
Fullabrook Wind Farm
Post Construction Noise Compliance Assessment
Validation of Noise Measurements
August 2015

Report No: RD/0815/NDC01.

For:

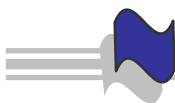
North Devon Council
Civic Centre
Barnstaple
Devon EX31 1EA

Prepared by:



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Date: 14 August 2015



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1 Introduction

1.1 Noise monitoring at sites around the Fullabrook wind farm has been carried out over several periods since February 2012. All surveys reported to date have concluded that the noise levels at residential properties exceeded the noise limits (as stated in the planning conditions) in some wind conditions. The operator (ESBI) has progressively introduced noise-reduction measures to address this problem. The progress of the noise monitoring to the end of 2014 is set out in the key reports listed in Section 5 (References 1-4). A further programme of monitoring commenced in March 2015 and is still in progress at the date of this report.

1.2 The monitoring is being carried out by the Hayes McKenzie Partnership (HMP) on behalf of ESBI. I have been engaged by North Devon Council to oversee the monitoring procedure and the subsequent analysis of data. I have agreed with HMP the scope of measurements, measurement locations and analysis techniques and have reviewed their reports. I have also witnessed the installation of the monitoring equipment on a number of occasions. On all occasions I have been satisfied that HMP were carrying out the monitoring and analysis of data in a competent and objective manner.

1.3 In May 2015 the Council requested that additional independent noise measurements should be carried out at the selected locations, as a further check on the validity of HMP's measurements. It was agreed that these could take the form of short-term random measurements over a few days, with the results being compared with HMP's measurements for the same time intervals. Similar check measurements were carried out, in conjunction with the Council, during the first series of measurements in 2012. At that time, no significant discrepancies were identified between the HMP and the Council's measurements (Reference 2)

1.4 The agreed current programme of monitoring, which follows the implementation of further measures by ESBI to reduce noise emissions, involves measurements at seven 'reference' locations:

Binalong, Milltown EX31 4HQ	Burland Farm, Bittadon EX31 4HL
Longways, Metcombe EX31 4EE	Northleigh, Marwood EX31 4HF
Old Patsford Farm, Marwood EX31 4ER	Burland House, Halsinger EX33 2ML
Little Beara, Marwood EX31 4EH	

- 1.5 I attended site on 5 March 2015 to witness the initial installation and calibration of the equipment by HMP. For the purpose of making 'check' measurements, I visited the locations on 16 - 18 June 2015 and carried out independent measurements in turn at each location for periods of up to 12 hours. However, the measurements showed some anomalies which were attributed to a fault in the equipment I was using and I did not consider the data to be robust. I therefore repeated the measurements using different equipment on 28 – 30 July 2015. Only these latter measurements are presented in this report.
- 1.6 In addition to carrying out the check measurements, I was also able to confirm that the HMP equipment was still located at the agreed positions. I had been requested by HMP to review the position of the equipment at one location (Halsinger) where the resident had asked for the equipment to be moved to a less obtrusive position in the garden. When visiting the site in June an alternative position was agreed with HMP.

2 Measurement Scope and Procedures

- 2.1 The equipment used by HMP for the long-term noise monitoring comprises RION NL-52 Class 1 sound level meters contained within weatherproof boxes with additional external batteries, with a remote microphone carried on a tripod at a fixed height (1.2 – 1.5 metres) above the ground. The microphones are protected by double-layer windscreens to reduce the influence of wind noise on the microphone. HMP personnel visit the sites at intervals to change batteries, download data and check the equipment calibrations. Recording rain gauges are installed at Burland Farm and Halsinger to detect periods of rainfall, to allow measurements likely to have been affected by rainfall to be excluded from subsequent analysis in accordance with accepted practice.

- 2.2 For the check measurements I used two systems:

System 1: A Larson-Davis LD-820 sound level meter with microphone tripod mounted and fitted with a double-layer windscreen of similar design to the HMP windscreen

System 2: A RION NL-52 sound level meter, with tripod-mounted microphone protected by a RION WS-03 spherical windscreen.

Both systems were check- calibrated before and after each measurement using a Larson Davis CAL200 Electronic Calibrator and did not show any significant drift in sensitivity.

- 2.3 The double-layer windscreens (as used by HMP and on my System 1) are non-proprietary but constructed to an approved design, as referred to in the Insutute of Acoustics Good Practice Guide (Reference 5) which is specific to wind farm noise measurements. All measurement systems and their operation comply with the recommendations in the Good Practice Guide.
- 2.4 The check systems were located close to the HMP systems (at a spacing of approximately 1.5 metres) Photographs in Section 6 show the installations at some of the monitoring locations.
- 2.5 All systems were set up to record noise data continuously, with data being stored for successive 10 minute intervals, in accordance with the defined procedure. The HMP systems are synchronised to commence each measurement interval at 'integral' times (e.g. 01:00, 01:10, 01:20 BST etc) with the clocks set to 'GPS' time. My equipment was set up in the same way so that measurements at each location during identical 10-minute periods could be compared.
- 2.6 It is emphasised that these measurements do not form any part of the overall wind farm noise monitoring exercise, which is necessarily long-term and involves detailed analysis of noise levels in conjunction with wind speed, wind direction and wind farm operational information. Also, the full assessment process takes no account of noise during daytime hours (07:00 – 18:00), noise during periods of recorded rainfall, or noise levels measured when one or more turbines is stopped for maintenance. 'Outlying' noise data, obviously resulting from some event not associated with the wind farm, is excluded. The comparative measurements reported here include data measured during daytime hours, during rainfall, and include noise from sources such as domestic activities (children playing, lawn mowing) and agricultural operations. Also one wind turbine (identified as T14) was observed on several occasions to be not operating. The purpose of the current exercise is solely to compare noise levels measured by the HMP and the 'check' noise measurement systems, over short sample periods, to provide some further validation of HMP's equipment and its operation.

3 Comparisons between measurements

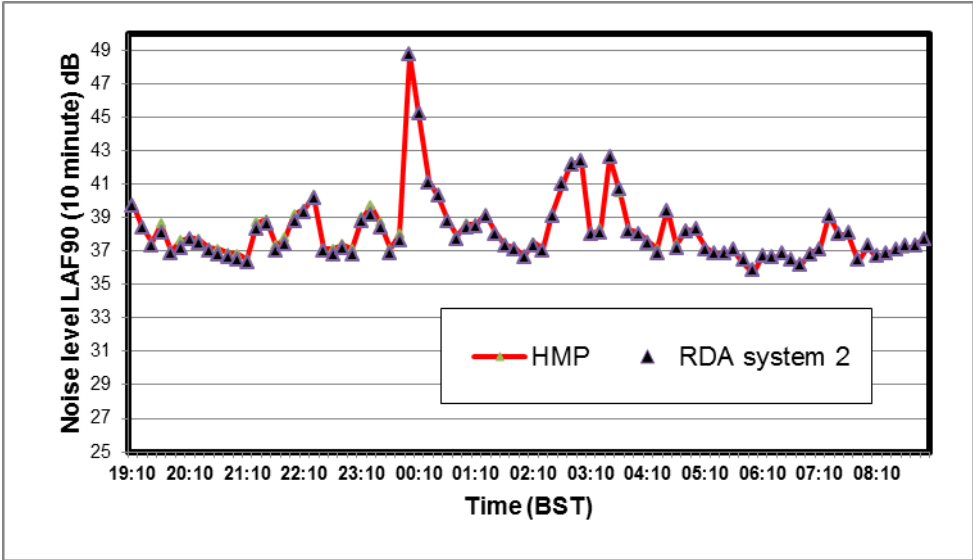
- 3.1 HMP have provided to me the 'raw' noise data, in spreadsheet format as downloaded from their seven monitoring systems, for the month of July. From this data I have extracted the measurements for the relevant period at each location for comparison with my check measurements
- 3.2 In assessing the data, it must be appreciated that all noise measurements are subject to uncertainty. The sound level meters used are certified to meet IEC 61672 Class 1 precision standards. The standard necessarily specifies permissible measurement tolerances, and the sensitivity of the equipment and the field calibrators are subject to small changes as a result of changes in environmental conditions (such as temperature and humidity). Two identical measurement systems placed in close proximity in an external environment can be expected to measure non-identical results for these reasons. Also, in a typical outdoor location, one system may be slightly closer to a local noise source (such as vegetation causing noise when disturbed by wind) than the other system.
- 3.3 Considering these factors, my professional view is that for outdoor noise measurements in these situations, systematic or random differences in measured noise level of 0.5dB or less between two noise measurement systems with microphones placed 1.5 metres apart would not be indicative of a defect or excessive calibration drift in either system. Greater differences might be expected during individual 10-minute intervals as a result of a local 'event' taking place closer to one microphone than the other. .
- 3.4 The assessment procedure, as is standardised for wind farm noise measurements and defined in the planning conditions is based on the noise measurement parameter $L_{AF90, 10m}$ – the A-weighted noise level exceeded for 90% of the time during each 10 minute interval, with the instrument set to the standard 'fast' time weighting. The comparisons between the HMP measurements and the check measurements are therefore made for this specific noise parameter.
- 3.5 Comparisons are shown in the graphs below which show the HMP measured values of L_{AF90} for each 10-minute interval and the corresponding values measured by the check systems (RD Systems 1 or 2). To provide a simple measure of the average difference between the two measured levels during the measurement periods, the arithmetic mean of the differences during all 10 minute period is calculated. This value is rounded to the

nearest 0.1 dB. A negative value indicates that the average value of the HMP measurements is lower than the check measurements.

BINALONG

Measurement period 19:10 28 July – 09:00 29 July

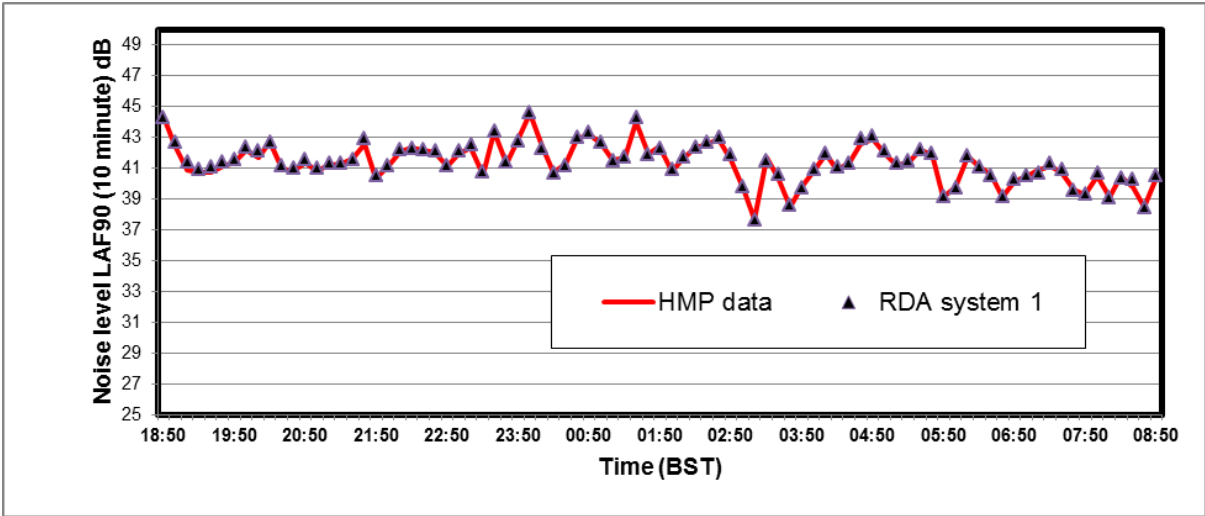
Average difference HMP – check system = -0.1 dB L_{AR90}



BURLAND FARM

Measurement period 18:50 28 July – 09:00 29 July

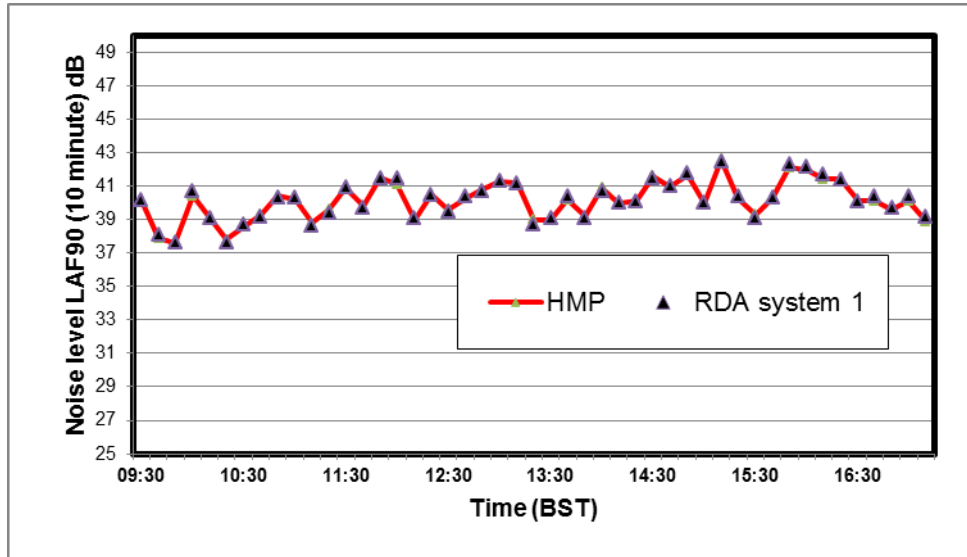
Average difference HMP – check system = -0.1 dB L_{AR90}



METCOMBE

Measurement period 09:30 – 17:20 29 July

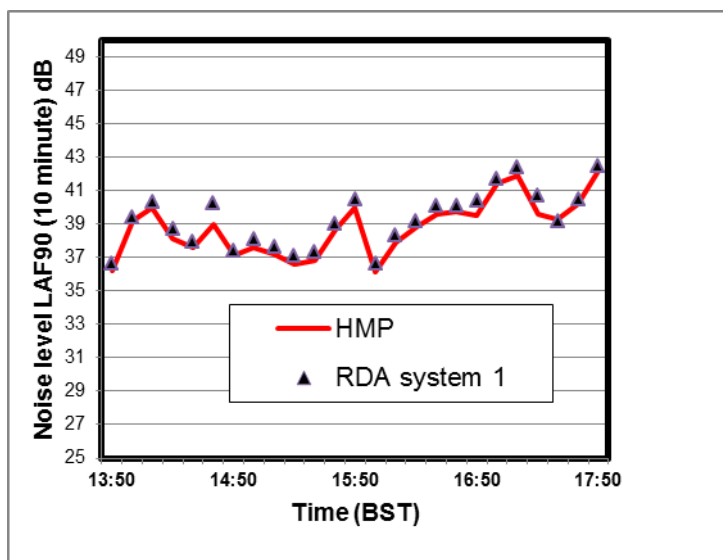
Average difference HMP – check system = 0.0 dB L_{AR90}



NORTHLEIGH

Measurement period 13:50 – 18:00 28 July

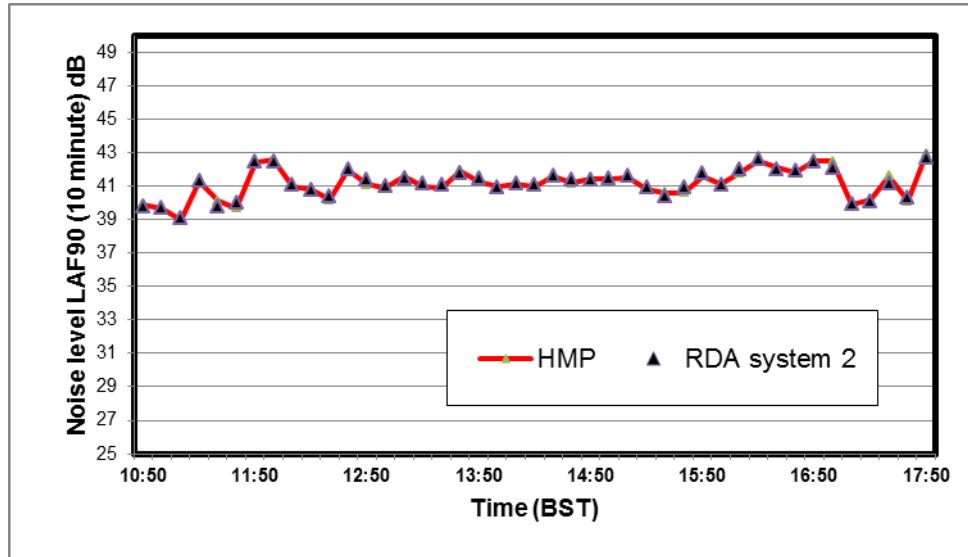
Average difference HMP – check system = -0.5 dB L_{AR90}



PATSFORD

Measurement period 10:50 – 18:00 29 July

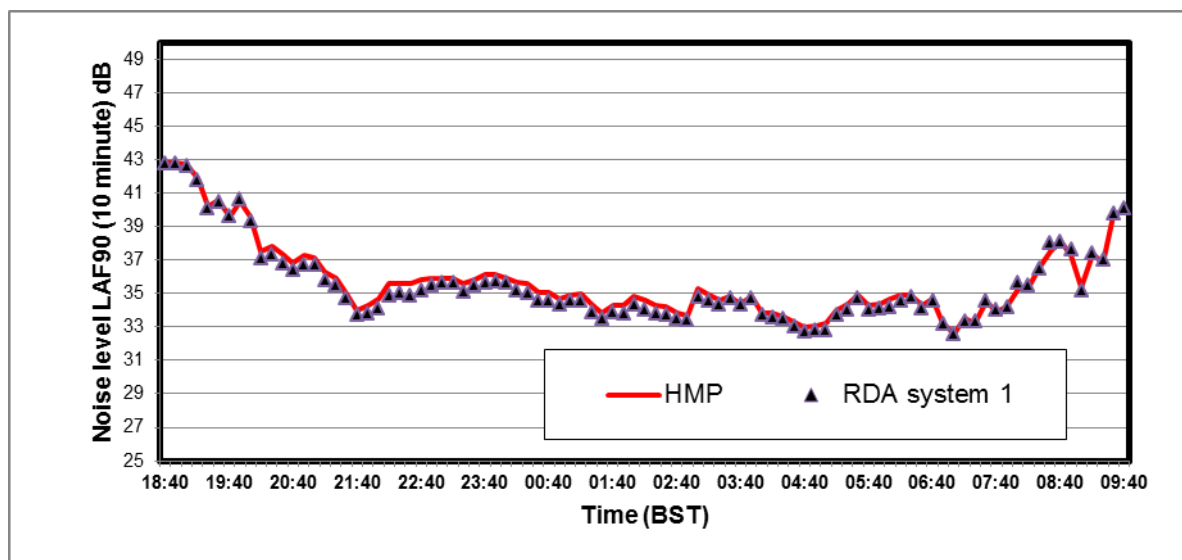
Average difference HMP – check system = -0.2 dB L_{AR90}



BEARA

Measurement period 18:40 29 July – 09:50 30 July

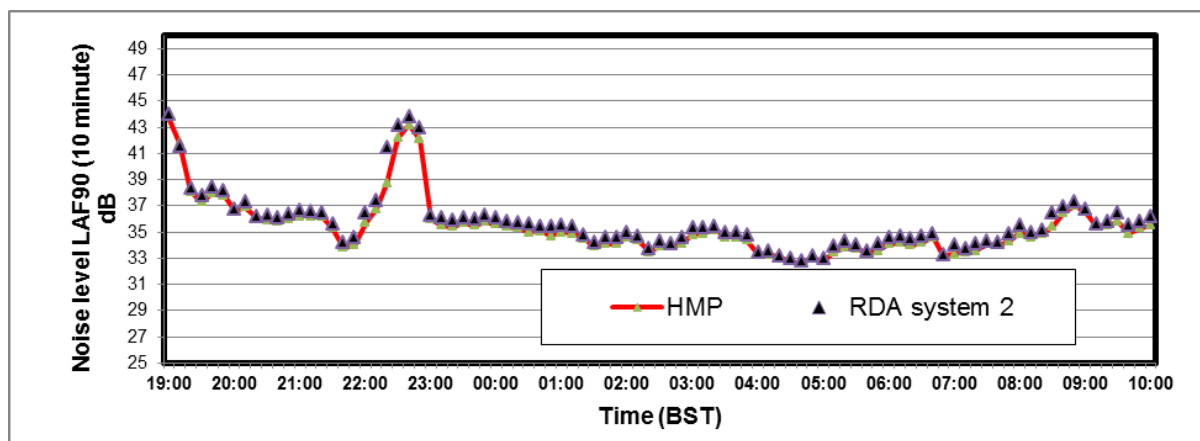
Average difference HMP – check system = + 0.3 dB L_{AR90}



HALSINGER

Measurement period 19:00 29 July – 10:00 30 July

Average difference HMP – check system = -0.4 dB L_{AR90}



4 Conclusions

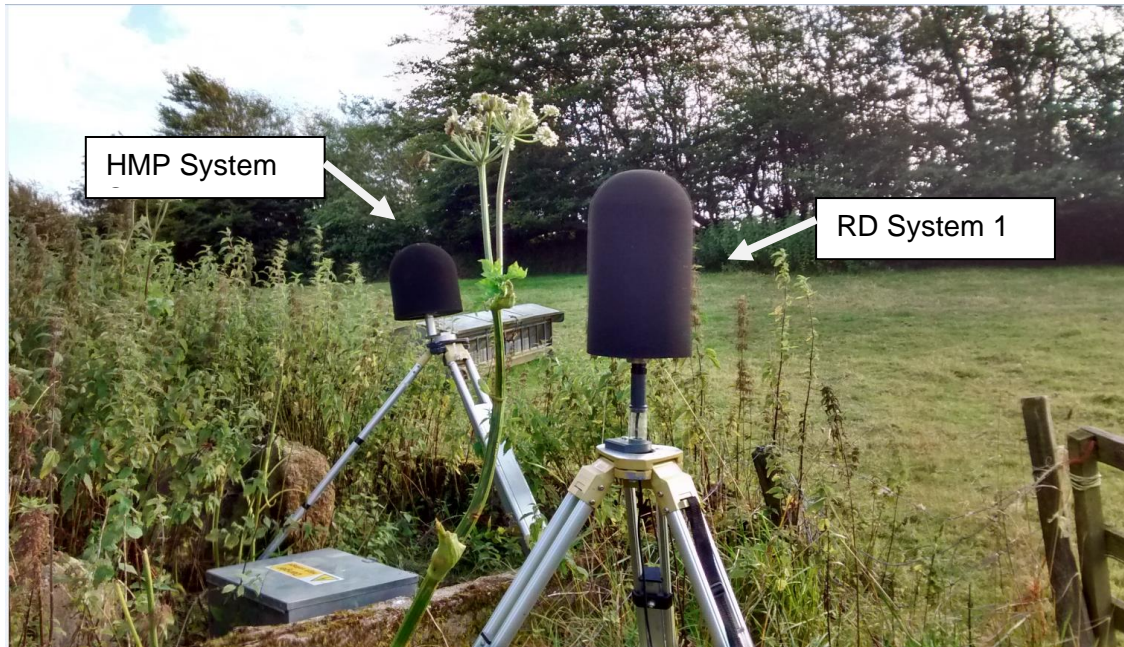
- 4.1 From my observations during my visits to site, most recently in March, June and July 2015, I consider that the noise monitoring at Fullabrook wind farm is being carried out by the Hayes McKenzie Partnership (HMP) in a competent manner, using appropriate equipment operated correctly in accordance with current best practice. The measurements would be expected to provide robust data for the purposes of assessing wind farm noise against the prescribed noise limits.
- 4.2 The check measurements made on 28 - 30 July 2015 at the current seven monitoring locations were identical (within accepted tolerances) with the measurements made by HMP at these locations during the same measurement intervals. This agreement provides further confirmation of the validity of the noise measurements carried out on behalf of the operator.

5 References

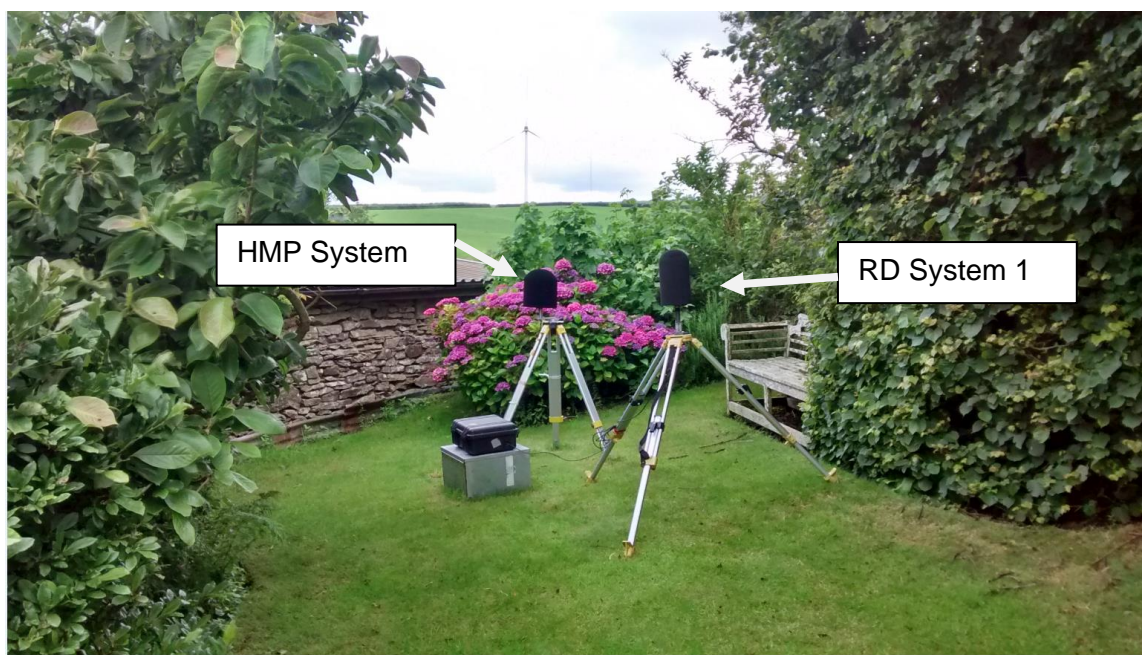
1. Hayes McKenzie Partnership Report HM 24567/R2. *Fullabrook Wind Farm Post Construction Noise Compliance Assessment* (28 September 2012)
2. RD Associates: *Fullabrook Wind Farm - Review of Report HM:2467/R2 - Post Construction Noise Compliance Assessment*. (October 2012)
3. Hayes McKenzie Partnership Report HM 2761:R1. *Fullabrook Wind Farm – 2014 Noise Compliance Assessment* (28 August 2014) and amended report HM 2761 (1 December 2014).
4. RD Associates: *Fullabrook Wind Farm – Noise Compliance Assessment 2014 - Review of Report HM:2761:R1* (September 2014) and Supplementary Note (to cover HM: 2761 R2) dated December 2014.
5. *Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise Assessment*. Institute of Acoustics, (May 2014) and associated Supplementary Guidance Notes.

6. Photographs of Monitoring locations

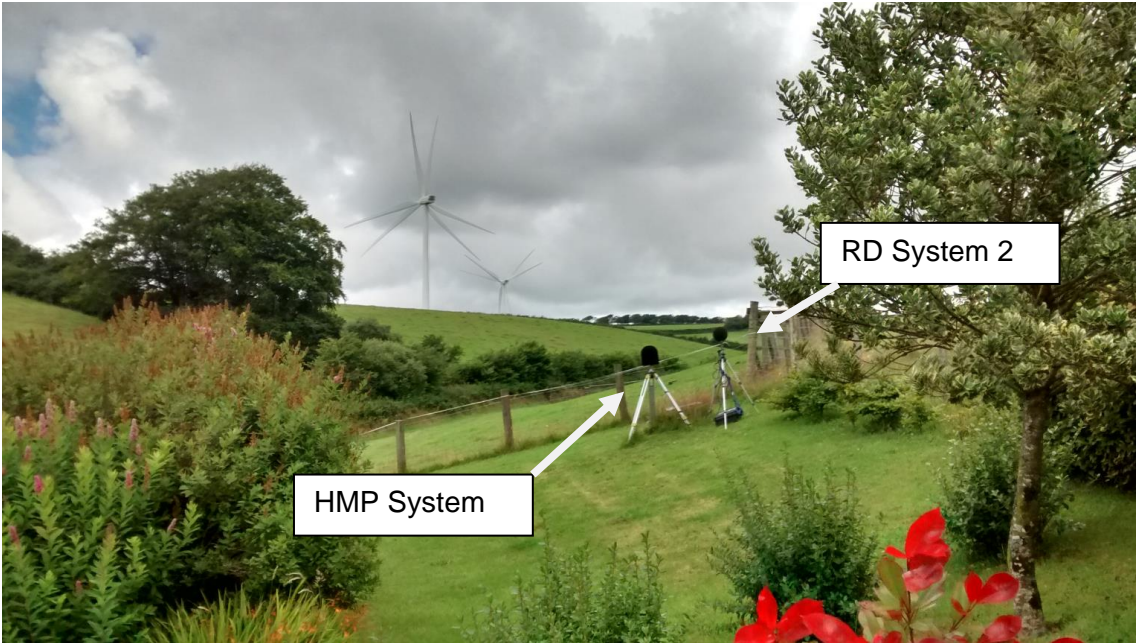
Burland Farm



Metcombe



Patsford



Halsinger

