Fullabrook Wind Farm

Noise Compliance Assessment 2015

Review of Report HM:2948_ R1_ EXT4

December 2015

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For: North Devon Council
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Devon
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1 Introduction

1.1 Complaints about noise were received from residents in the vicinity of the Fullabrook Wind Farm after the wind farm became operational in 2011. Specific noise limits (not to be exceeded at residential properties) were imposed on the development by way of planning conditions. These conditions also required the operator to carry out noise measurements, following the commissioning of the wind farm, to demonstrate that the prescribed noise limits were complied with when all wind turbines were operating. The operator is also required to carry out noise compliance measurements in the event of reasonable complaints about noise.

1.2 It was clear at the design stage (and accepted by the Inspector at the planning appeal in 2006) that to comply with the noise limits some of the Vestas V90 3.0 MW wind turbines would have to be operated in special 'reduced-noise' modes, or shut down completely, in some wind conditions. At the time of the planning appeal the strategy for operating each of the 22 turbines, to comply with the noise limits, was not defined. Therefore during construction ESBI commissioned the Hayes Mackenzie Partnership (HMP) to carry out predictions to enable the operator, in conjunction with the turbine manufacturer, to develop an operating scheme intended to ensure that the wind farm noise levels would comply with the noise limits. HMP were subsequently commissioned by ESBI to carry out the required a programme of noise compliance testing at representative dwellings around the wind farm after it became operational.

1.3 I was instructed by North Devon Council to work with officers of the Council's Environmental Health and Housing Services Department to monitor the noise compliance measurements and the data analysis procedures, and to liaise with HMP/ESBI as necessary, to ensure as far as possible that the noise compliance assessment was carried out in an objective and robust manner.

1.4 During the first six months of 2012, HMP carried out noise monitoring at locations close to 12 representative properties. The measurement locations and procedures were agreed with the Council. The results were submitted to the Council in Report HM: 2467/R2 dated 28 September 2012. I reviewed this report and submitted my own report to the Council in October 2012 (Reference 1). My main conclusions were as follows:

- The 2012 measurements showed that the measured broadband noise levels (L_{A90}) from the wind farm exceeded the noise limits in Condition 20, in some wind speeds and directions, at four locations - Burland Farm, Metcombe, Patsford and Northleigh.
- Noise levels (L_{A90}) at Beara, Halsinger, Fullabrook and Binalong appeared to comply with the noise limits but by small margins.
- Noise levels (L_{A90}) at Crackaway, Greenhill, Pippacott and Luscott appeared to be significantly lower than the noise limits.
- However, audio recordings (initially made at 4 locations only) showed the presence of audible tonal noise (i.e. noise containing single–frequency components, distinguishable as a whine, hum or drone) at some wind speeds. Tonal noise is recognised as being more likely to attract attention and cause annoyance than broadband noise with no distinctive 'character'. Depending on the audibility of the tones (as determined according to a standard calculation procedure) these would incur a 'penalty' of up to 5dB. The noise limits apply to the noise **rating** level – the measured noise level plus any tonal penalty. At that time the values to be assigned to tonal penalties, if any, could not be reliably determined because audio data not available for all survey locations, but it was clear that the addition of tonal noise penalties was likely to mean that the wind farm noise rating levels were actually exceeding the noise limits at most if not all of the measurement locations. (It is relatively unusual for modern wind turbines to generate significant tonal noise, and this characteristic of the Vestas V90 3.0 MW turbine was not anticipated in HMP's initial mitigation strategy).

1.5 At that stage, ESBI committed to the following actions:

i. In conjunction with HMP and Vestas, the turbine supplier, they would implement a mitigation strategy to reduce broadband noise (excluding tonal penalties) to levels complying with the noise limits. The mitigation strategy would involve operating turbines in different 'noise modes' in some wind speeds and directions.

ii. Further noise monitoring would then be carried out to demonstrate the effects of the mitigation. The scope of this further monitoring would be discussed and agreed between ESBI/HMP and the Council and these measurements carried out as soon as practicable.

iii. Investigations by Vestas into the tonal noise 'issue' had already started and would continue. It was anticipated that some remedial work to the turbines would be required.

2 Further Actions and Noise Surveys 2013-2014

2.1 Investigations by Vestas into the tonal noise issues continued into 2013. As a result, modifications were made to the generators in all wind turbines. These were intended to reduce the level of a low-frequency (99 Hz) tonal component observed at the sites where audio recordings had been made. The noise mitigation strategy recommended by HMP in the September 2012 Report was implemented.

2.2 Further noise surveys were then carried out by HMP made at 8 locations: Burland Farm, Binalong, Crackaway, Halsinger, Beara, Patsford, Metcombe and Northleigh commencing in August 2013. These locations were agreed to be representative of properties that would be exposed to the highest levels of wind farm noise: there was reasonable certainty that if the noise limits were complied with at these locations then this would also be the case at all other properties in the vicinity of the wind farm

2.3 Audio recordings were made at all 8 locations for the purpose of assessing tonal noise and calculating the appropriate tonal 'penalties' where appropriate. The protocol for determining the broadband noise levels and tonal penalties was agreed with HMP.

2.4 It was initially anticipated that the surveys could be completed by November 2013, although it was recognised that the timescale was weather-dependent. At any location, wind farm noise levels depend on wind speed (because the noise emission from a wind turbine depends on the wind speed) and wind direction (broadband noise levels, although not necessarily tone levels, being at a maximum in the 'downwind' direction). Measurements made during rainfall are discarded. It was therefore agreed that the monitoring would be continued until sufficient valid data had been obtained to enable robust determinations of noise levels to be made. In the event, this position was not reached at all survey locations until July 2014.

2.5 During the further noise surveys and the subsequent analysis I was kept informed by HMP of progress. Decisions to terminate the surveys (dependent on the adequacy of the collected data) were made in conjunction with me and the Council.

2.6 HMP then analysed the data in accordance with the agreed procedures. The results were published in HMP Report 2761_R1 dated September 2014, which was updated by a second report 2761_R2 dated December 2014. I reviewed these reports and submitted my comments in two reports to the Council (References 2 and 3). I found the HMP reports to be competent and I did not disagree with the main conclusions, which were as follows

- Generally, measured noise levels had been reduced, compared with the 2012 measurements. However, the noise rating levels (i.e. the measured noise levels plus tonal penalties) exceeded the limits at 7 of the 8 survey locations in some wind directions and some wind speeds.
- Further noise-reduction measures were required to achieve compliance with the noise limits. HMP proposed a further mitigation strategy, which defined the operating modes of each turbine for different combinations of wind speed and direction. The strategy called for some turbines to be shut down completely in some conditions.
- Further surveys would be carried out to demonstrate the effects of this further mitigation.

3 Noise Compliance Surveys 2015

3.1 Further noise surveys have been carried out by HMP in 2015. The results are set out in HMP Report 2498_R_EXT4 dated 30 October 2015. This is the Report that is subject to review here.

3.2 The surveys were carried out at seven locations: Burland Farm, Binalong, Halsinger, Beara, Patsford, Metcombe and Northleigh. These were the same locations as those selected for the 2013-14 surveys, except that the measurements at Crackaway were not repeated since it was agreed that the 2013-14 measurements adequately demonstrated compliance with noise limits in that area, and since the further mitigation would reduce noise levels at all locations it was not necessary to include this site. The

same approach had been applied to the other locations monitored in 2012 but not included in the 2013-2014 surveys.

3.2 The surveys were carried out between March and July 2015. I witnessed the initial installation of the equipment at each site and agreed that the noise levels at the measurement position would be representative of noise levels in the vicinity of the adjacent dwelling or dwellings.

3.3 The procedure for measuring wind farm noise levels and analysing the data is generally prescribed in the document ETSU-R-97 (Reference 4 - referred to in the planning conditions). Some aspects of the application of ETSU-R-97, including procedures for compliance testing, are clarified in the Institute of Acoustics Good Practice Guide (the 'IOA GPG' - Reference 5). In my view the procedures followed by HMP are in accordance with ETSU-R-97 and the guidance in the GPG. The equipment used was fit-for-purpose and operated correctly. At the request of the Council I carried out a short series of independent 'check' measurements during July 2015, with measurement systems set up alongside the HMP equipment. During some of these measurements I was accompanied by Mr A Cole of North Devon Council. These measurements yielded results that were identical with the HMP measurements, within accepted measurement tolerances. The results of these 'check' measurements are set out in my report to the Council (Reference 6).

3.4 The results of the 2015 surveys, and the conclusions drawn from them, are presented in the HMP Report identified in 3.1 above. The overall conclusion of the report (**6.4**) is that:

"The results indicate with a high degree of certainty that the wind farm is compliant with its noise limits at all of the measurement locations".

I have critically reviewed the October 2015 HMP report: my observations and comments are set out in Section 4 below.

4 Review of the October 2015 HMP Report

4.1 The HMP report necessarily presents a large amount of data. The following guide to the report layout might be helpful to the reader: Where I refer to paragraphs, figures, tables or pages in the HMP report these appear in **bold** text.

- **Section 1** summarises the background history (essentially as described in my Sections 1 and 2 above)
- **Section 2** explains the noise limits applied in the planning conditions. The protocol for carrying out surveys to determine whether the noise limits are complied with, as required under Condition 21, as previously agreed with the Council, is attached to the report as **Appendix A**.
- **Section 3** gives details of the monitoring procedures: information on the noise measurement equipment, the procedures for monitoring rainfall, wind speed and wind direction, the method of measuring background noise levels (with turbines shut down) and of recording data for the assessment of tonal noise.
- **Section 4** explains how the data is analysed to determine values for wind turbine noise levels at any given wind speed at each of the monitoring locations.
- **Appendices B and C** present data on background noise levels and the calculation of tonal penalties. The measured noise levels, with corrections for background noise and the addition of tonal penalties (the noise rating levels are then compared with the noise limits to assess compliance. These comparisons are shown on the Figures and in the Tables in **Appendix D**. The results of the assessments are summarised in **Appendix E**.

4.2 Overall, I am satisfied that the measurements were carried out in accordance with current best practice and can be taken to be robust, and that the data has been properly analysed. However, there are some 'data gaps' and HMP have necessarily relied to some extent on calculation, judgments and deductions in cases where it was difficult to accurately quantify the noise emissions from the wind farm on the basis of the measured data only.

4.3 In particular, as noted in **paragraph 6.2**, the assessment results based on the measurements appear to indicate that at some locations, and for some wind directions, the noise limits are exceeded. The HMP report sets out to explain that these apparent exceedances are the result of noise from other sources, or are artefacts of the analysis procedure. Since the validity of these explanations is fundamental to HMP's overall

conclusion – that the wind farm is compliant with the noise limits – I have given this aspect of the report close scrutiny.

4.4 The presentation and interpretation of the noise assessment graphs in **Appendix D** is the key to developing the overall conclusions, and some explanation of these may be helpful.

4.5 For each location there are 8 graphs: for example the data for Burland Farm is shown on **pages 71 – 74**. The upper graph on each page refers to the 'night' hours (2300-0700); the lower graph refers to the 'evening' hours This graph also covers all the daytime hours (0700-2300) since the daytime and evening noise limits, and the mitigation applied to the turbines, remain the same from 0700-2300. Therefore this graph could more correctly be titled 'day/evening'.

4.6 The measurements are also separated into four 90 degree wind direction 'sectors' numbered 1-4 **(Table 4)**. Noise from the wind farm, at any location, will be highest when that location is downwind of the wind farm - when there is a component of wind from the wind turbines towards that location. For example, from **Figure 1** it is seen that Burland Farm will be downwind of the greatest number of turbines when the winds are in the S-W sector (sector 3) but upwind of all turbines for winds in sector 1 (the N-E sector). The critical comparison between noise levels and noise limits is therefore the 'sector 3' case, when noise levels at Burland Farm will be highest. Some locations will be downwind of turbines for a wide range of wind directions (Beara, for example – see **Figure 1**) in which case there would be more than one 'critical' sector. The report provides data for all four sectors, for both day/evening and night, hence the 8 graphs per location. This is clearly the appropriate approach so that the assessment is made for all wind directions, including the 'worst case' (critical) direction(s).

4.7 As explained in **paragraph 3.9** the wind direction was taken from a wind vane located on a mast at a height of 33 metres: this was judged to representative of the wind direction 'seen' by the turbines. More importantly, it would also be expected to represent the wind direction in the noise propagation path between any wind turbine and a monitoring location, which is the important factor in defining the wind sector for analysis. I note from **paragraph 3.9** that in previous surveys the wind direction was measured using a wind vane at a height of 63 metres, not available in 2015. I would not expect the wind directions indicated by vanes at these two heights to differ

significantly and I see no reason to question the validity of the 33 metre direction data used in the current survey.

4.8 Each data point (the round open 'dots') on the assessment graphs represents the noise level (L_{A90} dB) measured in a single 10 minute interval, this noise level being plotted against wind speed. Although the equipment was recording continuously, only data recorded between 1800-2300 is included in the day/evening analysis, and between 2300-0400 in the night time analysis. Because the measured noise levels (when the wind farm is operating) necessarily represent the sum of wind farm noise and noise from other sources (background noise) this approach has been adopted to minimise the contribution of background noise by utilising only the data taken at times when the background levels are expected to be lowest.

4.9 The noise limit at each location (day/evening or night) is plotted on the graphs as a chain-dotted black line. The fact that some measured data points lie above this line does not necessarily mean that the noise limit is breached. The data points show considerable scatter (variations in noise level at any given wind speed): the scatter is 'averaged-out' by deriving a best-fit line through all the measured data points using a mathematical technique (regression analysis). This best-fit is shown as a thin black line (the 'derived prevailing measured levels') on each graph. This 'averaging' technique might be questioned, since it can obviously permit noise levels in individual 10-minute periods to exceed the limit, even though the 'average' level is lower than the limit. However, this procedure is standard practice, it is specified in the UK guidance (References 4 and 5) and in the Fullabrook planning conditions as the method to be used in determining compliance with noise limits. Also, the measured noise levels have to be corrected by deducting the background noise contribution and adding any tonal penalty.

4.10 The measured level is the sum of wind farm noise and background noise, whereas the noise limits apply to the wind farm noise only. The noise from other sources (the background noise level) has to be subtracted from the measured overall level. Where the background noise and wind farm noise are of similar level, this subtraction is of uncertain reliability. For these surveys, background noise levels for a range of wind speeds were obtained during period between 2200 and midnight, when turbines were shut down on a number of separate occasions. The background noise levels measured between 2200 and 2300 are taken to represent the typical background levels

during the daytime survey period (1800-2300) and levels measured between 2300-2400 taken to represent the typical levels during the night time survey periods (0000-0400). The background noise measurements are also averaged using a best-fit technique to produce the background noise curves (the thin yellow/orange curves), representing the variation in average background noise with wide speed, on the assessment charts.

4.11 Because of the limited amount of available background noise data this is not segregated into the four wind direction sectors (i.e. the background noise level at a given wind speed is taken to be the same for all wind sectors). The background noise for a given wind speed***** may at some locations depend on wind direction:: for example, where a location is in a valley the background noise level, which is usually the result of noise generated by wind in trees and vegetation, will generally be higher when the wind is in a direction along the valley, since in other directions a valley location will be more sheltered. (*It is important to note that the reference wind speed applied to all the data, and to the noise limits in the planning conditions, is the wind speed at a height of 10 metres on the wind farm site, **not** the wind speed at any of the survey locations).*

4.12 The inherent assumption that background noise levels are not dependent on wind direction could be questioned: if background noise levels at a location for the 'critical' wind sector are lower than the average (all wind directions) levels, then the corrections (deductions) made to the measured noise levels would be of greater magnitude than the 'true' corrections. The calculated rating noise levels of the wind farm would therefore be understated and this approach could lead to breaches of the noise limits not being identified. However, I have examined the data from this and previous surveys, and assessed the situation of each survey location and how background noise levels might vary (for a given on-site wind speed) with wind direction. I am satisfied that it is unlikely that any of the noise assessments were affected adversely by this simplifying assumption – it is most unlikely that it would have resulted in noise rating levels being understated to the extent that a breach of the limits would not have been detected. Therefore I believe that neglecting the effect of wind direction on background noise levels is a justifiable simplifying approach in this case.

4.13 Obtaining sufficient background noise data for all wind sectors would have required the wind turbines to be shut down for long periods (months), to cover the necessary ranges of wind directions and speeds. Such a shutdown would have effectively doubled the

durations of the surveys and therefore the time taken to reach an operating strategy that enabled the noise limits to be met, apart from representing a large cost to the operator because of the lost output. Therefore in my opinion there was no justification for extending the survey period to collect a 'full set' of background noise data.

4.14 There is one instance where it is clear that the simplifying assumption has resulted in wind farm rating noise levels being *over*-stated, such that the noise limits appear to be breached. This particular case is discussed in 4.21 below.

4.15 The final step is to adjust the derived measured levels by correcting for background noise and adding the tonal noise penalties The tonal penalties are calculated as explained briefly in **5.1 – 5.2** and shown on the figures and tables in **Appendix C**. The outcome is a curve of wind farm noise rating level (the blue dashed lines on the **Appendix D** figures). Where this curve lies below the noise limit curve at all wind speeds, for all wind direction sectors, it can be reliably concluded that the wind farm noise level complied with the noise limits during the survey period. Where the noise rating level curve lies above the noise limit curve at any wind speed, this indicates that the noise limit is breached, unless the apparent excess of noise above the limit can be reliably attributed to sources of noise other than the wind farm.

4.16 From examination of the noise assessment figures in **Appendix D**, the wind farm noise rating levels are shown to exceed the noise limits at the following locations in some wind direction sectors and for some ranges of wind speed:

Location	Wind sector	Wind speed range	Appendix D page number
Burland Farm	Sector 3	> 9 m/s (night) > 7.5 m/s (day)	73
Binalong	Sector 1	> 9 m/s (night) > 7.5 m/s (day)	75
	Sector 2	3.5 – 7.5 m/s (day)	76
Halsinger	Sector 1	> 7.5 m/s (night) 5 – 8 m/s (day)	79
Metcombe	Sector 1	> 8 m/s (night)	87
Northleigh	Sector 1	> 7.5 m/s (night) 6-8 m/s (day)	91

Patsford	Sector 1	> 8 m/s (night)	95

Apparent exceedances of noise limits – 2015 Compliance Surveys

4.17 These instances of apparent non-compliance with noise limits correspond with those identified in **paragraph 6.2** of the HMP report, except that: the HMP list does not include Metcombe/Sector1/night, Binalong /sector 1/night or Patsford/sector 1/night although these omissions (compared with the above table) are picked up in the Noise Assessment Summary in **Appendix E**.

4.18 HMP have reached the conclusion that these apparent exceedances are not the result of wind farm noise exceeding the limits, but are attributable to other causes. The justifications for reaching this conclusion, in each case, are described in **Appendix E**. It is a fundamental problem for this site (as it is for many wind farm sites) that it is difficult to reliably separate, from an overall measured noise level, the relative contributions of noise from the wind farm and background noise from other sources. At high wind speeds background noise levels around wind farm sites generally exceed wind farm noise levels: where wind farm noise is 'submerged' in background noise it is not possible to establish the level of noise from the wind farm alone on the basis of measurements. And when background noise levels and wind farm noise are of the same order of magnitude this separation exercise is of uncertain reliability. HMP have approached the apparent noise exceedances by assessing, by various methods, whether the noise exceedances can reasonably be attributable to noise from the wind farm or to background noise from other sources or some other effect inherent in the analysis.

4.19 Obviously an attempt to 'explain away' apparent breaches of the noise limits may be viewed with scepticism and I have given this aspect of the report particularly careful examination.

4.20 An illustration of the methods used to examine the apparent breaches of the noise limits can be gained by examining, as an example, the charts for Burland Farm for wind direction sector 1 (**page 73**). The upper figure (night noise) shows the rating noise level (the blue dashed line) exceeds the noise limit at wind speeds above 9 m/s. However, HMP have predicted the noise levels at Burland Farm for this condition: the predicted levels (the wide grey line) would clearly comply with the limits. The prediction

method used (ISO 9613-2) is accepted as being robust and experience suggests that the uncertainty associated with wind farm noise predictions is generally 2 dB or less. In this case it can be seen that the *predicted* noise rating are very close to the *survey* noise rating levels at wind speeds up to 7 m/s, but then diverge: above 7 m/s the predicted wind farm noise levels-off and then falls, but the rating level based on the measurements continues to rise, such that the difference at 12m/s is of the order of 10dB, and the apparent wind farm noise rating level exceeds the limit by about 4 dB. Logically, this excess cannot be due to wind farm noise. Examination of the sector 1 background noise data for Burland Farm (**Appendix B, page 25**) shows that there is little data above 8 m/s wind speed. The derived best-fit curve indicates that background noise levels appear to level-off and fall at higher wind speeds. This is not a real effect, but is an artefact of the curve-fitting procedure resulting from the lack of measured background noise data above 8 m/s for this wind direction. On the upper (night time) graph on **page 73** the background noise curve has been 'levelled-off' at wind speeds above 8 m/s, in recognition of the fact that there is no valid background noise data at higher wind speeds. However, in practice the background noise level will continue to increase as wind speed rises, and a reasonable extrapolation of the data to higher wind speeds would indicate that at wind speeds above 9 m/s, where the limits are apparently breached, background noise is almost certainly the dominant source and is likely to be responsible for the apparent breach.

4.21 The assessment graph for Binalong (daytime/evening, Sector 1) shows a rather different characteristic (**page 75**). The rating noise level shows a 'bulge' between 6 and 8 m/s and an indicated breach of the limits. There is also an apparent breach of the day/evening limits when winds are in sector 2 (**page 76**). Wind farm noise levels would be expected to be very low at Binalong in these wind sectors (0-180º) since the house would be upwind of any turbine. Examination of the background noise data in **Appendix B (page 25)** shows that for this wind sector (sector 1) background noise levels (the data points marked with yellow squares) were significantly above the average level for all wind sectors: this average level has been used to correct measured noise levels to allow for the background noise contribution. Binalong is relatively sheltered from wind in sectors 3 and 4, since the ground rises steeply to the west, immediately behind the house. Therefore background noise generated by wind in trees might be expected to be highest when winds are in sectors 1 and 2, when the assessments indicate a breach of the noise limits although the predictions would indicate compliance. Again, in my view it can be reasonably concluded that the

apparent breach of the noise limits is attributable to background noise, not noise from the wind farm.

4.22 The same judgements can reasonably be applied to the other cases where apparent noise levels exceed the predicted noise levels, particularly at higher wind speeds. The logical conclusion is that the principal source leading to apparent breaches of the noise limits is background noise, not wind farm noise.

4.23 The rationale underlying HMP's interpretation of the results in cases where there is an apparent breach of the noise limits, which I have illustrated by examples above, is set out in the summary sheets **(Tables 23-29**) in **Appendix E**. I believe that the approach and interpretations are reasonable and justified. It follows that I agree with HMP's overall conclusions: the results of the 2015 noise surveys demonstrate, with reasonable certainty, that the noise from the wind farm are within the prescribed noise limits at the 7 locations surveyed.

4.24 Overall, I consider that the approach taken by HMP to the collection of noise data, and analysis of the results, is technically sound. There are some data gaps which have resulted in the need to apply judgement to the interpretation of the results in some cases. These data gaps mainly result from the paucity of data for some wind speed and directions: for example, little data was collected at wind speeds above 8 m/s for winds in Sector 1 (0-90º) or 7 m/s in Sector 4 (270-360º) which means that the measured noise (turbines operating) and background noise curves cannot be extended above that wind speed except by extrapolation.

4.25 It might be questioned whether more data could and should have been collected by extending the survey period, but from experience it might have proved necessary to extend the survey by months (or even years) to obtain a 'full' data set. This would have involved a further delay in determining whether further noise mitigation, if any, was required. My recommendation to the Council in July 2015 was that such an indeterminate extension to the survey duration was not justified and the survey was terminated.

5 Conclusions

5.1 The 2015 noise compliance surveys have been carried out in a competent manner in accordance with the agreed procedures. There are data gaps, principally because some combinations of wind speed and direction occur only rarely. However, in my opinion the data is sufficient to provide a robust basis for determining whether wind farm noise levels comply with the limits in the planning conditions.

5.2 The survey demonstrates that the wind farm noise rating levels (the measured noise levels, corrected for background noise and with the addition of penalties for tonal noise) were within the noise limits at most locations for most combinations of wind speed and direction. However, at six locations some breaches of the noise limits were indicated in some wind directions at some wind speeds.

5.3 The HMP Report examines these instances of apparent breaches of the noise limits in detail and concludes that where the results show noise levels exceeding the noise limits, these indicated breaches can be attributed to noise sources other than the wind farm, and that there is reasonable certainty that wind farm noise rating levels were actually lower than the limits at the seven survey locations in all cases. I recognise that any attempt to 'explain away' apparent breaches of the noise limits might be viewed with some scepticism. However, having examined the data I am satisfied that HMP's approach is technically supportable and I do not disagree with the HMP's overall conclusions as set out in Report HM:2948_ R1_ EXT4**.**

5.4 As explained in my letter to the Council of June 2015 (Reference 7) I consider that if it is demonstrated that the noise limits are complied with at the locations adopted for the 2015 noise surveys, there is also reasonable certainty that the noise limits are complied with at all other residential locations, subject to the qualifications set out in that letter.

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5.5 Therefore I consider that the noise surveys carried out by ESBI/HMP in 2015 meet the requirements of Condition 21 and provide adequate confirmation that the Fullabrook Wind Farm noise levels comply with the limits in Condition 20.

5.6 Continued compliance with noise limits obviously depends on the wind turbines being operated at all times in accordance with the mitigation strategy employed during the 2015 survey. ESBI and Vestas (the turbine supplier) have explained how the operation

of the system is monitored: I commented on this procedure in my letter of September 2015 (Reference 8). In my view this appears to offer adequate safeguards against turbines being operated in a way likely to result in higher noise levels.

5.7 If Condition 21 is discharged, the Council is still able to request the operator to carry out further noise monitoring or investigations in the event that complaints about noise are received from any resident, under the provisions of Condition 22. Logically, such action would require that the Council considered the complaints to be reasonable and justified.

6 References

1. *Fullabrook Wind Farm - Review of Report HM:2467/R2 - Post Construction Noise Compliance Assessment.* RD Associates Report ref: RD/1012/R01. (October 2012).

2. *Fullabrook Wind Farm – Noise Compliance Assessment 2014 – Review of Report HM:22761/R1.* RD Associates Report ref: RD/0914/NDC01. (September 2014).

3. *Fullabrook Wind Farm – Noise Compliance Assessment 2014 – Supplementary Note: Review of Report HM:2761/R2.* RD Associates Report ref: RD/1214/NDC01. (December 2014).

4. *The Assessment and Rating of Noise from Wind Farms.* Report ETSU-R-97. Energy Technology Support Unit (ETSU). (1996).

5. *Good Practice Guide to the Application of ETSU-R-97 for Assessment and Rating of Wind Turbine Noise.* Institute of Acoustics. (May 2013).

6. *Fullabrook Wind Farm – Post-Construction Noise Compliance Assessment – Validation of Noise Measurements.* RD Associates Report ref: RD/0815/NDC01. (August 2015).

7. Letter R Davis (RD Associates) to A Cole (North Devon Council) dated 22 June 2015.

8. Letter R Davis (RD Associates) to A Cole (North Devon Council) dated 18 September 2015.