East Anglia ONE North and East Anglia TWO Offshore Windfarms

East Anglia ONE Operation Phase Noise Monitoring Report

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Applicable to East Anglia ONE North and East Anglia TWO

East Anglia ONE
Offshore Windfarm

Onshore Substation Operational Noise Assessment

DCO Requirement 24
Final for Discharge

ID: EA1-GRD-N-OWC-238737

Created by / date: Alasdair Baxter-ITPEnergised / 24 August 2020

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REVISION CONTROL

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1 Introduction

1. East Anglia ONE Limited (EAOL) was awarded a Development Consent Order (DCO) by the Secretary of State; Department of Energy and Climate Change (DECC) on June 17th 2014 for East Anglia ONE Offshore Wind Farm (EA ONE). The DCO granted consent for the development of a 1200MW offshore windfarm and associated infrastructure.

2. In February 2015 EAOL secured a Contract for Difference (CfD) award to build a 714MW project and ScottishPower Renewables (SPR) announced its role in leading East Anglia ONE towards construction. In April 2015 EAOL submitted a non-material change application to DECC to amend the consent from direct current (DC) technology to alternating current (AC). In March 2016 DECC authorised the proposed change application and issued a Corrections and Amendments Order.

3. The onshore construction works associated with EA ONE comprised of the following, which was based on AC technology with an installed capacity of 714MW and transmission connection of 680MW:

- A landfall site at Bawdsey, Suffolk.
- Up to six underground cables, approx. 37km in length.
- Up to four cable ducts for the East Anglia THREE projects.
- An onshore substation located at Bramford next to existing National Grid infrastructure.

4. SPR, the UK's leading renewable energy developer, has recently moved to the operational phase with the East Anglia ONE Offshore Windfarm. Only minor civil works remain along the onshore cable route. The scope of this document relates to the operational phase noise measurements at the onshore substation at Bramford.

1.1 Purpose and Scope

5. The Acoustics Team of ITPEnergised (ITPE) was commissioned by ScottishPower Renewables (SPR) to undertake noise measurements and make an assessment of noise emissions as required in order to discharge Requirement 24 of the Development Consent Order (DCO (ref. DCO 2014 No. 1599) for the project. The noise monitoring relates to the East Anglia One (EA1) onshore substation which is located at Burstall, Ipswich and is located within the administrative area of Mid Suffolk District Council (MSDC).

6. This report provides the results of the noise measurements to test compliance with the noise limit criteria set in the DCO. The noise measurements in this report were undertaken on 04 and 05 August 2020.

7. The methodology for determining compliance with the DCO Requirement contained herein has been produced based upon appropriate information on the proposed development provided by SPR and current best practice. The methodology is based on monitoring at the receptor locations, supplemented by source level determination and predictions to assess the received sound levels at the receptor locations. This is a common approach representing best practice in scenarios where baseline sound levels (in the absence of the development) may exceed predicted sound levels due to the development.

8. The authoring of this report has been undertaken with integrity, objectivity and honesty in accordance with the Code of Conduct of the Institute of Acoustics (IOA).

9. The technical content of this assessment has been provided by ITPE personnel, Alasdair Baxter and Simon Waddell, both of whom are corporate members (MIOA) of the IOA, which is the UK's professional body for those working in acoustics, noise and vibration and holders of the IOA Post Graduate Diploma in Acoustics and Noise Control. This report has been peer reviewed within the ITPE team to ensure that it is technically robust and meets the requirements of our Quality Management System.

1.2 DCO Requirement

10. The operational noise related Requirement, contained in the DCO, related to the onshore substation is reproduced as follows for reference:

24.—(1) No part of Work No. 39 will commence until written details that provide for the insulation of the onshore converter station against the transmission of noise and vibration have been submitted to and approved in writing by the relevant planning authority. Work No. 39 must thereafter be implemented in accordance with the approved details. The rating level of operational noise immissions (including any relevant penalties for tonal or impulsive noise in accordance with section 9 in the ***current version*** *of* ***BS4142****) from Work No. 39 (including from Work No. 39 (including transformers, air handling units and cooling fans) shall not exceed 35 dB LAeq, 5 min at Bullenhall Farm (610287, 246601) Hill Farm (609088, 245652) and Woodlands Farm (609597, 246806).*

(2) Within three months of the completion of commissioning of Work 39, the undertaker shall submit measurements to the relevant planning authority taken in the vicinity of the relevant property or properties specified at sub-paragraph (1) to confirm the rating level of operational noise immissions do not exceed 35 dB LAeq, 5 min, including details of any remedial works and a programme of implementation should the immissions exceed the stated levels.

(3) Measurements shall be undertaken in accordance with the equipment specifications, measurement procedures and monitoring equipment positioning guidelines outlined in sections 4, 5 and 6 of ***BS4142:2014***

(4) For the purposes of this requirement, "completion of commissioning" means the date when the circuits have been fully tested and verified that they are able to transmit their rated power capacity to the grid connection point and National Grid has issued an FON (final operation notification) to the generator.

11. At the time of writing this report, the FON was scheduled for issue to National Grid by 30th September 2020. Therefore, the noise measurement has been undertaken within three months of completion of commissioning of Work 39 and in compliance with Requirement 24 (2).

2 Noise-Sensitive Receptors and Assessment Criteria

2.1 Noise Sensitive Receptors

12. The Noise Sensitive Receptor (NSR) locations at which monitoring was undertaken are identified in Table 2.1 below. These locations were predetermined and identified in the DCO requirement 24(1). The locations of the NSRs are identified on a map in Figure 1 at the end of this report.

13. Also provided in Table 2.1 are the noise limits and assessment criteria as defined in DCO Requirement 24.

Table 2-1 Noise Sensitive Receptors and Noise Limit Criteria

ID	Receptor Name	DCO Noise Criteria
NMP1	Bullenhall Farm	**35dB $L_{A,rTr,5mins}$**
NMP2	Hill Farm, Burstall	
NMP3	Burstall Hall, Burstall	

2.2 Assessment Criteria

14. DCO Requirement 24 refers to BS 4142:2014 which was current at the time of the consent. The Standard has since been revised and replaced by BS4142:2014+A1:2019. The noise criterion contained within Requirement 24 has been interpreted in accordance with the guidance contained within BS4142:2014+A1:2019, which is commensurate with current best practice. This approach was agreed between SPR and the Environmental Health Officer of MSDC in an email correspondence dated 06 March 2020

15. BS 4142:2014+A1:2019 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the proposed development) at residential NSRs. The specific sound level, L_S, may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the 'rating level', $L_{Ar,Tr}$, whether or not a rating penalty is applied. The 'residual sound' is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound. The rating, specific and residual sound levels defined in BS 4142:2014+A1:2019 relate to external sound levels.

16. Therefore, it is necessary to determine the appropriate rating penalty to apply to the specific sound so that the predicted levels can be compared with the criterion contained within Requirement 24.

17. The sound emissions (i.e. sound level emitted at source) from transformers and reactors at substations typically contain a significant proportion of their acoustic energy (if not most) at 100 Hz. The commentary to clause 9.2 of BS 4142:2014+A1:2019 suggests the following subjective method for the determination of the rating penalty for tonal specific sounds:

18. "Tonality

19. For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a rating penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

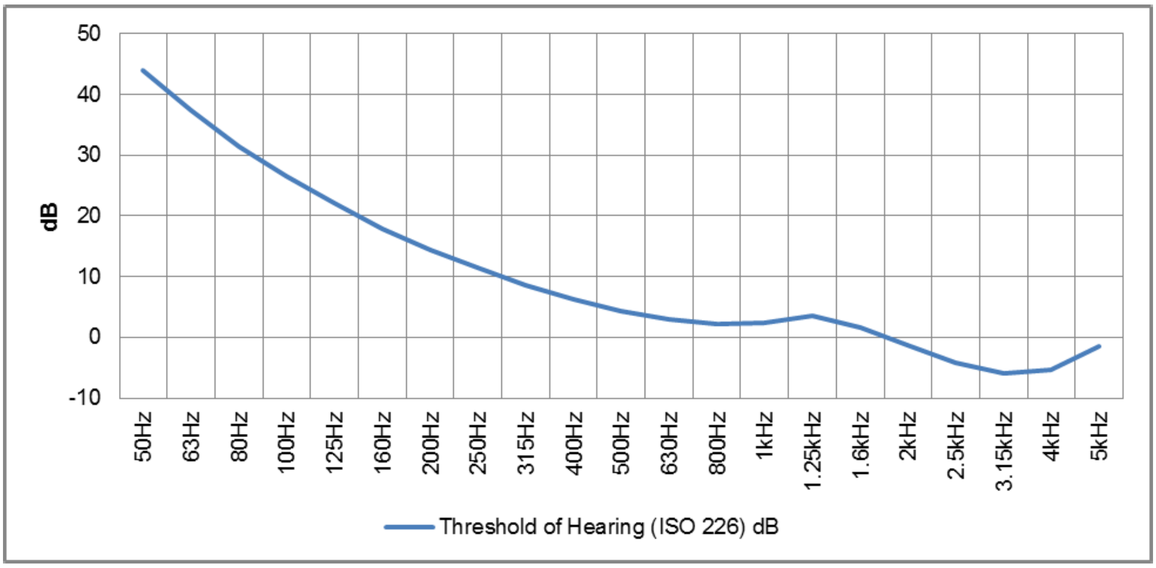
20. The perceptibility of tonal characteristics of noise outside a property was subjectively assessed during the monitoring survey at each location and supplemented with Fast Fourier Transform (FFT) measurements and analysis of the measured third octave band noise levels recorded during the survey.

21. The perceptibility of tones within the NSRs requires an assumption of the likely sound reduction provided by the facades of the houses. Report NANR 116 provides details of a programme of laboratory measurements that were undertaken by the Building Performance Centre at Napier University on behalf of the Department for Environment, Food and Rural Affairs (Defra), in order to quantify the sound insulation provided by a variety of window types, opening styles, areas of opening and ventilator devices set within a facade.

22. The authors of NANR 116 consider that the most appropriate open window area for background ventilation is 0.05 m^2. NANR 116 indicates that the statistically derived D_{ne} sound insulation ratings for a window with an open area of 0.05 m^2 are 23, 17 and 19 dB in the 63, 125 and 250 Hz octave bands, respectively. On this basis, the spectral level of a 100 Hz tone in the specific sound from the substation that is no greater than 42 dB $L_{eq,100Hz,outside}$ may be approximately 19 to 25 dB $L_{eq,100Hz,inside}$. The spectral level of a 200 Hz tone in the specific sound from the substation that is no greater than 32 dB $L_{eq,200Hz,outside}$, may result in approximately 13 dB $L_{eq,200Hz}$,inside.

23. Plate 1 below provides the threshold of hearing contained within BS ISO 226:2003 'Acoustics — Normal equal-loudness-level contours'. BS ISO 226:2003 defines the threshold of audibility by measurement of 50% of a group of ontologically selected young adults. This means that an initial large group are first screened based on stringent medical measurements of ear health and relative pressure of the inner ear and middle ear, then the results of half of the screened group are disregarded in favour of the half which exhibit a greater sensitivity. With reference to BS ISO 226:2003, the threshold of hearing at 100 Hz and 200 Hz are approximately 26 and 14 dB, respectively.

Plate 1: Threshold of hearing (BS ISO 226:2003)



24. With regard to the likely internal sound levels considered above and the threshold of hearing in the 100 Hz and 200 Hz frequency bands considered under paragraph 2.10, it is considered that a 100 Hz tone in the specific sound from the substation that is no greater than 42 dB $L_{eq,100Hz}$,outside is unlikely to be perceptible within any nearby dwelling and that a 200 Hz tone in the specific sound from the substation that is around 32 dB $L_{eq,200Hz,outside}$ is also unlikely to be perceptible within any nearby dwelling.

25. Therefore, should these values for $L_{eq,100Hz,outside}$ and $L_{eq,200Hz,outside}$ be achieved and assuming that broadband and tonal emissions from the substation have been appropriately controlled, the appropriate rating penalty to apply to the specific sound level in accordance with clause 9.2 of BS 4142:2014 is 0 dB; i.e. the rating level, $L_{Ar,Tr}$ is equal to the specific sound level, L_S. In summary, the noise criteria contained within Condition 24 is:

- $L_{Ar,Tr}$ (as defined in BS 4142:2014 and equal to L_S) ≤ 35 dB (where the reference time interval ,Tr = 5 minutes).

26. Changes in meteorological conditions will influence the levels of L_S (hence $L_{Ar,Tr}$ and $L_{eq,100\ Hz,outside}$ also). Wind direction, wind speed and the presence of temperature inversions and/or low-level jetstreams are the primary meteorological conditions that affect outdoor sound propagation. In such cases, BS 7445-3:1991 'Description and measurement of environmental noise - Part 3: Guide to application to noise limits' states that noise limits shall be based on an average value for either all relevant meteorological conditions or for specified meteorological conditions only.

27. Requirement 24 does not state the meteorological conditions during which the stated limits apply. The limit is therefore taken to apply during meteorological conditions favourable to sound propagation, i.e. representing a worst case.

2.3 Assessment Methodology

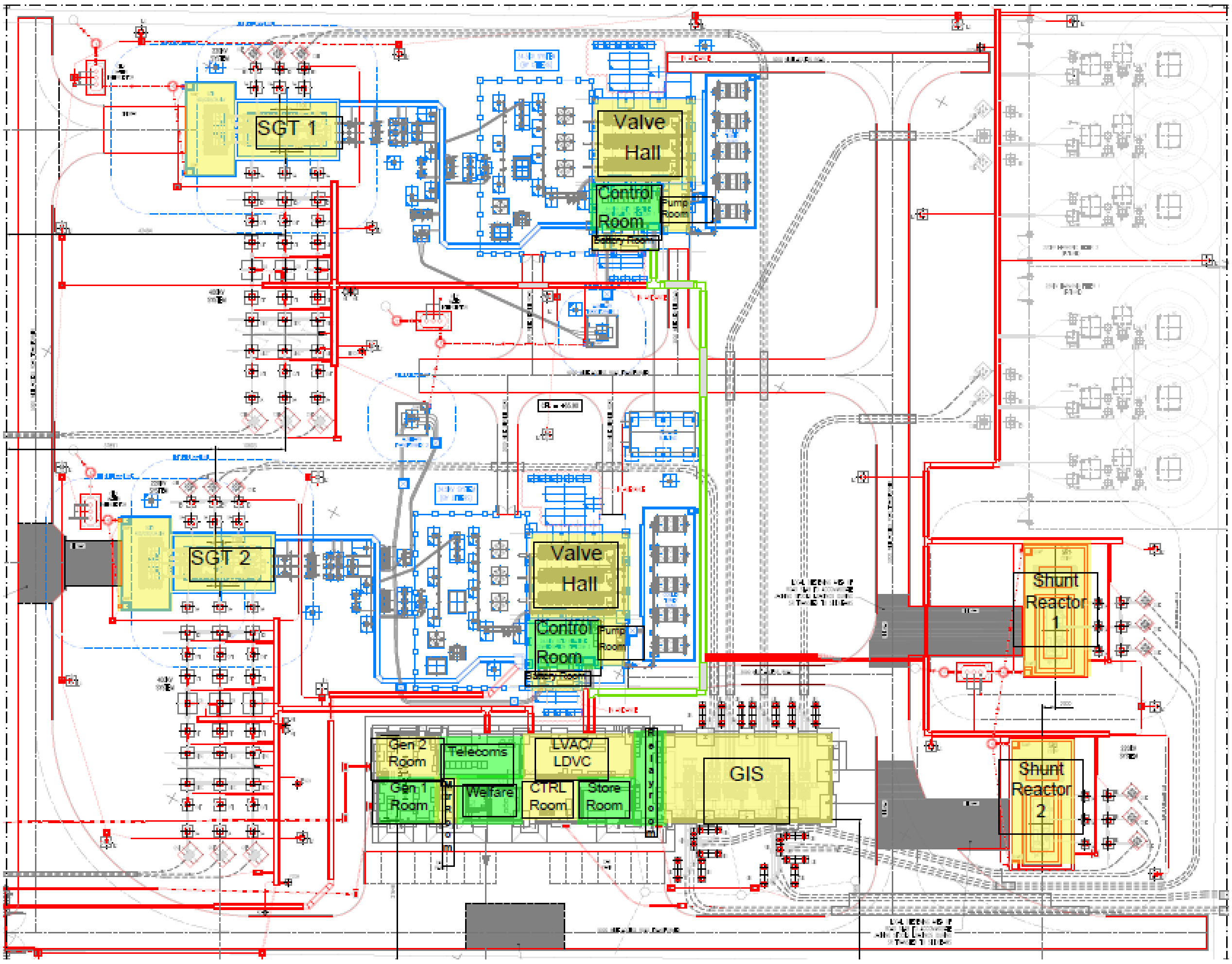
2.3.1 General Approach

28. The general approach to the methodology is as follows: undertake modelling of the operational substation based on comprehensive acoustic measurements of all operational plant items; and undertake attended monitoring at the NSR locations. The assessment required to demonstrate compliance with the noise level criteria will then be undertaken on the basis of the results of the monitoring, supported by the predicted sound levels from the detailed model.

2.3.2 Source Measurements and Sound Power Determination

29. FFT and sound intensity measurements were used to determine the sound power level of all operational plant items. A diagram showing the layout of the site, and all plant items, is provided in Plate 2.

Plate 2: Diagram Showing Layout of Substation



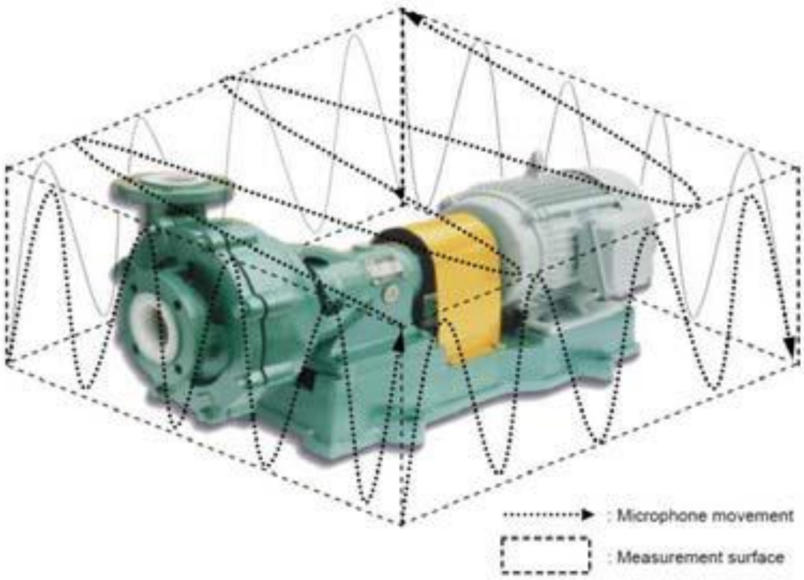
30. When attempting to determine the sound power of a noise source that is operating in a high noise environment, measuring sound intensity allows a more accurate assessment of sound power to be made than can be achieved through sound pressure measurements alone. This is due to the fact that sound pressure is a scalar quantity and as such provides a measure of the magnitude of the noise irrespective of the direction from which it arrives at the microphone, meaning that contributions from significant sources in the vicinity of the source under measurement are included in the subsequent sound power calculation, resulting in an over-estimate of the quantity.

31. Since sound intensity is a vector quantity, the technique provides a measure of the magnitude of noise travelling in a given direction. Sound intensity is measured using a sound intensity probe, consisting of two phase-matched microphones spaced at a known distance which measures only the component of the sound travelling parallel to the probe axis, allowing measurements to focus on the noise source in question and reject contributions from surrounding sources, thus increasing the accuracy of the subsequent sound power calculation.

32. In addition, sound intensity allows measurements in the near-field of a sound source without having to make adjustments for the near-field effect (where the particle velocity is not in phase with pressure).

33. A method for measuring sound intensity is used whereby an enveloping measurement surface is formed around the noise source in question, and the sound intensity in a given direction is measured by scanning a sound intensity probe across the face of the relevant measurement surface (see Plate 3).

Plate 3: Scanning surfaces used for measurement of sound intensity of a typical noise source



34. Once the sound intensity (Li) has been measured through all scanning surfaces, the sound power (LW) is calculated using the following formula:

$L_W = Li + 10 \log (S)$

where S = the surface area of the measurement surface in question.

35. The total sound power of the item is then obtained through the logarithmic summation of the individual surface sound powers.

36. Near-field measurements of sound intensity and sound pressure were undertaken using a Norsonic Nor150 Sound Intensity Meter with intensity probe and dual microphone attached. Measurements were undertaken using a 12mm spacer between the microphones and the microphones were calibrated using a Norsonic Nor 1251 calibrator and Phase Calibrator prior to the measurements. Measurements were undertaken in as close proximity to plant items as possible, whilst observing safe stand off distances. No measurements were taken above head height due to stand off distances to the overhead busbars throughout the site.

37. Conversations between site operatives and the substation Senior Authorised Person indicated that the substation was running at full capacity during the measurements and therefore may be assumed to be representative of worst-case (noisiest) conditions.

38. Surface dimensions for plant items were taken from site drawings and supplemented by onsite measurements.

39. Site boundary sound pressure measurements were not undertaken due to fence installation works in proximity of the site.

40. The model was produced in the CadnaA 8.1 software package and implements the prediction methodology contained within BS ISO 9613-2:1996.

41. The BS ISO 9613 methodology uses correction terms, applied to the source term level, for various factors affecting the propagation of noise from the source, to calculate a sound pressure level under meteorological conditions favourable to propagation (i.e. light downwind). The standard includes terms for geometrical divergence, atmospheric absorption, ground effects, reflections and screening due to obstacles.

2.3.3 Monitoring at NSRs

42. Attended monitoring was undertaken at the NSR locations during the night-time, between 00:00 and 04:00 hours, on the 5th August 2020.

43. In accordance with the wording of Requirement 24, publicly accessible monitoring locations immediately adjacent to the NSRs were used. The monitoring locations are shown on Figure 2. Measurements were undertaken in accordance with the procedures contained within British Standard (BS) 7445-1:2003 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures using a Class 1 Sound Level Meter (SLM), fully calibrated, traceable to United Kingdom Accreditation Service (UKAS) standards and satisfying the requirements of BS EN 61672:2003 for a 'Class 1' SLM.

44. At locations NMP1 and NMP3 a Rion NL-52 SLM was used, serial number 00264486. At Location NMP2 the SLM was a Norsonic Nor140, serial number 1406430, with a high-performance windshield. The microphones were mounted in free-field conditions approximately 1.5m above the ground at each location and were field calibrated before and after the measurements using a Rion NC-74 calibrator, serial number 34167510 and a Norsonic Nor1251 calibrator, serial number 29150. No drift in calibration was noted. Third octave measurements were collected in 1minute intervals (with 1s resolution) and the required 1hr period was extracted in post processing.

45. Weather conditions during the monitoring were dry with light winds of between 1 and 3m/s with occasional gust of 4m/s. Cloud cover was approximately 90% during measurements at NMP2 and NMP3 and approximately 30% during measurement at NMP1. Temperatures during the measurements were between 18 and 20ºC. Weather conditions were therefore in accordance with the requirements of BS 7445-1:2003.

2.3.4 Noise Modelling

46. The source levels (i.e. the calculated sound power levels of equipment, as determined by the source measurements) were entered into a CadnaA 8.1 noise model for the site to calculate the expected sound pressure levels at the receptors. CadnaA incorporates the propagation method described in ISO 9613.

47. The BS ISO 9613 methodology uses correction terms, applied to the source term level, for various factors affecting the propagation of noise from the source, to calculate a sound pressure level under meteorological conditions favourable to propagation (i.e. light downwind). The standard includes terms for geometrical divergence, atmospheric absorption, ground effects, reflections and screening due to obstacles.

48. Ground absorption coefficient was, conservatively, set to 0.6 to reflect the mix of hard and soft ground between the site and receivers. All receivers were modelled free-field at a height of 1.5 m above ground level, representative of the monitoring locations used to represent the NSRs.

49. Statcom cooling fans were represented as point sources, with all other sources represented as area or vertical area sources using the site and drawing measurements.

50. All calculation runs used the following settings:

- Reflection order = 3
- Max. reflection distance to receiver = 1000 m
- Max. reflection distance to source = 200 m
- Search radius = 5,000 m (5 km)
- Weighting = dB(A)
- Tolerance = 0.001 dBA.

The following meteorological inputs were used:

- Air pressure = 1013.25 mbar
- Rel. Humidity = 70%
- Air Temperature = 10C

3 Results

3.1.1 Noise Monitoring at NSRs

51. Due to the nature of noise generated by substations (continuous and not impulsive or intermittent) it is appropriate to examine the background (L_{90}) noise level at the receptors, i.e. the noise level free from the influence of individual noise events.

3.1.1.1 Description of the Noise Environment

NMP1 Bullenhall Farm

52. The noise environment at NMP1 was, subjectively, quiet and consisted predominantly of gentle rustling of trees and vegetation with occasional distant traffic and a distant plane passing.

53. Crackling noise from busbars was audible intermittently and a low-level hum was also identified continuing throughout the measurement period. These noises were considered to be emanating from a south-westerly direction, from the Bullen Lane National Grid substation adjacent to the EA1 substation , rather than the EA1 substation.

54. Following the completion of the measurement the site operatives conducted further investigation of the crackling and low-level hum noises. Observations were made from the bridleway to the north of the National Grid substation and it was identified that the crackling noise was from busbars at the northern edge of the National Grid substation and the low level electrical hum emanated from further within the National Grid substation.

55. The site operatives also conducted observations on the bridleway at its closest point to the EA1 substation (approximately 100m from the southern boundary of the EA1 substation) and confirmed that there was no discernible or audible noise from the EA1 substation site at this location.

NMP2 Hill Farm

56. The noise environment at NMP2 was again, subjectively, quiet and consisted predominantly of the rustle of trees and vegetation in the light breeze. There were contributions from a distant motorcycle and a distant plane passing as well as infrequent bird calls.

57. It was observed that substation noise was not audible at all and there were no discernible tonal elements or other characteristics within the noise environment.

NMP3 Burstall Hall

58. The noise environment at NMP3 was again, subjectively, quiet and consisted predominantly of the rustle of vegetation (wheat in the nearby field) in the light breeze. There were contributions from a distant motorcycle and a distant plane passing as well as infrequent bird calls and noise from insects.

59. It was observed that substation noise was not audible at all and there were no discernible tonal elements or other characteristics within the noise environment.

60. The monitoring results are presented in Table 3-1 below:

Table 3-1 Monitoring Results NSRs Background L_{90}

ID	Receptor Name	Start Date/Time	Duration (hh:mm)	Broadband L_{A90}, dB	100 Hz L_{90}, dB	200 Hz L_{90}, dB
NMP1	Bullenhall Farm	05/08/20 02:22	01:00	25.0	28.7	17.1
NMP2	Hill Farm, Burstall	05/08/20 00:27	01:13	30.5	23.9	19.7
NMP3	Burstall Hall, Burstall	05/08/20 00:26	01:00	29.1	24.4	18.2

61. The frequency spectrum measurement results are shown in Appendix A.

62. The measurement results show that, at all locations, the background (L_{A90}) measured levels are below the criteria of 35 dB, indicating that the specific sound from the substation (which, as discussed previously, will be represented by the L_{A90} level at the receptors) is below 35 dB $L_{Aeq,5mins}$ set out in Requirement 24 (2) of the DCO,.

63. Further discussion of the results is included in Section 4.

3.1.2 Noise Model

3.1.2.1 Verification

64. Site boundary measurements during the onsite survey were not possible due to nearby construction activities. A measurement was taken during the daytime period on 4th August 2020 on the bridleway to the south of the EA1 substation, approximately 110m from the boundary of the substation site (NMP4, Figure 1). The measured L_{A90} level has been compared with the model predicted noise level at that location in Table 3-2 below:

Table 3-2 Noise Model Results at Verification Point

ID	Start Date/Time	Duration (hh:mm)	Measured $L_{A90,T}$, dB	Predicted $L_{Aeq,T}$, dB
VER1	04/08/20 18:55	00:08	35.0	36.0

The model results are considered to be consistent with the measured result at this location.

3.1.3 Model results

The results of the noise modelling are presented in Table 3-3:

Table 3-3 Noise model results

ID	Location	Predicted Broadband L_{Aeq}, dB	Predicted 100Hz L_{eq}, dB	Predicted 200Hz L_{eq},dB
NMP1	Bullenhall Farm	22.9	24.0	15.8
NMP2	Hill Farm, Burstall	18.2	20.1	11.4
NMP3	Burstall Hall, Burstall	16.5	18.1	9.4

65. The results show that predicted noise levels are below the measured background level at each of the receptors and the predicted 100Hz and 200Hz levels are below the 42 dB and 32 dB respective free-field external levels detailed in Section 2.2 and would therefore be inaudible within buildings.

4 Analysis

4.1 Noise Monitoring Results

66. Subjective observations of the acoustic environment during the attended measurements indicate that sound from the EA1 substation was not audible at any of the NSR locations.

67. The results in Table 3-1 indicate that broadband, 100 Hz and 200 Hz sound levels are below the criteria set out in Requirement 24 (2) of the DCO.

68. Numerical analysis of the results, using the third-octave method described within BS 4142:2019 Methods for rating and assessing industrial and commercial sound, confirms that no tones are objectively quantifiable.

69. On the basis of the above it is considered that sound from the EA1 substation does not significantly influence the acoustic environments at any of the measurement locations. The measurement results demonstrate that no tonal or broadband sound from the EA1 substation is identifiable at these locations, and the subjective observations indicate that sound from the EAI substation was inaudible.

4.2 Model Results

70. The model results accord with the findings of the monitoring that the specific sound from the EA1 substation does not significantly affect any of the NSR locations and is in compliance with the Requirement 24 (2) noise limits.

5 Discussion

5.1 Rating Penalties

71. On the basis of the discussions presented in Section 2.2, and in consideration of the likely specific sound level at the NSRs based on the measurements and predictions undertaken, no rating penalties have been applied and the specific sound level is equal to the rating level.

5.2 Results of Monitoring at NSRs

72. The subjective observations during the attended monitoring indicates that sound from the EA1 substation plant was inaudible. This is a positive demonstration that sound from the EA1 substation is not causing unacceptable sound levels at the NSR locations.

73. The results of the attended monitoring confirm that the broadband sound levels, and 100 Hz sound levels, measured at all locations were below the noise limit criteria.

5.3 Noise Model Results

74. The results of the noise model confirm that the noise limit criteria were not exceeded during the monitoring period. The results accord with the findings of the noise monitoring that the contribution of sound from the EA1 substation at the NSR locations was at an insignificant level such that it was not possible to quantify it through measurement or identify it in subjective observations.

6 Conclusions

75. ITPEnergised were commissioned by SPR to undertake noise measurements and make assessments of noise emissions from the operation of the EA1 onshore substation.

76. Monitoring at NSRs and sound intensity measurements of onsite noise sources were undertaken in accordance with the methodology described in Section 2. Modelling of the EA1 substation noise sources, based on the sound intensity measurements, was also undertaken and the results of the modelling were compared with the measured noise levels at the NSRs.

77. On the basis of the results and discussion presented herein it is concluded that the specific sound of the EA1 substation is in compliance with the noise limit criteria contained in Requirement 24 (2) of the DCO for the EA1 Windfarm.

78. The noise measurements were also undertaken within three months of completion of commissioning of the EA1 substation in compliance with Requirement 24 (2).

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Appendix A – 1/3 Octave Band Measurements

Appendix A – 1/3 Octave Band Measurements

ID	Third Octave Centre Frequency (Hz) Measured L_{90}, dB																															
	12.5	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1k**	**1.25k**	**1.6k**	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**	**12.5k**	**16k**	**20k**
NMP1	37.1	36.5	33.3	33.4	31.0	30.5	34.3	30.7	32.7	28.7	22.8	18.9	17.1	13.1	13.1	14.9	18.0	17.1	16.2	13.9	11.3	10.5	9.9	8.8	8.6	8.0	7.6	8.1	8.0	8.6	9.0	8.0	6.5
NMP2	33.4	33.6	33.1	30.3	29.2	30.3	29.4	27.3	25.3	23.9	22.2	21.0	19.7	19.5	20.3	21.2	21.9	21.5	20.4	19.4	18.5	17.6	17.2	16.8	16.5	15.9	15.3	14.6	14.5	16.1	18.2	12.8	10.2
NMP3	39.7	38.5	36.8	33.4	31.3	31.1	30.4	28.6	25.9	24.4	22.4	20.5	18.2	17.3	18.4	19.5	19.7	19.6	18.6	17.3	16.0	15.2	15.3	15.8	16.1	16.4	16.1	15.6	15.1	14.6	13.3	11.3	7.8

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Figures

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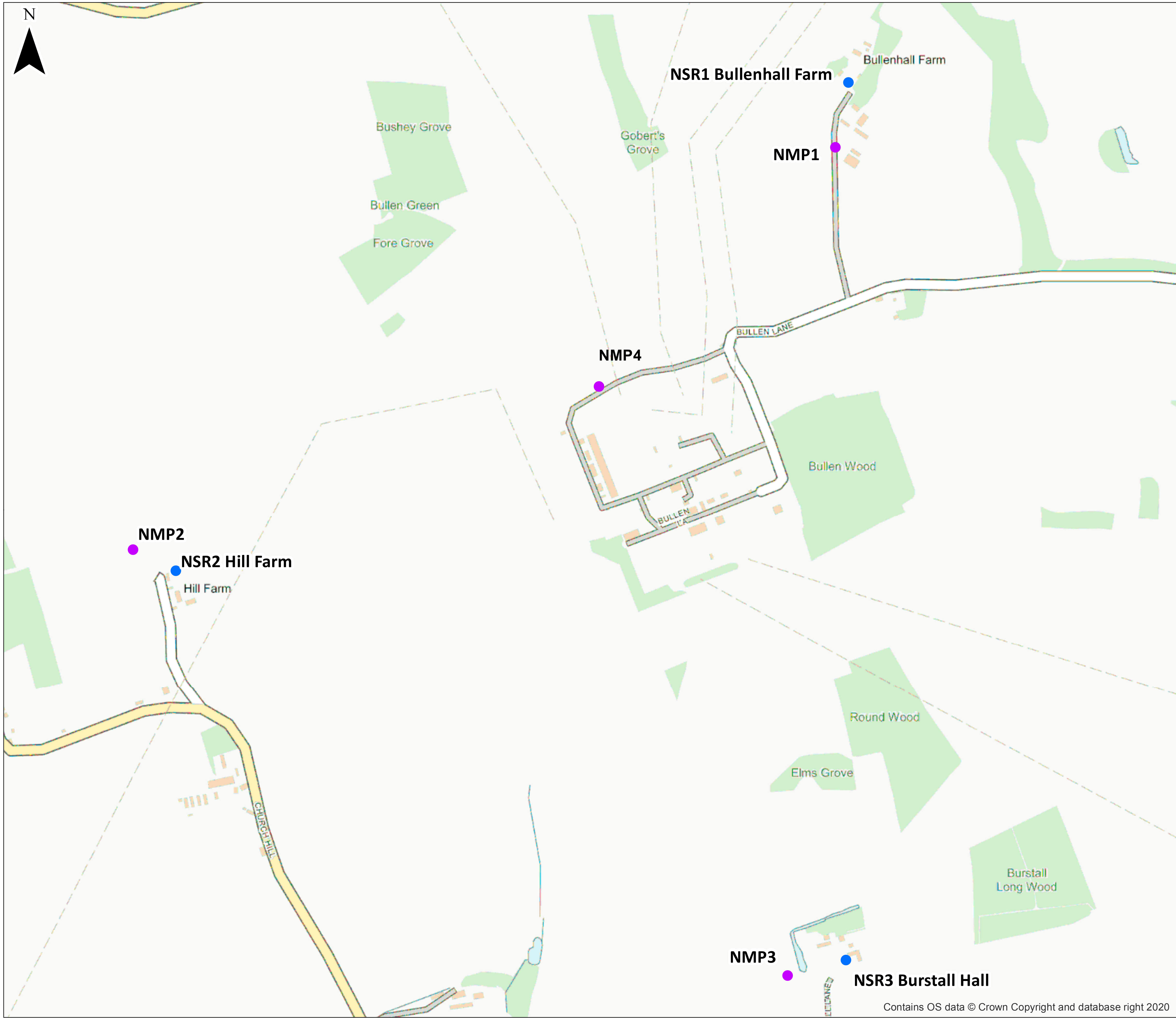

KEY

- Noise Sensitive Receptor (NSR)
- Noise Monitoring Position (NMP)

0 150 300 m

Scale 1:6,500 @ A3

EA1 Operational Noise Assessment

Figure 1
Noise Sensitive Receptors (NSR) and Noise Monitoring Positions (NMP)

Date: 08/09/2020	Drawn by: JB	Checked by: AB	Version: V1

Project Number: 3342