Batsworthy Cross Wind Farm
Operational Noise Compliance Testing
Method Statement
V5.0 - 05/12/2014

1. Intent

The intent of this document is to define a Method Statement for the Operational Noise Compliance Testing at three receptor locations (the Properties). The results of this Compliance Testing shall be used to verify the noise immissions of the Batsworthy Cross Wind Farm, hereafter referred to as the 'Wind Farm', against the noise limits contained in condition 35 attached to the planning consent for the development, as required by condition 37 of this consent. The conditioned noise limits relate to the level of noise at due to the operation of the Wind Farm only and exclude any contribution from background noise. The intent of the proposed method is therefore to establish, as far as is practicable and necessary, the noise immission levels at the Properties due to the operation of the Wind Farm only. This protocol is intended to apply between the Wind Farm operator (and its appointed consultant) and North Devon Council, hereafter referred to as 'the Parties'.

2. Outline Methodology

To determine the noise immission levels at the Properties resulting from the Wind Farm alone, the following steps are necessary:

- measure the 'ambient noise' level at the Properties over a long enough period to experience conditions which are typical for the site (note that in the present context the 'ambient noise' level is defined as the L_{A90} noise level due to the combined effect of the background noise and the Wind Farm operational noise);
- using wind speed data from an on-site meteorological mast, determine the average ambient noise trend as a function of wind speed at 10m height;
- if the resultant average ambient noise curve exceeds the conditioned noise limits at any of the Properties then, where necessary, subtract the average L_{A90} background noise trend from the average L_{A90} ambient noise trend (as a function of wind speed) to determine the Wind Farm average noise immission trend line;
- compare the noise immission levels calculated from the Wind Farm average noise immission trend line against the conditioned noise limits.

The precise measures necessary to achieve these steps are detailed below.

3. Measurement Procedure

3.1 Acoustic Consultant

The Wind Farm Operator shall appoint an independent acoustic consultant from a list of potential Consultants agreed with North Devon Council. This list shall be as set out in the Appendix to this document, unless names are added or removed (at any time from prior to appointment of the Consultant): either by North Devon Council or by the Operator with the written agreement of both parties.

The appointed Consultant will undertake the measurements in accordance with the present protocol. The Consultant shall use all reasonable endeavours to complete the required assessment within 6 months of the first export date of the Wind Farm, and to provide a written

report setting out the results of this assessment within 28 days of completing the measurements, unless an extension is agreed between the Parties.

3.2 Measurement locations

A schedule of three dwellings neighbouring the Wind Farm (the Properties), at which measurements are to be undertaken for Operational Noise Compliance Testing, shall be agreed between the Parties. The aim of this selection is to identify three properties in relative proximity to the Wind Farm with a representative geographical coverage.

For each property, a specific day-time and night-time noise limit shall be selected from Tables 1 and 2 attached to condition 35 of the consent for the Wind Farm. This selection shall have regard to the coordinates of Table 3 attached to condition 35, the proximity and similarity of the Property to those listed in the Tables. The resulting noise limits shall be agreed between the Parties as representative of each of the Properties. If access to any of the initially selected Properties cannot be secured in practice, an alternative property will be sought and agreed between the Parties (as per Noise Guidance Note 1b).

3.3 Acoustic Measurements

Ambient noise, as defined above to comprise the cumulative sum of the Wind Farm noise and background noise and measured using the L_{A90} noise descriptor, shall be measured at each of the Properties. Data shall be collected over continuous 10-minute intervals using the same, or similar approved, equipment as used for the original background noise survey.

This equipment shall comply with the requirements of Noise Guidance Note 1, including the windshield system which shall be approved between the Parties prior to the start of the measurements. At all three locations, the recording equipment shall have the capability of recording audio samples, of a duration of no less than 2 minutes every 10 minutes for the period of the measurements. The audio should be recorded at sufficient resolution to allow the ETSU-R-97 tonal analysis to be undertaken, and using instrumentation which accords with the guidance of Supplementary Guidance Note 5 (SGN5) (Post Completion Measurements) of the IOA Good Practice Guide.

Data shall be collected over the general range of wind speeds over which the turbines operate and as a minimum over a wind speed range of not less than 4 m/s to 8 m/s, as determined at 10 m height on the Wind Farm site in accordance with Section 3.4 of this Method Statement. The collected data extent must be such that at least 25 valid data points[1] are obtained over the range of 4 to 8 m/s and under the subset of analysis conditions defined in Section 3.5. Indicatively, this may require of at least 28 days of measurement. For Properties situated upwind of the wind farm under the prevailing wind direction, downwind conditions as defined in Section 3.5 below may not occur often: the above data requirements may then be relaxed but the adequacy of the measurement extent shall be agreed between the Parties prior to completion of the survey.

The location of the measurement microphone shall, as far as is reasonably practicable, be in 'free-field' conditions relevant to each of the Properties, in accordance with the requirements of Noise Guidance Note 1. It should be:

- within the immediate amenity area around the dwelling if possible: taken to be at least 3.5 m away from the dwelling but preferably 10 m to 35 m away if possible;
- or, where relevant, close to the position used for the original background noise measurements, provided this location is agreed between all parties as being relevant to the present assessment.

[1] With at least 5 valid data points in each wind speed "bin", i.e. a 1 m/s wide interval centred around each integer wind speed.

3.4 Non-acoustic Measurements

Wind speed shall be measured at the Wind Farm site at a height of 10 metres above ground level. Ten metre height wind speeds will either be measured with an on-site permanent meteorological mast or with a temporary mast installed within the site itself for the period of the measurements, as agreed between the Parties. The location of the mast shall accord with the guidance set out in SGN5 of the IOA GPG. Full details of the measurements of wind speeds will be reported. Average wind speeds shall be logged for the same time-synchronised ten-minute intervals noted above.

A rain monitoring device shall be installed on the Wind Farm site to indicate when rainfall occurred. Rainfall indication shall be logged for the same time-synchronised ten-minute intervals noted above.

3.5 Data Pre-Processing

Due to the requirement to minimise the effects of background noise, which is generally higher during the daytime than the night-time periods, all data shall be filtered such that only that collected during the periods 23:00 to 04:00 local time shall be incorporated in any subsequent analysis, unless it is agreed by the Parties that the L_{A90} data measured outside these night-time periods is sufficiently unaffected by sources of extraneous background noise that it may still be used in the analysis.

Data affected by rainfall (as indicated by the rain gauge data), or other extraneous sources of noise, e.g. central heating boiler flues, agricultural equipment, traffic, airplanes, high levels of bird song associated with the 'dawn chorus', etc, shall be removed prior to analysis. For each of the Properties, the data shall also be filtered to only retain periods in which the measurement location is downwind of the Wind Farm. Unless otherwise agreed between the Parties, this can be defined for each Property as conditions in which the angle between the wind direction and the direct line from any wind turbine to the measurement location considered is no greater than ±45 degrees.

All periods in which turbines are either not operating at all or not functioning correctly shall be excluded from the ambient noise analysis. Data that has been collected at the extreme ends of the wind speed range, i.e., outside the range of wind speed relevant for the normal operation of the Wind Farm, shall be excluded from this analysis.

4. Data Analysis

The measured ambient noise data at each of the Properties, filtered in accordance with Section 3.5, shall be plotted against the corresponding 10 m height wind speed data, in accordance with Noise Guidance Note 2. A best fit regression analysis (of no more than fourth order) shall then be performed on the data. The resulting best fit regression curve is defined as the 'average ambient noise trend'. Where the data are clearly not well described by a best fit regression curve according to the Consultant, a binned analysis assuming 1 m/s wide bins centred on integer wind speeds should be performed instead: the value used is then the average of the valid filtered data in each wind speed bin.

At one location selected in agreement with the Council, the Consultant will analyse the tonal content of sample audio recordings according to ETSU-R-97. The sample periods will be chosen to provide representative results for the tonal immissions over the range of wind conditions identified above for filtering of data, where this is possible. This analysis will not be applied to every period for which data has been acquired but a selected sub-set which are considered to provide representative indication of whether there are tonal components within the noise emitted sufficient to incur any tonal penalties when analysed according to the method given in Noise Guidance Note 3. If audible tones sufficient to incur penalties and attributable to the wind farm are detected, the analysis shall be extended to the remaining two measurement locations.

5. Compliance Assessment

5.1 Stage 1

The 'average ambient noise trend' shall be used to determine the average ambient noise level at the assessed wind speed or speeds. Tonal analysis shall be performed in accordance with Noise Guidance Note 3 on a sub-sample of those periods included within the filtered data-set to determine whether any tonal penalties[2] might apply at each assessed wind speed. If audio recordings were not made at a property, the tonal penalties applied shall be those determined from the analysis at the location at which audio recordings were made.

The average ambient noise level determined at the assessed wind speed(s), with the addition of any tonal penalties, shall be compared with the conditioned noise limits which relate to the day-time and night-time periods. Compliance with the Wind Farm's noise condition at any of the Properties shall have been successfully demonstrated if the average ambient noise level including any penalty does not exceed the relevant noise limits for the at the assessed wind speed(s).

5.2 Stage 2

Where it is not possible to demonstrate Stage 1 compliance, the ambient noise levels determined in Section 5.1 shall be corrected for the influence of residual noise sources (i.e. those sources of noise not associated with the operation of the Wind Farm) by logarithmically removing the measured average L_{A90} background noise level from the measured 'average ambient noise trend' at the assessed wind speed.

The correction for the influence of background noise should be made using the method of Noise Guidance Note 4. The background noise levels used for this correction will be those derived using a series of 'On/Off' operation of the wind farm. The proposed methodology for 'On/Off' noise measurements will be achieved by obtaining the measurements of ambient noise and background noise with the Wind Farm alternately switched 'On' and 'Off' at specific hourly intervals during night-time hours.

These measurements should seek to establish background noise levels in the wind conditions of wind speeds and wind directions defined above in Section 3.3, or at least in the subset of conditions for which compliance could not be demonstrated in Stage 1. In order to minimise disruption and downtime, the background noise levels need not be acquired in specific wind directions, subject to agreement with the Council that this does not represent a significant consideration at the Property with reference to good practice guidance on the subject. In any case, no less than 5 valid data points shall be acquired in each 1 m/s wide bin. The variation of background with wind speed shall be characterised using regression or binned analysis in the manner described in Section 4 above.

The resulting background noise levels are used to correct the ambient noise trend by subtracting the effect of the residual background noise to leave the Wind Farm noise level at the assessed wind speed(s). The correction for the influence of background noise should be made in accordance with Noise Guidance Note 4. If at the assessed wind speed(s) the average ambient noise immission level measured at the any of the Properties with the Wind Farm operating is lower than the average background noise level at the same wind speed, as derived from the "off" measurements, the Wind Farm average noise immission level shall be taken as the measured ambient noise level with no correction being made for the measured background noise.

[2] A tonal penalty is a value in decibels which is determined for each wind speed and added to measured wind farm noise levels at that wind speed so that the resulting wind farm noise levels are higher in noise level or 'rated' for the presence of tones when comparing the results with the consent noise limits.

The average background corrected ambient noise level determined at the assessed wind speed(s) shall be compared with the relevant agreed noise limits which relate to the day-time and night-time periods with the addition of any tonal penalties. Compliance with the Wind Farm's relevant noise condition shall have been successfully demonstrated if the average background corrected ambient noise level including any penalty does not exceed the relevant noise limits at the assessed wind speed(s).

Appendix – list of approved consultants

- **Hayes McKenzie Partnership Ltd**: Unit 3, Oakridge Office Park, Whaddon, Salisbury, Wiltshire SP5 3HT, Phone +44 01722 710 091. salisbury@hayesmckenzie.co.uk
- **Hoare Lea Acoustics:** 140 Aztec West Business Park, Almondsbury, Bristol, BS32 4TX, Tel: + 44 (0) 1454 201 020. acoustics@hoarelea.com
- **Ion Acoustics**: The Wool Hall, 12 St Thomas Street, Bristol, BS1 6JJ. Tel: 0117 910 5200. mail@ionacoustics.co.uk
- **Parsons Brinckerhoff**: Queen Victoria House, Redland Hill, Bristol, BS6 6US, 0117 933 9300. Perkins, Richard: PerkinsR@pbworld.com
- **Sgurr Energy**: SgurrEnergy Ltd, 225 Bath Street, Glasgow, G2 4GZ, +44 (0)141 227 1700. http://www.sgurrenergy.com/
- **Spectrum Acoustics**: Spectrum Acoustic Consultants, 27-29 High Street, Biggleswade, Bedfordshire, SG18 0JE. +44 (0)1767 318871. http://www.spectrumacoustic.com/
- **TNEI**: TNEI Services Ltd, Floor B, Milburn House, Dean Street, Newcastle upon Tyne, NE1 1LE, Tel: 0191 211 1400. info@tnei.co.uk
- **Arcus Consultancy Services Ltd,** 7th Floor, 145 St Vincent St, Glasgow, G2 5JF, 0141 847 0340, acoustics@arcusconsulting.co.uk