (dB L_{Af90,10min})

Location	Wind speed at 10m above ground level (m/s)									
	3	4	5	6	7	8	9	10	11	12
New Maythorn	37.6	39.3	41.1	42.8	44.5	46.2	48.0	49.7	51.4	53.2
Spicer House	35.5	37.1	38.8	40.5	42.1	43.8	45.5	47.1	48.8	50.4

The noise limits specified shall also apply to all other dwellings which lawfully exist at the time of this consent. Noise limit values shall be taken from the nearest non-financially involved dwelling having pre-established background noise to the dwelling in question.

In the event of a complaint being received in writing by the Local Planning Authority alleging noise nuisance due to the wind turbines on the development hereby approved, the wind farm operator shall measure the level of noise emissions from the wind farm at the location of the complainant's property (or, in the event that access is not possible, at the nearest publicly accessible location acceptable to the Local Planning Authority) and the operator shall cooperate with the Local Planning Authority and ensure that the development is compliant with the above defined limits for the site.

NB: The above noise conditions should be read in conjunction with the Schedule of Noise Guidance Notes contained at the end of this conditions list.

Schedule of Noise Guidance Notes (Informatives)

The following paragraphs are based upon steps 2-6 specified in Section 2 of the Supplementary Guidance Notes to the Planning Obligation contained within page 102 and following pages of "The Assessment and Rating of Noise from Wind Farms, ETSU-R-97" published by ETSU for the Department of Trade and Industry. It has been adapted in the light of experience of actual compliance measurements.

Note 1

Values of the $L_{AF90,10min}$ noise statistic should be measured at the affected dwelling using a sound level meter of at least IEC 651 Type 1 quality (or the equivalent relevant UK adopted standard in force at the time of the measurements). This should be fitted with a ½" diameter microphone and calibrated in accordance with the procedure specified in BS4142:1997. The microphone should be mounted on a tripod at 1.2 - 1.5m above ground level, fitted with a two layer windshield or suitable equivalent according to current best practice, and placed in the vicinity of, and external to, the dwelling. The intention is that, as far as possible, the measurements should be made in "free-field" conditions. To achieve this, the microphone should be placed at least 3.5m away from the building facade or any reflecting surface except the ground.

The $L_{AF90,10min}$ measurements should be synchronised with measurements of the 10-minute arithmetic mean average wind speed and with operational data from the turbine control systems of the wind farm.

The wind speed and wind direction and a note of all 10 minute periods when one or more of the turbines was not operating normally should be available to enable an analysis to take place.

The precise definition of "normal operation" should be agreed in writing with the local authority prior to the commencement of the development on the basis of data available but should generally be taken to mean when the turbine power output is not significantly different from the reference power curve, which may be a noise optimised power curve if appropriate, using the nacelle anemometer.

In the interests of commercial confidentiality no information is required to be provided for individual turbines or on the nature of any abnormality or for any period during which noise monitoring is not taking place.

Note 2

The noise measurements should be made over a period of time sufficient to provide not less than 100 valid data points. Measurements should also be made over a sufficient period to provide valid data points throughout the range of wind speeds considered by the Local Planning Authority to be most critical. In determining the wind speeds most critical The Local Planning Authority shall have regard to those wind speeds which were most likely to have prevailed during times when the complainant alleges there was disturbance due to noise. Valid data points are those that remain after the following data have been excluded:

- all periods during rainfall;
- all periods during which the measurement position is not within 45 degrees of being downwind of any wind turbine;
- all periods during which turbine operation was not normal.

A least squares, "best fit" curve of a maximum 4th order should be fitted to the data points.

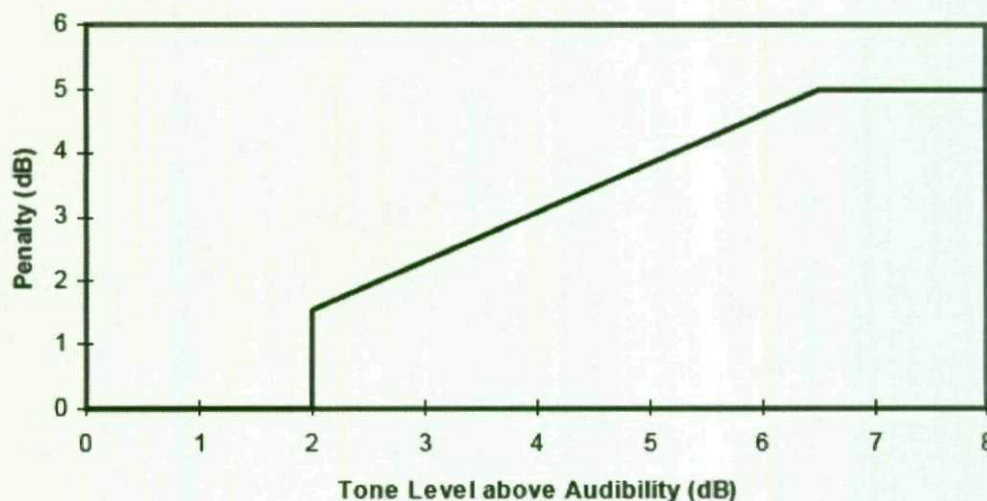
Note 3

Where in the opinion of the Local Planning Authority, the noise emission contains a tonal component, the following rating procedure should be used. This is based on the repeated application of a tonal assessment methodology. For each 10-minute interval for which $L_{AF90,10min}$ data have been obtained, a tonal assessment is performed on noise emission during 2-minutes of the 10-minute period. The 2-minute periods should be regularly spaced at 10-minute intervals provided that uninterrupted clean data are obtained.

For each of the 2-minute samples the margin above or below the audibility criterion of the tone level difference, ΔL_{tm} , is calculated by comparison with the audibility criterion given in Section 2.1 on page 104 and following pages of ETSU-R-97. The margin above audibility is plotted against wind speed for each of the 2-minute samples. For samples for which the tones were below the audibility criterion or no tone was identified, substitute a value of zero audibility.

A linear regression is then performed to establish the margin above audibility at the assessed wind speed. If there is no apparent trend with wind speed then a simple arithmetic average will suffice.

The tonal penalty is derived from the margin above audibility of the tone according to the figure below.



The rating level at each wind speed is the arithmetic sum of the wind farm noise level, as determined from the best fit curve described in Note 2, and the penalty for tonal noise. The rating level shall be determined for each integer wind speed. If the rating level lies at or below those values set out in Condition 21 then no further action is necessary.

Note 4

If the rating level is above the limit, a correction for the influence of background noise should be made. This may be achieved by repeating the steps in Note 2, with the wind farm switched off, and determining the background noise at the assessed wind speed, L_b . The wind farm noise at this speed, L_w , is then calculated as follows where L_a is the measured level with turbines running but without the addition of any tonal penalty:

$$L_w = 10 \log \left[10^{L_a/10} - 10^{L_b/10} \right]$$

The Rating level is re-calculated by adding the tonal penalty (if any) to the wind farm noise. If the rating level lies at or below those values set out in Condition 21 then no further action is necessary. If the rating level exceeds those values set out in Condition 21 then the development fails to comply with Condition 21.

4. Conclusion

Condition 21 of the planning permission would seriously restrict the energy output and goes against the principles of the ETSU-R-97 guidance, which PPS22 states should be used to assess and rate noise from wind energy development.

The Environmental Statement submitted with the planning application 2008/0171 details that the proposed wind farm is within the noise limits recommended in the ETSU-R-97 report and concludes that the wind farm will have no significant effects in relation to operational noise.

Alternative wording has been suggested as part of this application to vary Condition 21 that takes into consideration the varying background noise levels and provides the Local Planning Authority with a mechanism for monitoring and enforcement. To vary the condition to similar wording as that suggested would be in line with the ETSU-R-97 report and be in accordance with PPS22.

Appendix A

Environmental Statement Chapter 6: Noise

20 Pages

6. Noise

6.1 Introduction

- 6.1.1 This chapter has been prepared by Neil Parnell of Entec UK Ltd. Neil, an Associate Member of the Institute of Acoustics, holds a Diploma in Acoustics and Noise Control, a Certificate of Competence in Environmental Noise Measurement, MRes Marine Technology and BSc (Hons) Environmental Physical Sciences. The chapter assesses the effects of construction and operational noise upon residential receptors surrounding the proposed wind farm.

6.2 Context

Site Context

- 6.2.1 Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. Noise is often therefore an important consideration in the determination of planning applications.
- 6.2.2 Construction noise effects are normally of a temporary nature and comprise both moving and static sources. Assessment allows the temporary impact of construction noise to be understood and for suitable mitigation measures to be identified to minimise any adverse effects. The assessment of construction noise can also consider the effects of increased traffic levels where appropriate. In the context of the Blackstone Edge site, the two nearest properties are considered for effects in relation to direct noise from the construction, New Maythorn Farm and Spicer House, in addition to properties along the main access route to site for traffic noise.
- 6.2.3 When operational, wind turbines emit two types of noise – mechanical noise and aerodynamic noise. The main sources of mechanical noise are from internal components housed within the nacelle, such as the gearbox and generator. Mechanical noise from a modern wind turbine is negligible as the nacelles are insulated to reduce noise emissions and the various mechanical components housed within the nacelle are acoustically isolated to prevent structure borne noise. Aerodynamic noise occurs from the movement of the blades passing through the air. At higher wind speeds aerodynamic noise is usually masked by the increasing sound of wind blowing through trees and around buildings at the receptor location. In the context of the Blackstone Edge site, the two nearest properties are considered for effects in relation to noise from the development, New Maythorn Farm and Spicer House.

Policy Context

National

- Planning Policy Guidance Note 24: Planning and Noise
- Planning Policy Statement 22: Renewable Energy

Regional

- 6.2.4 No regional policies are relevant to noise.

Local

- Policy ES12 'Wind Energy Generation' B) states that proposals for wind energy generation will be assessed with regard to the following:

"The impact on residential amenity with particular reference to noise, visual outlook, and shadow flicker and flashing from turbine blades."

Legislative Context

- ETSU-R-97 The Assessment and Rating of Noise from Windfarms

6.3 Methodology

Data Gathering

- 6.3.1 Information regarding noise emissions from a number of proposed turbines was obtained in order to predict noise levels at receptors. This information also included noise levels from the existing Royd Moor site and the recently consented Hazlehead site, taken from the associated planning application for each site.
- 6.3.2 Traffic data was obtained from chapter 10, Traffic and Transport.

Survey Work

- 6.3.3 Measurements of background noise levels at two receptors surrounding the site were taken for a period of around fourteen days and correlated with wind speeds measured at the site. These measurements are covered in depth in Section 6.4.

Scope of Study**Approach to Scoping**

- 6.3.4 Initial modelling of operational noise emissions from the proposed wind turbines was undertaken to determine properties at which noise levels would necessitate a full assessment in accordance with ETSU-R-97.
- 6.3.5 This information was used to develop the approach to the noise assessment and consultation was undertaken with the Environmental Health Department of Barnsley Metropolitan Borough Council to agree the methodology.

Effects Requiring Further Consideration

- 6.3.6 The following effects have been scoped in:
- operational noise;
 - construction noise (including construction traffic and grid connection);

Effects Not Requiring Further Consideration

- 6.3.7 The following effects have been scoped out:
- operational traffic noise.

Assessment and Evaluation Methodologies

Overview of Construction and Decommissioning Noise Assessment Procedure

- 6.3.8 It is anticipated that the overall duration of the construction stage would be approximately 6 - 9 months, as detailed in Chapter 4. During the construction period a range of different activities would take place within the site, for example, there would be delivery of materials to the site, earthmoving within the site and turbine installation.
- 6.3.9 Advisory Leaflet (AL) 72 Noise control on building sites provides some guidance on acceptable levels of construction noise, stating that between 07:00 to 19:00 in rural, suburban and urban areas away from main road traffic and industrial noise sources, the noise level should not exceed 70 dB(A) when measured outside the nearest occupied room. An assessment of construction noise is made following the methodology laid out in British Standard (BS) 5228 Noise and Vibration Control on Construction and Open Sites.
- 6.3.10 It is assumed that decommissioning noise will be generally less or, at worst realistic case, similar to that experienced during the construction period. It can therefore be assumed that noise relating to the decommissioning of the windfarm may also be perceptible at the receptors, but will be limited by restricting working hours and transport routes.

Overview of Traffic Noise Assessment Procedure

- 6.3.11 Following guidance presented in the Design Manual for Roads and Bridges, a noise assessment is only necessary for a change in traffic flow of greater than 25%. This equates to a change in noise levels of 1dB, which is noted as being the point at which adverse effects can occur.
- 6.3.12 Subject to the above screening criteria, the likely level of noise resulting from traffic movements can be predicted using the methodology found in the document Calculation of Road Traffic Noise. This model uses numbers, type of vehicle movement and speed of vehicles to calculate likely noise generated by traffic. Where sufficient data is available for the routes to site (generally the main road network), a comparison will be drawn between levels that would pertain should the development proceed compared with those that would pertain if they did not.
- 6.3.13 Given the low levels of traffic expected throughout the operational phase of the wind farm, this is not considered in the assessment.

Overview of Operational Noise Assessment Procedure

- 6.3.14 In England, advice specific to noise emanating from wind energy developments can be found in Planning Policy Statement 22. Paragraph 22 guides the assessment process as follows:
- "The 1997 report by ETSU for the Department of Trade and Industry should be used to assess and rate noise from wind energy development."*
- 6.3.15 Furthermore, Planning for Renewable Energy – A Companion Guide to PPS22, expands the point by presenting a discussion of the broad issues surrounding noise from wind farms, detailing why the ETSU-R-97 method is accepted over other possible assessment techniques. Experience has now demonstrated that the

implementation of these recommendations has enabled the operation of wind farms without giving rise to noise difficulties. This methodology has therefore been adopted for the Blackstone Edge Wind Farm assessment.

- 6.3.16 The advice presented in the document was produced by the Working Group on Noise from Wind Turbines, a body comprising a number of interested parties including, amongst others, windfarm operators, environmental health officers, acoustic consultants and legal experts. The assessment approach was developed to address the shortcomings of other standards in addressing windfarm noise.
- 6.3.17 An explanation of noise terminology is provided in the Glossary and Abbreviations (Appendix A).

Noise limits

- 6.3.18 The acceptable limits for wind turbine operation noise are defined in ETSU-R-97. The test for operational noise is therefore whether or not the calculated windfarm noise levels at receptor properties lie below the noise limits derived in accordance with ETSU-R-97.
- 6.3.19 ETSU-R-97 provides a simplified approach if predicted operational noise at receptors is limited to an $L_{A90,10min}$ of 35dB in wind speeds up to 10ms⁻¹ at 10m height. Preliminary modelling for the Blackstone Edge Wind Farm indicated that noise was likely to exceed this threshold at a number of properties surrounding the site. Hence, the guidance recommends that windfarm noise limits should be set relative to existing background noise levels, subject to a fixed minimum limit, and that these limits should reflect the variation in both turbine source noise and background noise with wind speed. The wind speeds that should be considered range from the cut-in speed (the wind speed at which the turbine begins to generate power, commonly around 4ms⁻¹) up to 12ms⁻¹, the point at which wind turbines are usually at 95% of their rated power and thus no significant increases in noise emission are expected. Wind speeds are referenced to a 10m measurement height (V10).
- 6.3.20 The daytime noise limit is derived from background noise data measured during 'quiet daytime' at residential properties, which comprise:
- all evenings from 18:00 - 23:00; plus
 - Saturday afternoons from 13:00 - 18:00; and
 - all day Sunday 07:00 - 23:00.
- 6.3.21 The data is plotted against the concurrent wind speed data measured at the proposed Blackstone Edge Wind Farm site and a 'best fit' correlation is established.
- 6.3.22 In low noise environments (i.e. where background noise levels are less than 30-35dB(A)), ETSU-R-97 recommends that windfarm noise for quiet daytime periods should be limited to an absolute fixed level within the range $L_{A90,10min}$ 35-40dB or 5dB(A) above the prevailing background, whichever is the greater. The lower absolute fixed level selected for Blackstone Edge is 35dB(A), reflecting the relatively small size of the scheme.
- 6.3.23 The night-time noise limit is derived from background noise data measured during the night-time 23:00 to 07:00 every day. As with the daytime data, this is plotted

against the concurrent wind speed data and a 'best fit' correlation established. For night time periods the recommended limits are $L_{A90,10min}$ 43dB or 5dB(A) above prevailing background, whichever the greater.

- 6.3.24 The ETSU-R-97 noise criteria assume that the wind turbine noise contains no audible tones. Where tones are present a correction is added to the measured or predicted noise level before comparison with the recommended limits. The level of correction will depend on the amount by which the tone exceeds the audibility threshold.

Operational Noise Modelling

- 6.3.25 Whilst there are several noise propagation models available, the model used is that found in ISO 9613-2. The model takes account of:

- geometric divergence (attenuation with distance);
- air absorption;
- barriers (including buildings or topography);
- screening (including vegetation); and
- ground absorption and reflection.

- 6.3.26 The ISO 9613-2 algorithm has been chosen as being the most robust prediction method, based on the findings of a joint European Commission research project into windfarm noise propagation over large distances (Bullmore & Sloth, 1998). According to this research, this model (like all the others considered in the research) tends to over-estimate noise levels at nearby dwellings, rather than under-estimate it. The over-riding conclusion of the study was that the ISO 9613-2 algorithm tended to predict noise levels that would generally occur under down wind propagation conditions.

- 6.3.27 The other important outcome of the research was to demonstrate that under upwind propagation conditions, between a given receiver and the windfarm, the windfarm noise level at that receiver will be as much as 10dB(A) to 15dB(A) lower than the level predicted using the ISO 9613-2 algorithm.

- 6.3.28 Calculations were undertaken using LIMA noise propagation software. For the purposes of the present assessment, all noise level predictions have been based upon the following model parameters:

- a receiver height of 4.0m above local ground level - to represent the height of a typical bedroom window;
- hard ground ($G = 0$) - in reality the ground between the turbines and receptors is almost entirely porous, hence including an element of hard ground in the model is a conservative assumption since hard ground has virtually no absorptive properties; and
- air absorption based on a temperature of 10°C and 70% relative humidity.

- 6.3.29 ETSU-R-97 states the $L_{A90,10min}$ descriptor should be used for both the background noise and windfarm noise when setting limits and the $L_{A90,10min}$ is likely to be about

1.5 to 2.5dB less than the $L_{Aeq,10min}$. The noise model predicts operational noise levels in terms of L_{Aeq} . In this instance it is assumed the $L_{A90,10min}$ is 1.5dB less than the $L_{Aeq,10min}$ presenting the most conservative case.

Cumulative Impacts

- 6.3.30 The Blackstone Edge Wind Farm is located less than 1km from the operational Royd Moor wind farm. In addition, planning permission has recently been granted for the development of a small wind farm known as Hazlehead, approximately 1.7km south west of the site. Schemes further afield are not considered as they would have negligible noise impact.
- 6.3.31 As agreed with the Environmental Health Officer of Barnsley MBC, in order to take account of the cumulative effects of all three schemes operating simultaneously, the noise modelling described below includes a contribution from all of the schemes.
- 6.3.32 The existing background noise measurements were undertaken with the Royd Moor turbines operating, but during site visits the Royd Moor site was not audible at either New Maythorn or Spicer House. The predicted noise levels associated with the Hazlehead and Royd Moor schemes were added to the predicted levels from the proposed Blackstone Edge turbines and the total wind turbine noise from all three sites assessed against ETSU guidelines.
- 6.3.33 Noise source data for the Royd Moor turbines was obtained from the wind farm operators. The equivalent data for the Hazlehead turbines was obtained from the Environmental Statement submitted in support of the planning application. In summary, the predicted noise levels below include the contribution of all three schemes operating simultaneously.

6.4 Description of Baseline Conditions

Off-Site

- 6.4.1 Background noise monitoring was undertaken at two properties surrounding the Blackstone Edge Wind Farm site, the locations of which are shown on Figure 6.1 and listed in Table 6.1. The equipment was left in-situ and data collected from 11 December 2006. The equipment was not recovered until 3 January 2007, however the batteries had expired earlier and no further data was logged after 26 December 2006.

Table 6.1 Noise Monitoring Locations

Receptor	Easting ^a	Northing ^a	Monitoring Position
Spicer House	420479	405628	Yard to northwest of house
New Maythorn Farm	418963	405515	Northeast corner of garden

^aGPS coordinates

- 6.4.2 A 10m high meteorological monitoring mast was installed on the site concurrently to collect simultaneous 10 minute-averaged wind speed, direction and rain data. Figure 6.2 shows the range of wind speeds and directions which were recorded over the monitoring period. Where rainfall occurred, the noise and wind speed data has been excluded from the assessment and is not presented within the figures. During the survey, wind speeds up to around 14ms-1 were recorded during both quiet daytime and night-time periods. Winds were generally south-westerly.
- 6.4.3 The equipment used for the background noise monitoring comprised Rion NL-31 Class 1 integrating logging sound level meters. These were enclosed in an environmental case with sufficient battery power to enable approximately 10 days continuous logging at the required 10 minute averaging periods, logging the L_{A90} , L_{A50} , L_{A10} , L_{Aeq} , L_{Amax} , and L_{Amin} . The measurement systems were fitted with appropriate wind and rain protection for the microphone to maintain Class 1 measurement accuracy. All microphones were located a sufficient distance away from reflective façades in a location deemed to be representative of background noise at the property, away from any obvious local sources of noise. Photographs of the measurement location are provided in Appendix C.
- 6.4.4 The sound level meters were calibrated on deployment and recovery. The batteries were changed and the meter calibrated once during the survey. No significant drifts in calibration were noted at any point.
- 6.4.5 The upper graphs on Figure 6.3 and Figure 6.4 present charts showing the 10 minute average wind speed plotted against noise levels measured for the same period, together with a calculated 'best fit' line, for both day and night-time periods at the two locations. The charts exclude periods of rainfall.
- 6.4.6 A summary of the measured levels is provided in Table 6.2, together with a qualitative description of the background noise environment. In general, it was noted that the ambient noise environment at the receptors was dominated by natural sources, including the wind blowing through trees, and animals. Distant traffic was also audible at both locations. The existing Royd Moor Wind Farm was not audible at either location during the survey visits.
- 6.4.7 The values of the best-fit background noise curve and subsequent noise limit derived following the ETSU-R-97 procedure described in Section 6.3 are detailed later in Table 6.5 and Table 6.6.

Table 6.2 Summary of Background Noise Levels at Receptors

Receptor	Quiet Daytime $L_{A90,10min}$	Night-Time $L_{A90,10min}$	Construction Hours $L_{Aeq,10min}$	Description of Noise Environment
Spicer House	21 - 62	19 - 61	27 - 66	Birdsong, wind in trees, distant traffic
New Maythorn Farm	21 - 63	19 - 64	32 - 74	Wind, livestock, aircraft, wildlife, distant traffic, agricultural activity

Predicted Future Baseline

- 6.4.8 It is reasonable to assume that over time, background noise levels in the vicinity of the wind farm will increase gradually in line with increased traffic levels.

6.5 Mitigation

- 6.5.1 Mitigation, offsetting and enhancement proposals are outlined below. No mitigation measures are identified for operational noise as the site complies with the noise limits derived. Significant effects associated with construction traffic noise are forecast to occur for a short period only (three days), therefore no mitigation is proposed.

Construction and Decommissioning

- 6.5.2 Construction noise is transient in nature and can generally be controlled by following standard industry practices, applying best practicable means and using modern, well-maintained and serviced items of plant.

- 6.5.3 No specific mitigation is required with regards to construction noise. However, general guidance for controlling construction noise is given in British Standard 5228. E.ON propose to implement the following mitigation measures concerning construction noise:

- Restricted hours of working (08:00 to 19:00 Monday to Friday, 08:00 - 13:00 Saturdays and no audible activities Sundays) to avoid sensitive periods. Any requirement to work outside of these periods would only occur through prior agreement with the local planning authority (for example turbine erection requires low wind speed conditions and may require longer working hours if conditions are poor at the time).
- All construction activities to be undertaken in accordance with good practice as set out in BS5228:1997.
- All employees on the Blackstone Edge Wind Farm construction site will be advised of quieter methods of operating plant and tools, and to report any damage to noise control measures as soon as they are identified.
- Where practicable, for any particular activity, locally available and suitable plant, machinery and working practices would be adopted. All equipment will be maintained in good working order and will be fitted with appropriate noise controls at all times (e.g. silencers, mufflers and acoustic hoods).
- Construction plant capable of generating significant noise and vibration levels will be operated in a manner to minimise the duration of the higher magnitude levels.
- The site will register with the Considerate Constructors Scheme, a government endorsed scheme which encourages good practice on construction sites. Registered sites provide a commitment to comply with a Code of Practice which details how the construction site should present itself to and interact with the general public, and includes guidance on managing noise emissions.

6.6 Assessment of Potential Effects

Construction and Decommissioning Noise

- 6.6.1 Construction noise may arise through the operation of large items of plant on site, such as heavy goods vehicles, excavators, dumper trucks and cranes. In terms of plant operations on site, it is likely that the most noise-intensive period of activity will occur during the laying of turbine foundations, which may require piling of the bases and filling with concrete over a short period of time.
- 6.6.2 The nearest receptor to the turbines, New Maythorn Farm, is situated 616m from the nearest turbine location and a similar distance from any access tracks; distance attenuation alone over this separation is greater than 55dB. Thus, it is not anticipated that levels will exceed the AL72 recommended limit of 70dB(A) for construction site noise, given that the combined sound power level of plant operating at the turbine location would have to exceed 133dB(A) for this to occur, which is highly unlikely. Typical combined sound power levels for construction activities would be more likely to be in the region of 116-120 dB(A). Limited potential for occasionally significant noise effects may occur when work is closest to the receptors, though such effects will be short-lived and transient in nature, given that the access tracks to the turbines lie within the site boundary itself. It is assumed that decommissioning noise will be less than, or as a worst-case, comparable with construction noise.
- 6.6.3 The site is to be connected to the electricity distribution network by underground cable. It is understood this will be laid alongside the existing road network. Typical plant for this operation would include two excavators (one carrying the cable drum), a roller, delivery lorry and small dumper. Using BS5228 methodology, based on this plant operating 66% of the time, at a distance of 10m from the nearest property, noise levels of 56dB(A) are predicted. This is significantly below the AL72 criterion of 70dB(A). It should also be noted that the operations would be mobile and would only be in proximity of a single property for a short period.

Traffic Noise

- 6.6.4 Traffic noise consists of two main parts:
- vehicle engine/exhaust noise; and
 - tyre noise.
- 6.6.5 Noise from traffic travelling along a road consists of a contribution from a number of different sources. The overall traffic noise level is influenced by traffic flow, speed and composition (% HGVs), road gradient and road surface. The noise experienced by a nearby receptor is dependent upon the separation distance from the road and any intervening ground cover and/or screening.
- 6.6.6 As noted in Chapter 10, the maximum traffic impact associated with the construction of the wind farm will occur during month four, when 128 two-way HGV trips per day are forecast for three days during the concrete deliveries. For the remainder of the scheme, when concrete deliveries are not taking place, a maximum of 18 daily two-way trips is forecast.

6.6.7 Details of the more typical level of movements and base traffic levels are also given in Chapter 10 for Royd Lane and the A628, the access route to site. The resulting changes are as follows:

- **Non-concrete delivery days** - maximum of 18 two-way HGV trips per day - due to high existing numbers of HGV movements on the A628, this 3.2% change in traffic results in a less than 1dB change in noise levels. For Royd Lane, lower existing traffic levels mean that the change in HGV movements is around 30%. However, this also equates to a change in noise levels of less than 1dB. Hence traffic noise impacts for non-concrete pouring days are not considered significant.
- **Concrete delivery** - maximum 128 two-way HGV trips per day for three days - for the A628, this is a 23% increase in HGV movements, again resulting in a change in traffic noise of less than 1dB. For Royd Lane this increase represents a 213% change in traffic noise levels and subsequent increase in traffic noise levels of 3.2dB. This level of change will be perceptible at the properties, and is thus considered a significant effect for the three days of concrete deliveries.

Operational Noise

6.6.8 There is a range of commercially available turbines that would be appropriate to the Blackstone Edge Wind Farm site. The final selection of turbine will follow a competitive tendering process and thus the actual model of turbine may differ from that on which this assessment has been based. However, the final choice of turbine will be required to comply with the noise criterion levels which have been established for the site within this noise assessment.

6.6.9 A number of candidate wind turbines satisfying the proposed dimensions for the site have been assessed for noise compliance, including the Vestas V80, the Nordex N80 and the Repower MM82. It was concluded that all of these machines would satisfy the noise limits derived in this assessment. In order to maintain simplicity of this noise assessment and consistency with the rest of the ES, this assessment considers only the Repower MM82.

6.6.10 The turbine MM82 turbine has a nominal power of 2MW. Noise data for this turbine has been obtained from the following sources:

- sound power levels for integer wind speeds - *Sound Power Level of REpower MM82ⁱ*; and
- one-third octave spectra - *Summary of results of then noise emission measurement, in accordance with IEC 61400-11, of a WTGS of the type REpower MM82ⁱⁱ*.

6.6.11 At a reference wind speed of $V_{10} = 10\text{ms}^{-1}$ (i.e. wind speed at 10 metres height, as referred to in ETSU-R-97) the turbine operates with its maximum sound power level $L_{WA} = 105.5\text{dB}$. The data provide an indication of the variation in sound output with wind speed over the range 4 to 12ms^{-1} as detailed in Table 6.3. In order to take account of any measurement uncertainty and thus present the worst case, the values have been increased by the 0.7dB uncertainty quoted in the test report referred to above from which the one-third octave spectra was taken.

Table 6.3 Repower MM82 Sound Power Levels

	Wind Speed at 10m Height (V_{10}) ms^{-1}							
	3	4	5	6	7	8	9	10
Data as provided by Repower	89.2	93.2	99.6	101.7	102.6	103.8	104.8	105.5
Data used for modelling ^a	89.9	93.9	100.3	102.4	103.3	104.5	105.5	106.2

^aSound power levels increased by 0.7dB to account for measurement uncertainty

6.6.12 The sound emitted by wind turbines consists of a number of different frequencies, some of which are more dominant than others. These frequencies are grouped together into what are known as octave bands or spectra. Within each spectrum the highest frequency is twice the lowest frequency and the octave bands are defined by the centre frequency. The addition of these spectra will give an overall sound power level for the turbine. The amount of absorption over a given distance depends on the frequency of the noise - high frequencies are absorbed more readily than low frequencies.

6.6.13 Third-octave spectra data for the Repower MM82 turbine are detailed in Table 6.4. These were determined in a wind speed of $V_{10} = 8\text{ms}^{-1}$. The spectrum is scaled to the appropriate total sound power level detailed in Table 6.3 by the modelling software.

Table 6.4 One-Third Octave Band Spectra of Repower MM82

Centre Frequency (Hz)	LWA (dB)	Centre Frequency (Hz)	LWA (dB)	Centre Frequency (Hz)	LWA (dB)
50	77.5	315	95.3	2,000	89.4
63	81.7	400	95.2	2,500	87.2
80	85.8	500	93.4	3,150	84.2
100	89.4	630	92.4	4,000	81.9
125	92.3	800	91.6	5,000	77.2
160	93.8	1,000	90.8	6,300	73.0
200	95.9	1,250	90.5	8,000	66.1
250	95.8	1,600	91.0	10,000	59.4

6.6.14 Noise levels have been predicted for the two closest residential properties to the wind farm, as shown on Figure 6.1. The predicted noise levels also include a contribution from the Royd Moor and Hazlehead turbines.

6.6.15 Table 6.5 and Table 6.6 present the following information for each integer wind speed for both properties for daytime and night-time respectively:

- values of the background noise curve, measured as described in Section 6.3;
- the noise limits derived from the background noise curve, in accordance with ETSU-R-97;
- the predicted turbine noise levels, based on the above data and including the contribution of the Royd Moor and Hazlehead turbines; and
- the margin by which the turbine noise meets the noise limit.

6.6.16 Figure 6.3 and Figure 6.4 present this information graphically. It should be noted that the predicted turbine noise is equal for both day and night-time; the assessment is presented separately to take account of the different noise limits which are applicable.

Table 6.5 Noise Assessment Results - Daytime

Wind Speed V_{10} (ms^{-1})	3	4	5	6	7	8	9	10
New Maythorn								
Background noise curve	32.6	34.3	36.1	37.8	39.5	41.2	43.0	44.7
ETSU-R-97 derived noise limit	37.6	39.3	41.1	42.8	44.5	46.2	48.0	49.7
Predicted turbine noise*	26.7	31.5	37.7	39.7	40.5	41.6	42.6	43.2
Margin under noise limit [†]	-11.0	-7.9	-3.4	-3.1	-4.0	-4.6	-5.4	-6.5
Spicer House								
Background noise curve	30.5	32.1	33.8	35.5	37.1	38.8	40.5	42.1
ETSU-R-97 derived noise limit	35.5	37.1	38.8	40.5	42.1	43.8	45.5	47.1
Predicted turbine noise*	25.2	29.4	37.7	39.1	39.8	40.7	41.5	42.1
Margin under noise limit [†]	-10.3	-7.7	-1.1	-1.4	-2.3	-3.1	-3.9	-5.0

Noise levels are dB $L_{A90,10\text{min}}$

*Includes contribution from Hazlehead and Royd Moor turbines

[†]Negative values indicate the predicted turbine noise lies under noise limit

Table 6.6 Noise Assessment Results - Night-time

Wind Speed V_{10} (ms^{-1})	3	4	5	6	7	8	9	10
New Maythorn								
Background noise curve	29.5	31.4	33.3	35.2	37.1	39.0	40.8	42.7

Wind Speed V_{10} (ms^{-1})	3	4	5	6	7	8	9	10
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.0	45.8	47.7
Predicted turbine noise*	26.7	31.5	37.7	39.7	40.5	41.6	42.6	43.2

Table 6.7 (continued) Noise Assessment Results - Night-time

Wind Speed V_{10} (ms^{-1})	3	4	5	6	7	8	9	10
Margin under noise limit ^a	-16.3	-11.5	-5.3	-3.3	-2.5	-2.3	-3.3	-4.5
Spicer House								
Background noise curve	27.5	29.3	31.1	32.9	34.6	36.4	38.2	40.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.2	45.0
Predicted turbine noise ^a	25.2	29.4	37.7	39.1	39.8	40.7	41.5	42.1
Margin under noise limit ^a	-17.8	-13.6	-5.3	-3.9	-3.2	-2.3	-1.7	-2.9

Noise levels are dB $L_{A90, 10\text{min}}$ ^aIncludes contribution from Hazlehead and Royd Moor turbines^aNegative values indicate the predicted turbine noise lies under noise limit

6.6.17 It can be seen from Table 6.5 and Table 6.6 that the worst-case noise levels predicted are over 1dB below the ETSU-R-97 derived noise limits at Spicer House and over 2dB below at New Maythorn.

Other Operational Noise Issues

Tonality

- 6.6.18 The manufacturer's noise reports also provide information on the tonal noise characteristics of the Repower MM82 wind turbine. A number of tones were identified during the measurements, the audibility of which were assessed as in excess of -13dB. Thus, the turbine would incur no tonal penalty under ETSU-R-97.
- 6.6.19 The manufacturer of the turbine eventually installed at the site would be required to demonstrate that the turbine noise contains no tonal components which would require a penalty when assessed in accordance with ETSU-R-97 or, where tonal components warrant a penalty, the noise limits specified herein are met taking into account any penalty appropriate.

Wind Shear

- 6.6.20 The emission levels detailed above are referenced to a wind speed at a height of 10m. In consideration of the fact that the wind speed at hub height will be greater than that experienced at 10m above ground level the standard practice for measuring the noise emitted by a wind turbine (BS EN 61400-11:2003) includes a procedure for determining wind speed at 10m height from the measured level at hub height, based upon accepted wind shear profiles for particular ground conditions.
- 6.6.21 Meteorological conditions can lead to a change in the stability of the atmosphere and associated wind shear profile; hence the wind speed at hub height may differ from that encountered under test conditions for the same wind speed at 10m above ground level. This may result in higher or lower noise emissions from the turbine. However, recent data presented by Botha demonstrates that the extent to which the stability of the atmosphere can change is influenced by the topography of the site.

Where the surrounding terrain is complex in nature, as at the Blackstone Edge Wind Farm site, the potential changes will be much less significant than for a site in a flat area. Consequently, for this site it is not considered necessary to make adjustments to the noise emissions quoted above to reflect the potential phenomenon of enhanced wind shear.

Infrasound and Low Frequency Noise

- 6.6.22 Information published by the British Wind Energy Association presents a review of a number of sources of information on low frequency noise. Based upon these sources, it is concluded that levels lie below the threshold of perception even for those who are particularly sensitive to such noise, even on the actual windfarm site itself.
- 6.6.23 More recently, the Department of Trade and Industry commissioned report The Measurement of Low Frequency Noise at Three UK Wind Farms presents the results of a number of measurements taken at sites throughout the UK. The study concluded that modern wind turbines are not sources of infrasound at levels which could be injurious to health of a windfarm neighbour. Furthermore, the report goes on to describe how some low frequency noise measurements inside properties near to a windfarm were above the threshold of audibility. However, at all of the measurement sites low frequency noise associated with traffic movement along local roads was greater than that associated with the windfarm.
- 6.6.24 In the discussion of noise within the technical annex on wind energy, the Companion Guide to PPS22 goes on to state in paragraph 45:
- "There is no evidence that ground transmitted low frequency noise from wind turbines is at a sufficient level to be harmful to human health."*

Aerodynamic Modulation

- 6.6.25 The noise limits derived following the procedure recommended by ETSU-R-97 take into account the phenomenon of aerodynamic modulation (occasionally termed amplitude modulation or blade swish) to a certain extent and thus afford receptors some protection. However, the Department of Trade and Industry study into low frequency noise referred to above also investigated the phenomenon of aerodynamic modulation.
- 6.6.26 It was found that internal noise levels associated with aerodynamic modulation were above the threshold of audibility at some properties. While measurements indicated these were not high enough to awake occupiers of a room, they could result in difficulties returning to sleep once awoken.
- 6.6.27 Following publication of the report, the Department of Trade and Industry published a guidance note to advise planning authorities on the issue. It states that concerns apparently relating to the phenomenon have been expressed at 5 out of 126 windfarms throughout the UK. It is categorically stated that ETSU-R-97 should continue to be used for the assessment of noise from windfarms.
- 6.6.28 Given that little is known about the causes or locations where the phenomenon occurs, that there is currently no method of dealing with the issue, and that it only

occurs at a small number of UK sites, it is not considered necessary to further consider the issue for Blackstone Edge Wind Farm.

6.7 Summary of Significance Evaluation

6.7.1 Table 6.7 summarises the evaluation of effects.

Construction and Decommissioning Noise

6.7.2 As outlined in Section 6.4, construction noise is not anticipated to exceed the AL72 criteria of 70dB(A) at the nearest receptors to the site, given the high separation distance and compact nature of the site working areas, including access tracks. It is accepted that the works may be audible at the nearest receptors, and that limited potential for occasionally significant noise effects may occur when work is closest to the receptors, though such effects will be short-lived and transient in nature. It is assumed that decommissioning noise will be less than, or as a worst-case comparable with construction noise. Consequently, noise from the construction and decommissioning of the scheme is assessed as not significant.

Traffic Noise

6.7.3 For the road network assessed in Chapter 10, Traffic and Transport, the greatest increase in traffic will occur during the three days when concrete deliveries are taking place. This will result in a change in traffic noise levels of over 3dB on Royd Lane, which is considered a significant impact. However, this is only the case for Royd Lane; the wider road network is afforded a level of not significant. Furthermore, this will only occur for three days during the construction programme, the maximum credible impact for the remainder of the programme is not significant for all road sections.

Operational Noise

6.7.4 The assessment has derived noise limits for the windfarm using the methodology specified in ETSU-R-97 The Assessment and Rating of Noise from Wind Farms. These limits are repeated in Table 6.6, together with the predicted noise levels from the operation of the windfarm at the two properties assessed. The margin by which the predicted turbine noise lies within the limit are also specified. It can be seen that the predicted windfarm noise levels lie in excess of 1dB below the limits (as indicated by negative values in the table).

6.7.5 Figure 6.3 and Figure 6.4 demonstrate this point graphically. Consequently, taking into account these facts and the other issues discussed in Section 6.4, including low frequency noise, wind shear, tonality and aerodynamic modulation, it is concluded that the windfarm will have no significant effects in relation to operational noise.

Table 6.8 Summary of Effects and Evaluation of Significance

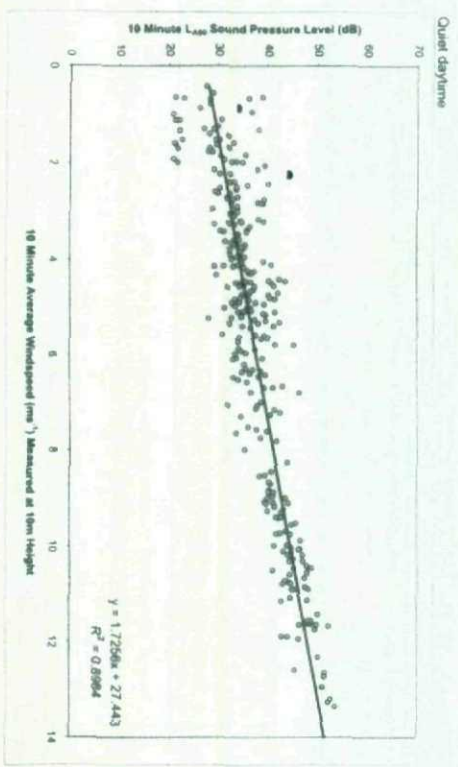
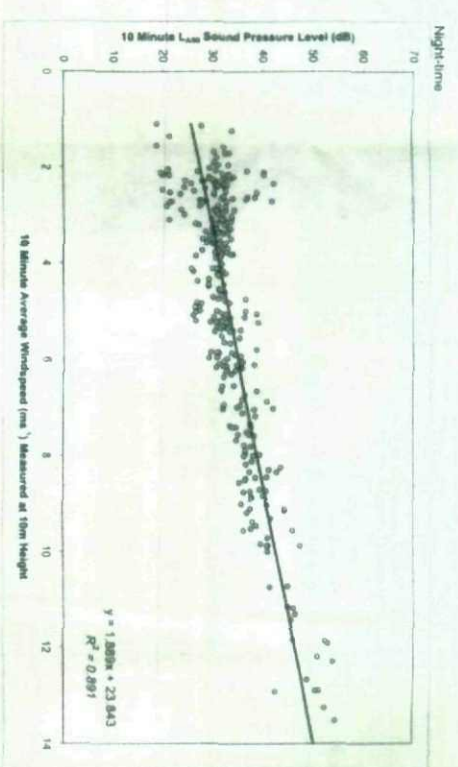
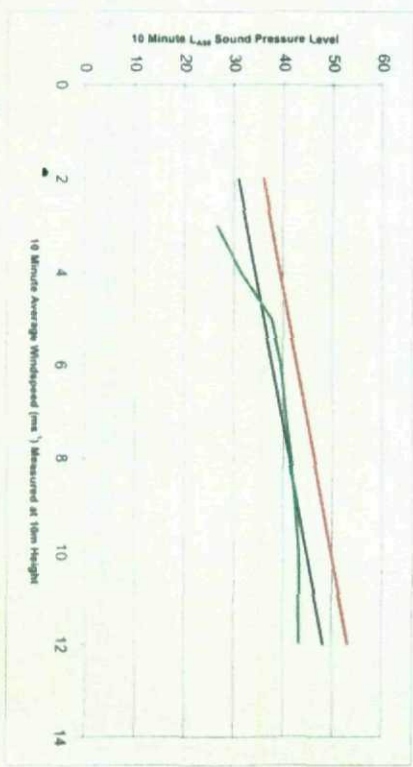
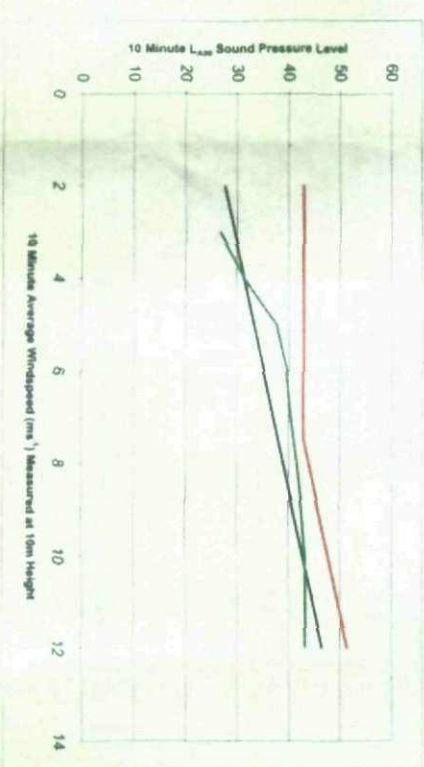
Receptor and summary of predicted effects	Type of effect ¹	Significance ²
Construction/decommissioning noise on residential receptors	-ve	NS
Traffic noise on residential receptors for three days of concrete delivery	-ve	S
Operational noise on residential receptors	-ve	NS
Key/footnotes:		
1. Type of effect	-ve = negative + ve = positive N = Neutral ? = unknown	2. S Significant or NS Not-significant

6.8 References

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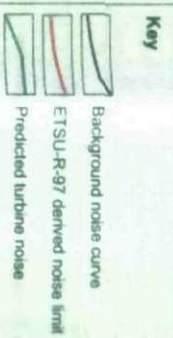
- Key**
- Background noise curve
 - ETSU R 97 derived noise limit
 - Predicted turbine noise



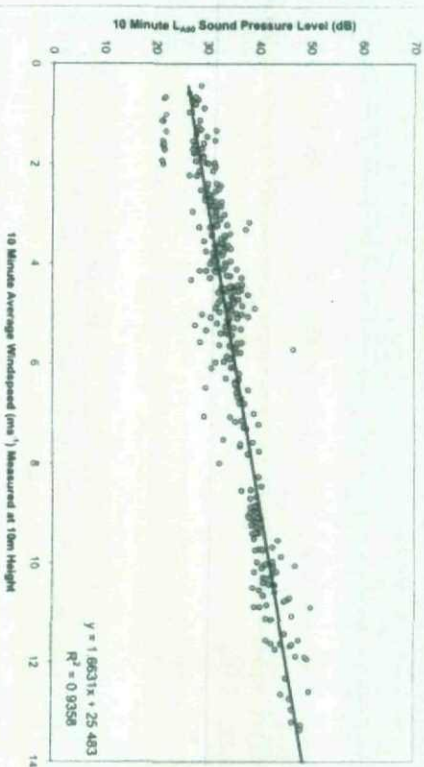
Blackstone Edge Wind Farm
Environmental Statement

Figure 6.3
Noise Assessment -
New Maythorn Farm

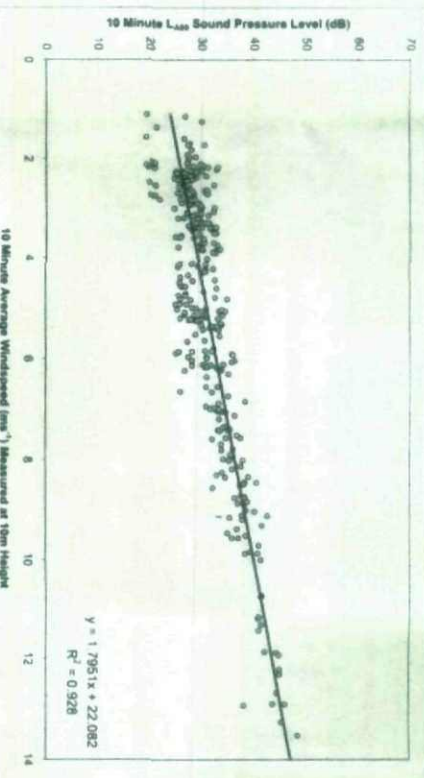
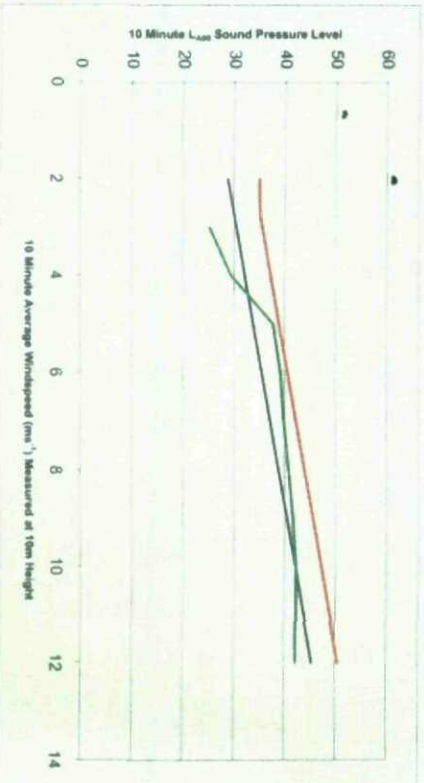
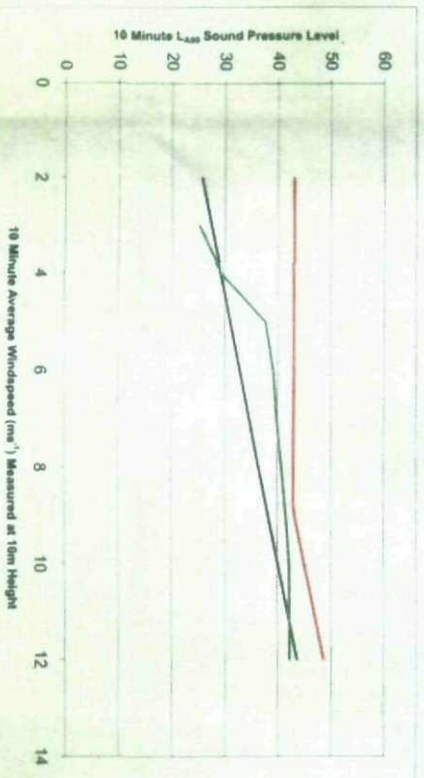
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Quiet Daytime



Night time



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Blackstone Edge Wind Farm
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Figure 6.4
Noise Assessment - Spicer House

January 2008
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