East Anglia ONE North and East Anglia TWO Offshore Windfarms

Applicants' Response to Appendix 4 of the Local Impact Report

Applicants: East Anglia ONE North Limited and East Anglia TWO Limited
Document Reference: ExA.AS-19.D3.V1
SPR Reference: EA1N_EA2-DWF-ENV-REP-IBR-001150

Date: 15th December 2020
Revision: Version 01
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Applicable to East Anglia ONE North and East Anglia TWO

Revision Summary				
Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**
01	15/12/2020	Paolo Pizzolla	Lesley Jamieson / Ian Mackay	Rich Morris

Description of Revisions			
Rev	**Page**	**Section**	**Description**
01	n/a	n/a	Submitted to the Examining Authority at Deadline 3

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Glossary of Acronyms

DCO	Development Consent Order
EIA	Environmental Impact Assessment
ES	Environmental Statement
ESC	East Suffolk Council
ETG	Expert Topic Group
LIR	Local Impact Report
LOAEL	Lowest Observed Adverse Effect Level
NNG	Night time Noise Guidelines for Europe
NOEL	No Observed Effect Level
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Project
PPG	Planning Practice Guidance
SCC	Suffolk County Council
SLM	Sound Level Meter
SoCG	Statement of Common Ground
SOAEL	Significant Observed Adverse Effect Level
WHO	World Health Organisation

Glossary of Terminology

Applicant	East Anglia TWO Limited / East Anglia ONE North Limited
The Councils	East Suffolk Council and Suffolk County Council
East Anglia ONE North project	The proposed project consisting of up to 67 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
National Grid infrastructure	A National Grid substation, cable sealing end compounds, cable sealing end (with circuit breaker) compound, underground cabling and National Grid overhead line realignment works to facilitate connection to the national electricity grid, all of which will be consented as part of the proposed East Anglia TWO / East Anglia ONE North project Development Consent Order but will be National Grid owned assets.
National Grid substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia TWO / East Anglia ONE North project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia TWO / East Anglia ONE North project Development Consent Order.
Onshore substation	The East Anglia TWO / East Anglia ONE North substation and all of the electrical equipment within the onshore substation and connecting to the National Grid infrastructure.
Onshore substation location	The proposed location of the onshore substation for the proposed East Anglia TWO / East Anglia ONE North project.

1 Introduction

1. This document provides comments from East Anglia ONE North Limited and East Anglia TWO Limited (the Applicants) on the Local Impact Report (LIR) prepared jointly by East Suffolk Council (ESC) and Suffolk County Council (SCC) (the Councils). This document follows the ***Applicants' Comments on Local Impact Reports*** submitted to the Examinations at Deadline 2 (REP2-013) and provides a specific response from the Applicants' to Appendix 4 of the LIR.

2. Appendix 4 of the LIR is a report provided by Adrian James Acoustics Ltd., the consultants commissioned by ESC to provide technical support on noise and vibration matters and to review the associated documents submitted with the East Anglia TWO project and East Anglia ONE North project (the Projects) Development Consent Order (DCO) applications (the Applications). Throughout this document, Adrian James Acoustic Ltd. are referred to as 'the Council's Consultant'.

3. Where appropriate, the Applicants' comments on the LIR signpost to other documents submitted to the Examinations. Further detail on each topic covered can be found in the documents submitted with the Applications and to the Examinations, such as (but not limited to): the Statements of Common Ground (SoCG) with the Councils (REP1-072); associated Clarification Notes submitted at Deadline 1, Deadline 2 or Deadline 3 of the Examinations; and specific responses to Written Questions (provided in REP1-085 to REP1-121). Where the Applicants anticipate providing further clarification on specific matters at future Examination deadlines, this is clearly stated within the response.

4. This document is applicable to both the East Anglia ONE North and East Anglia TWO DCO applications, and therefore is endorsed with the yellow and blue icon used to identify materially identical documentation in accordance with the Examining Authority's procedural decisions on document management of 23rd December 2019 (PD-004). Whilst this document has been submitted to both Examinations, if it is read for one project submission there is no need to read it for the other project submission.

2 Applicants' Comments

5. The Applicants' comments on the text extracted from Appendix 4 of the LIR are presented within ***Table 1***.

Table 1 Applicants' Comments on Appendix 4 of the Councils LIR

LIR topic	Applicants' Comments
1. Background	
In the Environmental Statement Royal HaskoningDHV have determined the representative background sound level for the receptors surrounding the EA1N and EA2 onshore substation sites to be 29 dB L_{AF90}. This is not consistent with our experience of the noise climate in this area from visits to the site and previous noise monitoring for other projects locally when we have found background noise levels to typically be below 25 dB L_{AF90}.	The noise climate of the study area fluctuates over a range of values as demonstrated by the post survey statistical analysis and charts for each specific measurement location (***section 25.3.7***, ***Chapter 25*** of the Environmental Statement (ES) (APP-524). The Applicants note the Council's Consultant's experience of the noise climate in the area around the onshore substation locations, but have not received any specific details regarding the following aspects: • the meteorological conditions at the time of visiting the area; • the duration of the site visit; • the spatial extent of the site visit; • the purpose of their visit to the area in relation to other projects; or • any monitoring equipment or calibration used to form their stated position on background noise at the onshore substation locations. Furthermore, the Council's Consultant has not provided baseline noise data to support the claim that background noise levels in this location are typically below 25 dB L_{AF90} and therefore the Applicants do not consider this a true representation of the noise climate for the onshore substation locations. As per ***Appendix 25.3*** of the ES (APP-524), baseline noise measurements were undertaken in accordance with BS 4142:2014+A1:2019 to ensure that the background noise level calculated to characterise the existing noise climate within the study area is based upon representative and repeatable samples. The noise monitoring locations used for the baseline noise survey were agreed with the Noise and Vibration Expert Topic Group (ETG) prior to undertaking the survey, with the ETG comprising representatives from ESC

LIR topic	Applicants' Comments
	and Suffolk Coast District Council (now ESC). It is also noted that at the ETG meeting (29th January 2019), ESC's representative agreed with the baseline noise levels obtained during the survey and confirmed the survey methodology used was comprehensive.
On 2 October 2020 Royal HaskoningDHV supplied the raw noise survey data and analysis methodology that they used to establish 29 dB L_{AF90} at the representative background sound level. We have reviewed this information and this document sets out our comments. Royal HaskoningDHV measured background sound levels at 9 survey locations for periods of between 6 and 9 days between 26 June and 12 July 2018 in 5-minute periods. We understand that access constraints prevented measurements at SSR4, SSR6 and SSR8.	Of the 12 receptors within the vicinity of the onshore substation locations identified as being noise sensitive (as agreed with the ETG), permission was given at nine for equipment to be installed for noise measurements. The Applicants consider that this provides adequate coverage to reliably establish the background noise levels in the area. Background noise measurements were taken at 5-minute intervals alongside weather data measured at 15-minute intervals.
2. Survey Data	
2.1 Weather conditions The proposed operational noise sources would run continuously, and the assessment is therefore based on the night-time measurements, when the background noise levels are normally at their lowest. The Royal HaskoningDHV weather station data suggests that the night-time periods were largely unaffected by adverse weather conditions with only 15 minutes of measurement data excluded from the analysis in total.	The weather data collected onsite during the baseline noise survey was screened and compared against the baseline noise level data. Baseline noise measurements recorded during periods of unsuitable weather were removed from the dataset and omitted from further analysis. Specifically, all three 5-minute noise measurements collected within a single 15-minute window of unsuitable weather were removed. Where the minimum windspeed and / or any gust within the 15-minute weather measurement timeframe exceeded 5m/s, all affected 5-minute periods were removed so as to provide a robust screening procedure for weather compliant conditions.

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	Over the survey period, only one 15-minute window of unsuitable weather was recorded. As such, a total of three 5-minute measurements (totalling 15 minutes) were removed from the dataset.
2.2 Limits of measurement The measured night-time noise levels varied between 17 and 46 dB L_{Af90}, 5mins. 17 dB L_{Af90} is an extremely low background noise level and although not uncommon at night in this type of rural environment it is below the reliable measurement range for conventional environmental noise measurement equipment. BS4142 states that: *"Care is necessary in circumstances where background sound levels are low to ensure that self-generated and electrical noise within the measurement system does not unduly influence the reported values, which may be the case if the measured background sound levels are less than 10 dB above the noise floor of the measurement system."* Royal HaskoningDHV do not state the limits of measurement of the sound level meters used in their surveys, but the data files for the Rion NL-52 meters report "under range" results for levels below around 26 dB $L_{Af90,5mins}$. This means that the measured level is affected by self-noise from the meter, pre-amp and microphone chain and that the reported level is likely to be an over-estimate of the true noise level. The data files for the B&K 2250 meters do not include an under range field, but we would expect similar limits of	As identified by the Council's Consultant, 17dB L_{A90} is a very low background noise level and is below the measurement range of the noise meter. Both the Rion NL-52 and the B&K2250 sound level meters (SLMs) are certified Class 1 noise meters, which must meet specific criteria in terms of measurement accuracy and range. The "noise floor" of the Rion NL-52 SLM is 25dB(A) and the B&K2250 SLM is 24dB(A). Within the analysis of the background noise level at the onshore substation locations, the Applicants have included measured baseline noise levels below the noise floor of the respective SLM. It is considered that removing values below the noise floor of each SLM within the analysis would result in artificially increasing the overall background noise level above that already determined for the onshore substation locations. By including these outliers, the Applicants consider that a more representative background noise level for the onshore substation locations has been determined. The measurement range of each of the SLMs in accordance with IEC 61672 is stated in the manufacturers specification are as follows: • Rion NL-52 SLM: between 25dB(A) and 138dB(A); and • B&K 2250 SLM: between 24.8dB(A) and 139.7dB(A). The manufacturers specification for both SLMs also refers to 'Inherent noise', which relates to the electronic noise generated by the SLM itself. Taking into consideration the 'inherent noise level' stated within the manufacturers specification, baseline noise measurements made between 18dB(A) and 24dB(A) are still acceptable but should be used with caution as an increasing

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measurement to apply. It is therefore likely that the real background sound levels at very quiet times are lower than indicated by the meters.	error margin in those measurements would occur as noise levels reduce towards 17dB(A). The Council's Consultant's position regarding the acceptability of including low noise level measurements within the analysis of background noise has the potential to undermine any noise measurement surveys undertaken in similarly rural areas using currently available noise measurement equipment.
2.3 Sources of noise Analysis of the logged survey data shows a significant variation in background sound levels between survey locations and in different periods at the same location. For example, the reported locations for measurement locations SSR1 and SSR7 are shown in Figure 2. The co-ordinates for these positions are less than 100m apart, but the logged results in Figure 3 show distinct differences in the noise climate between the two measurements. The night-time levels measured at position SSR7, between 26 June and 3 July 2018, were consistently between around 30 and 40dB $L_{AF90,5mins}$ with only slow variations in level. This is typical for a background noise climate dominated by a specific, slowly varying source. By contrast, the night-time levels measured at position SSR1 between 3 and 12 July 2018 saw much larger variations in background sound levels, at times dropping as low as 17dB $L_{AF90,5mins}$. This variation is more typical for night-time background noise levels in rural environments where background sound is dominated by transient and distant sources. The exceptions to this are the levels measured at SSR1 on the nights of 6 – 7 July, 10 – 11 July and 11 – 12 July where the levels were more similar to those measured at SSR7.	The Applicants note that differences in the noise climate at specific locations over short distances can arise due a number of factors, including (but not limited to) distance from noise sources, local (prevailing) meteorological conditions and screening. The Applicants note that the coordinates presented within ***Table 25.24*** of the ES (APP-073) differ slightly to the coordinates presented within ***Table A25.5.1*** (APP-526). It should be noted that the coordinates presented within ***Table A25.5.1*** are as illustrated on ***Figure 25.2***. ***Figure 25.2*** of the ES (APP-305) shows the location of the noise sensitive receptors agreed with the ETG prior to undertaking the baseline noise survey and corresponds with the coordinates provided in ***Table A25.5.1*** (APP-526). These are different to the as-surveyed noise monitoring locations, which were dependent upon access agreements with property-owners decided at the time of survey. The coordinates for the as-surveyed baseline noise monitoring locations are presented within ***Appendix 1*** and shown on ***Figure 1, Appendix 2*** of this document. In some instances, the exact location of baseline noise monitoring equipment deviates slightly from the position of receptors shown in ***Figure 25.2*** of the ES (APP-305), as a result of agreements with individual property-owners as to where to deploy noise monitoring equipment on their premises. The as-

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Given the proximity of the two measurement locations, the data suggests that the noise climate at both locations was affected by a continuous noise source which did not drop below 29 dB $L_{AF90,5mins}$, on 28 June to 2 July and on 10-11 July but not from 3 July to 9 July. There is no discussion in the RH DHV reports of the dominant sources of background noise at these locations. However, from the information available to us, the most likely source of this noise is corona discharge on the existing overhead transmission lines. This effect is related to the electrical conductivity of the air, and therefore varies with humidity and precipitation. We have asked RH DHV to confirm whether air humidity was considered as a factor that might affect background noise levels in the area. However, given that only 15 minutes of data were excluded from the analysis of night-time levels it would appear that this has not been considered.	modelled baseline noise monitoring locations are presented within ***Figure 1***, ***Appendix 2 Figures***. In particular, SSR1 and SSR9 shown on ***Figure 25.2*** (APP-305) do not reflect the exact location where the baseline monitoring equipment was deployed due to access constraints and agreements formed with individual property owners at the time of the survey. The as-measured baseline noise monitoring position of SSR1 was in practice 200m from SSR7 (whereas the distance between SSR1 and SSR7 as shown on ***Figure 25.2*** (APP-305) is approximately 80m). This alternative location was at the rear of the property and was subject to increased distance and additional screening from Grove Road (considered to be the nearest noise source to the agreed monitoring locations (as opposed to the as-surveyed noise monitoring location)) by the property and associated outbuildings/structures. The agreed location of the noise receptor SSR1 was the property northeast of the onshore substation locations, approximately 30m from Grove Road. Whilst the as-surveyed location of SSR1 was within the grounds associated with the property, it was in practice set back 100m from Grove Road to the west of the property, as shown on ***Figure 1, Appendix 2 Figures***. The position of noise monitoring equipment deployed at this location is considered representative of SSR1 for the purposes of the assessment of potential noise impacts. The Applicants do not agree that a 'specific, slowly varying source' was present at SSR7. A review of the graphical outputs of the raw baseline noise survey data (see ***Appendix 3***) shows a clear diurnal day and night variation in the measured baseline noise levels. The measured background noise levels during the night-time periods has been identified to range between 28.6dB(A) and 42.8dB(A). This baseline noise level range does not support the suggestion that there is a 'steady' sound source operating in close proximity to the measurement location at SSR7. A 'steady' source of the type inferred by

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	the Council's Consultant would affect all the statistical noise parameters (i.e. L_{10}, L_{90} etc.) and as a result they would all follow a similar profile. The profile on the graphical outputs in ***Appendix 3*** indicates that this is not the case. Baseline noise measurements at SSR1 and SSR7 were undertaken on consecutive weeks and it is noted that the Councils' Consultant is comparing baseline noise levels recorded at SSR1 and SSR7 across different days. The Applicants do not consider that a direct comparison can be made between the baseline noise at these two monitoring locations at different times. Whilst there is some question on the local differences in the profile of baseline noise measurements, particularly regarding the early period of measurement at SSR1 (i.e. continuously rising / steady levels), the measurements recorded during the remainder of the week correlate well with the general baseline noise profile observed at other survey locations within the onshore substation study area (see ***Appendix 3***). The Applicants do not agree with the Council's Consultant's suggestion that a 'continuous noise source' occurred at specific days during the survey period. Due to the surveys being unattended, it is not immediately clear what the variance in measured baseline noise levels at SSR7 were caused by. However, the variance in noise level could be explained in part by differing contributions from noise sources on weekdays versus weekends. Further analysis was undertaken of the night-time baseline noise levels recorded at SSR7 and it has been identified that on 28th and 29th July 2018 a deviation from the baseline noise profile shown at the other measured locations was observed at the same time. To address this, the baseline noise dataset at SSR7 was re-analysed by the Applicants' Consultants (Royal HaskoningDHV) with the data for those periods removed. The result of this reduces the mean noise level at SSR7 to 33.5dB and the mode to 33dB, which is a reduction of up to 3dB of the stated background noise level within ***Appendix 25.3*** (APP-

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	524). Removal of this data as part of the further analysis therefore made no material difference to the characterisation of the overall study area. Baseline noise survey measurements were collected at SSR1 and SSR7 on consecutive weeks, although under similar weather conditions. Having reviewed the graphical outputs of baseline noise profiles at both SSR1 and SSR7 (***Appendix 3***), the Applicants consider the data shows very similar patterns indicative of a relatively consistent noise climate (albeit at two separate receptor locations) over a two-week period under weather compliant conditions. The Applicants confirm that humidity was not considered within ***Chapter 25*** of the ES (APP-073), given this is not standard practice within the BS4142:2014 +A1:2019. However, consultation with National Grid Electricity Transmission since submission of the Applications has identified that corona discharge noise from overhead transmission lines occurs only under very specific meteorological conditions, including (but not limited to) periods of high humidity or damp or drizzly weather. Damp and drizzly weather would have been recorded by the *in-situ* weather station. Any baseline noise survey measurements recorded during such periods would have fallen outside the scope of suitable weather conditions (as described in BS4142:2014 +A1:2019 and BS7445:2003) and been omitted from analysis of the baseline noise data to derive the background noise level. Further review of the weather data collected during the baseline noise survey indicates a wide variation in humidity. However, there is no set range of humidity levels over which the corona discharge occurs so increased humidity is not an indication that the corona noise would occur. If corona discharge was a feature of the measured baseline noise levels, there would be indication in the measured baseline noise data such as small fluctuations within the profile limited over a small dB range. The reference made by the Council's Consultant that the baseline noise levels in the area around SSR7 are affected by a 'specific, slowly

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	varying' source does not fit with the fluctuating profile of corona discharge noise.
There was little or no corona discharge noise audible when we visited the site and without information on how regularly the overhead power lines generate noise it is not possible to determine whether it is appropriate to include this source within the "typical" background noise climate at the receptors. It is clear from the supplied data that noise levels would be substantially lower if noise from this source were excluded. This is shown clearly at SSR9 where a modal background level of 18 dB $L_{AF90,5mins}$ was measured. It is vitally important to understand the extent to which this noise source effects the noise climate around the proposed substation sites as this has significant effect of the choice of representative background sound levels for the assessment and the context of the new source in this this existing noise climate.	The precise position of baseline noise monitoring equipment for SSR9 could not be installed at the location agreed with ESC due to the property owner not permitting access. Baseline noise monitoring equipment at SSR9 was therefore positioned in a secure location away from the property. As explained in ***Paragraph 29***, ***Appendix 25.3*** of the ES (APP-524), during post-survey analysis the surveyed location was considered not to be representative of the soundscape at the residential dwelling(s) at SSR9. However, a decision was made to include the data collected at this location within the noise impact assessment presented within ***Chapter 25*** of the ES (APP-073) for transparency purposes. Whilst presented within the ES, the data collected at SSR9 was ultimately not considered to be representative of the noise climate at the originally agreed receptor location. Where consideration of the baseline noise levels was needed to represent SSR9, the baseline noise levels measured at SSR12 were used instead. This was considered a suitable proxy location as it is a similar distance to the B1119 and B1121 roads as SSR9 and is located at a greater distance from the existing overhead lines (unlike the other possible proxy location at SSR3). The Applicants refer to their comment above regarding corona discharge noise.
3. Statistical Analysis Methodology	
Aside from the question of whether noise from overhead transmission lines should be included within measurements of the "typical" background noise climate there are also significant questions over the suitability of the	The Applicants refer to their responses at points 3.1, 3.2 and Section 4 below.

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methodology used by RH DHV to pick a single figure for representative background sound levels at each assessment location.	
3.1 Methodology used in ES RH DHV produced modal distribution plots of the measured background sound levels at each assessment position. These results are reported in Appendix 25.3 of the ES documentation along with the "Average L_{A90}", which we understand refers to the arithmetic mean. These figures are reproduced in Table 1 along with the "representative" figure, as determined by RH DHV. As identified in the comments in Table 1, the process used to determine the "representative" figure at each assessment position is not adequately explained, is inconsistent and generally favours the highest of the modal or mean values, or an entirely different higher value in each case. We do not consider the approach adopted to be either appropriate or in accordance with any methodology set out in the assessment standard. The noise limits in the draft requirement were set at 5 dB over the "representative" level at SSR5 (see Paragraph 121 of Chapter 25 of the ES). We understand that this figure was selected because it was the lower of the noise levels at the two defined monitoring positions.	As detailed in ***Paragraph 144***, ***Chapter 25*** of the ES (APP-073), the methodology used for the baseline noise survey was agreed with relevant stakeholders, including the Councils, during ETG meetings. The baseline noise survey was undertaken over a representative period in accordance with BS4142:2014 +A1:2019. The statement by the Council's Consultant that the Applicants have used the highest figure in the selection of either the mean or modal values is incorrect, misleading and strongly disputed. The background noise level at each baseline noise monitoring location was determined through undertaking detailed statistical analysis of the measured baseline noise levels at the individual baseline noise monitoring locations. This analysis included creating and reviewing graphical distribution plots, calculation of the standard deviation, mode and median baseline noise level at each of the baseline noise survey measurement positions. All statistical parameters were considered and reviewed alongside the percentage of sampling around the mode / mean noise levels. As set out in BS4142:2014 +A1:2019 there is not a 'one-size-fits-all' method of determining background noise levels. No requirement is set out in BS4142:2014 +A1:2019 stipulating the use of the same statistical parameter in the determination of background noise level at each location. However, the methodology of the statistical analysis has been undertaken following the guidance in BS4142:2014 +A1:2019 which is applicable for all of the receptor locations. The Applicants further note that the Council's Consultant contradicts their accusation that the Applicants have generally favoured the highest values

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	within the following paragraph where they state "*We understand that this figure was selected because it was the lower of the noise levels at the two defined monitoring locations*". The Applicants therefore consider the approach to selecting the mean or modal value as the representative background noise level at each monitoring location is sufficiently sound and justified.
3.2 Clarification Note We questioned RH DHV on the validity of the methodology used in the ES to determine representative background noise levels. RH DHV issued a "Clarification note" in October 2020 which sets out a different assessment methodology and contradicts the ES. This states that: "*To determine an average background noise level representative of the onshore substation location, the statistical means for all noise sensitive receptor locations were averaged - calculated as 29.1dB. Separately, the statistical modal values for all noise sensitive receptor locations were averaged, which was calculated as 29.3dB1. The averaged means and the averaged modes were then compared against each other to understand the range between the statistical parameters (calculated to be 0.2dB). When rounded to the nearest whole integer, a background noise level of 29dB is considered representative.*" Averaging statistical modes and means across multiple positions across a very large assessment area is an extremely unusual choice of analysis technique and unsupported by BS4142 or any other standard or guidance.	The Applicants do not agree with the suggestion made by the Council's Consultant that an inappropriate methodology has been followed to determine a representative background noise level. As stated in the Applicants' response to LIR topic 3.1, the determination of background noise levels came as a result of undertaking detailed statistical analysis of the measured levels at the individual noise measurement positions. This analysis included creating and reviewing graphical distribution plots, calculation of the standard deviation, mode and median baseline noise level at each of the baseline noise survey measurement positions. All statistical parameters were considered and reviewed alongside the percentage of sampling around the mode / mean noise levels. There is not a 'one-size-fits-all' method of determining background noise levels. No requirement is set out in BS4142:2014 +A1:2019 stipulating the use of the same statistical parameter in the determination of background noise level at each location. However, the methodology of the statistical analysis has been undertaken following the guidance in BS4142:2014 +A1:2019, which is applicable for all of the receptor locations. This approach accords with the procedure referred to in BS4142:2014 +A1:2019.

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	Furthermore, Section 8.1.4 of BS4142:2014 +A1:2019 states *"The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed.* *NOTE 1 To obtain a representative background sound level a series of either sequential or disaggregated measurements should be carried out for the period(s) of interest, possibly on more than one occasion. A representative level should account for the range of background sound levels and should not automatically be assumed to be either the minimum or modal value".* The approach referred to by the Council's Consultant does not replace or contradict the original statistical approach set out in ***Appendix 25.3***, ***Chapter 25*** of the ES (APP-524). The additional analysis methodology referred to expands upon the detail set out in ***Appendix 25.3*** and aligns with BS4142:2014 +A1:2019 in illustrating context across the study area. It is considered appropriate to not only determine the individual background noise levels, but to also consider each background noise level within the context of the wider study area. This concept justifies the number of measurement locations selected by the Applicants in order to sufficiently characterise any variation in baseline noise level over the study area. After choosing the representative background noise level of 29dB(A) based upon the two closest receptors to the onshore substation locations, further analysis was undertaken to understand the variance within baseline noise measurements at each of the other measurement locations. The graphical outputs of each of the baseline noise monitoring locations (presented in ***Appendix 3***) was reviewed with regard to the measured L_{A90} noise levels over the two 1-week measurement periods grouped temporally dependent on when their individual measurement period occurred. The

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	profiles shown on these graphical plots show good correlation and correspond with the fluctuations in baseline noise levels recorded over the measurement time period. The Applicants consider that, although there is a reasonable distance between the individual baseline noise survey measurement locations across the study area, the general trend within the data illustrates that a single background noise level adopted for the whole of the study area is justified
The noise levels measured at different receptors have been shown to be affected by localised noise from transmission lines. For example, the modal background noise level measured by RH DHV close to the transmission lines (SSR10) is 19 dBA higher than the same descriptor measured at a position away from the transmission lines (SSR9). An average of these two figures produces a number which not representative of either measured noise level and which is therefore irrelevant. We consider the methodology used by RH DHV to completely inappropriate and contrary to any standardised assessment methodologies or guidance on environmental noise assessment. The clarification document goes on to justify the choice of 29 dB as the background sound level by considering the modal and mean results measured at the two monitoring positions (SSR2 and SSR5). These results are discussed in detail in Section 4, along with results at the proposed third monitoring position (SSR3).	The Applicants note that the Council's Consultant has not substantiated their assumption that baseline noise levels measured at different receptors have been affected by localised noise from transmission lines. No evidence has been supplied to confirm this statement and this is contradictory to the Council's Consultant's earlier statement that *"There was little or no corona discharge noise audible when we visited the site and without information on how regularly the overhead power lines generate noise it is not possible to determine whether it is appropriate to include this source within the "typical" background noise climate at the receptors"*. The background noise level at SSR10, SSR1 and SSR7 was determined to be 31dB(A), 33dB(A) and 35dB(A) respectively. These three receptors are in proximity to a road noise source and the existing overhead transmission lines. However, the baseline noise levels at SSR10 are lower than both SSR1 and SSR7 despite closer proximity to the existing overhead transmission lines. If, as the Council's Consultant states, corona discharge noise was dominant and highly influential at all times, then the baseline noise levels at SSR10 would be expected to be higher than those at SSR7 and SSR1 due to that influence. The Applicants therefore believe that the repeated reference to the level of influence on the background noise levels from corona discharge is unfounded and misleading. The graphical plots in ***Appendix 3*** do not show the variation

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	that would be expected as a result of influence from corona discharge noise emanating from the existing overhead transmission lines.
4. Statistical Analysis	
4.1 BS4142 and the Association of Noise Consultants Guidance It is important to note that BS4142 does not set a single prescriptive methodology to determine a representative figure for background noise from a data series. It provides an example where the frequency distribution of measured background noise levels is plotted, and the modal value is chosen as the representative background level. However, the standard also states that *"…A representative level should account for the range of background sound levels and should not automatically be assumed to be either the minimum or the modal value"* The choice of representative background noise level is therefore based on interpretation and context. In March 2020 the Association of Noise Consultants published "BS 4142:2014+A1:2019 Technical Note" which provides guidance on a number of worked examples of the implementation of the Standard in real life scenarios. In relation to the assessment of background sound levels, the guide states: "*In practice, a range of approaches to the derivation of background sound levels should be considered as part of a complex assessment and the relevance and applicability of the derived values discussed. The time history, mean and mode values over the period(s) of interest would ordinarily be considered but no one method is always applicable. The assessor should use*	As detailed in ***Paragraph 144***, ***Chapter 25*** of the ES (APP-073), the methodology used for the baseline noise survey was agreed with relevant stakeholders, including the Councils, during ETG meetings. The baseline noise survey was undertaken over a representative period in accordance with BS4142:2014 +A1:2019. The statement by the Council's Consultant that the Applicants have used the highest figure in the selection of either the mean or modal values is strongly disputed. The background noise level at each baseline noise monitoring location was determined through undertaking detailed statistical analysis of the measured baseline noise levels at the individual baseline noise monitoring locations. This analysis included creating and reviewing graphical distribution plots, calculation of the standard deviation, mode and median baseline noise level at each of the baseline noise survey measurement positions. All statistical parameters were considered and reviewed alongside the percentage of sampling around the mode / mean noise levels. There is not a 'one-size-fits-all' method of determining background noise levels. No requirement is set out in BS4142:2014 +A1:2019 stipulating the use of the same statistical parameter in the determination of background noise level at each location. However, the methodology of the statistical analysis has been undertaken following the guidance in BS4142:2014 +A1:2019, which is applicable for all of the receptor locations. The most sensitive receptors in proximity to the onshore substation locations have therefore been identified as SSR2 and SSR5 NEW. Therefore, it is

LIR topic	Applicants' Comments
their professional judgement to evaluate a representative value in each situation." Our detailed analysis of the available data for the three monitoring positions (including SSR3 as requested by East Suffolk Council) is contained in the following sections of this report.	reasonable that the baseline noise levels measured at these receptors should form the foundation for defining the operational noise limits secured under Requirement 26 and Requirement 27 of the ***draft DCO*** (APP-023). The Applicants are considering a request from the Councils for an operational noise limit at SSR3 secured via a DCO Requirement. Further context regarding this matter is provided in the Applicants response at LIR topic 5.
4.2 SSR2 Logged night-time background noise levels measured at position SSR2 are presented in Figure 4 and RH DHV's modal distribution plot is shown in Figure 5. The original RH DHV analysis resulted in a modal background noise level of 27 dB $L_{Af90,5mins}$ and a mean level of 31.5 dB $L_{Af90,5mins}$. In their clarification note RH DHV state that : *"The spread of data observed using the graphical outputs of step 10 identified the mean value as the most representative noise value at noise receptor SSR2 due to its bi-modal spread."* This analysis is not accepted, the modal distribution shows a clear mode at 27 dB $L_{Af90,5mins}$. This compares well with the logged noise levels which show a consistent "shelf" at around this level. We therefore consider the 27 dB L_{Af90} to be the representative background sound level based on the measurement data supplied by RH DHV. However, this measurement period corresponds with the measurements at SSR7 when background sound levels were raised by corona discharge from transmission lines. We would therefore expect	With reference to the graphs presented within ***section 25.3.7***, ***Appendix 25.3*** of the ES (APP-524), the Applicants note that whilst a modal peak is observed, only 24% of the cumulative sampled noise levels at SSR2 are equal to or below this noise level. A second peak centred around 35-36 dB $L_{Af90,5mins}$ is observed with an aggregation of measured noise levels ranging between 33–37 dB $L_{Af90,5mins}$ (shown as clearly defined peaks). It was therefore considered more appropriate to use the arithmetic average of the two modal peaks which centres around 31dB $L_{Af90,5mins}$. This average value is also observed as having 50% of the cumulative sampling which in this case is considered to be more statistically robust and repeatable. The Applicants therefore consider that the use of 27 dB $L_{Af90,5mins}$ as suggested by the Council's Consultant is unjustified and not appropriate. The Applicants note that the Council's Consultant has not substantiated their assumption that baseline noise levels measured at different receptors have been affected by localised noise from transmission lines. No evidence has been supplied to confirm this statement and this is contradictory to the Council's Consultant's earlier statement that *"There was little or no corona discharge noise audible when we visited the site and without information on how regularly the overhead power lines generate noise it is not possible to*

LIR topic	Applicants' Comments
background sound levels to be substantially lower at this location in the absence of corona discharge noise.	*determine whether it is appropriate to include this source within the "typical" background noise climate at the receptors"*. The background noise level at SSR2 and SSR7 was determined to be 31dB(A) and 35dB(A) respectively. SSR2 is approximately 310m away from the existing alignment of the existing overhead transmission line whereas SSR7 is only 60m. The noise climates of these two baseline noise monitoring locations compared by the Council's Consultant are considered to be dissimilar with regard to potential contribution from the existing overhead transmission lines and the Applicants consider these locations are not comparable. As stated above, the Applicants therefore believe that the repeated reference to the level of influence on the background noise levels from corona discharge is unfounded and misleading. The graphical plots in ***Appendix 3*** do not show the variation that would be expected as a result of influence from corona discharge noise emanating from the existing overhead transmission lines.
4.3 SSR3 Logged night-time background noise levels measured at position SSR3 are presented in Figure 6 and RH DHV's modal distribution is shown in Figure 7. The original RH DHV analysis resulted in a modal background noise level of 24 dB $L_{Af90,5mins}$ and a mean level of 26.1 dB $L_{Af90,5mins}$, but concluded without justification that the representative noise level at this position was 30 dB $L_{Af90,5mins}$. The modal distribution plot shows two peaks, the mode being at 24 dBA but with a with a secondary peak at 30 dBA. This secondary peak is presumably the undocumented reason for the choice of 30 dBA as representative background sound level in the original assessment.	A further review of the SSR3 graphical plots in ***Appendix 3*** for the night-time reference period was undertaken following the comments made by the Council's Consultant. The graph shows the baseline noise levels at SSR3 ranges from 18dB(A) to 39dB(A). Whilst the Applicants agree there is a modal baseline noise value around 24dB, there are other significant peaks around 30dB(A). As a result of this bi-modal distribution it is considered to be inappropriate to use the modal value suggested by the Council's Consultant. For consistency the same statistical analysis methodology was employed at SSR2 as was used in the analysis of SSR3 (i.e. using the arithmetic average value between the two modal peaks). The Applicants accept this background noise level was misreported within ***chapter 25*** of the ES (APP-073) and agree that a mean noise level of 26.1 dB $L_{Af90,5mins}$ is appropriate at SSR3. The

LIR topic	Applicants' Comments
The above analysis is not accepted, and we consider the true modal value of 24 dB L_{Af90} to be representative of the background sound level measured at this position. Again, this corresponds with a clear "shelf" in the logged data, although at times the noise levels dropped to substantially below this. These periods of lower levels correspond with measurements at SSR1 when noise from transmission lines did not appear to be to be present. It is therefore likely that the representative figure for background sound levels would be lower still in the absence of noise from transmission lines.	Applicants have reviewed all background noise levels at each of the monitoring locations and have not identified any further misreported values. Further consideration of the background noise level at SSR3 is provided below within this response. As per the Council's Consultant's reference to measurements of low noise levels in rural areas, the Applicants note that the measured baseline noise levels at SSR3 included levels below the measurement ranges of the SLMs. The measurement range of each of the SLMs in accordance with IEC 61672 is stated in the manufacturers specification are as follows: • Rion NL-52 SLM: between 25dB(A) and 138dB(A); and • B&K 2250 SLM: between 24.8dB(A) and 139.7dB(A). The manufacturers specification for both SLMs also refers to 'Inherent noise', which is understood to relate to the electronic noise generated by the SLM itself. Taking into consideration the 'inherent noise level' stated within the manufacturers specifications, baseline noise measurements made between 18dB(A) and 24dB(A) are still acceptable but should be used with caution as an increasing error margin in those measurements would occur as noise levels reduce towards 17dB(A). The cumulative sampling of the noise levels at SSR3 indicates that up to 41% of the measured data is below the level that the Council's Consultant would term as the "noise floor" of the SLM. This adds further weight to the use of 26.1 dB $L_{Af90,5mins}$ as the most appropriate background noise descriptor at this location. The background noise level at SSR1 and SSR3 was determined to be 33dB(A) and 26dB(A) respectively. SSR3 is approximately 210m away from the existing overhead transmission lines, whereas SSR1 is approximately 55m. The difference in measured baseline noise levels can be partially

LIR topic	Applicants' Comments
	attributed to distance from the nearest noise source, in the case of SSR1 and SSR3 considered to be Grove Road. The Applicants note that the Council's Consultant has not substantiated their assumption that baseline noise levels measured at different receptors have been affected by localised noise from transmission lines. No evidence has been supplied to confirm this statement and this is contradictory to the Council's Consultant's earlier statement that *"There was little or no corona discharge noise audible when we visited the site and without information on how regularly the overhead power lines generate noise it is not possible to determine whether it is appropriate to include this source within the "typical" background noise climate at the receptors"*. As stated above, the Applicants therefore believe that the repeated reference to the level of influence on the background noise levels from corona discharge is unfounded and misleading. The graphical plots in ***Appendix 3*** do not show the variation that would be expected as a result of influence from corona discharge noise emanating from the existing overhead transmission lines.
SSR5 Logged night-time background sound levels measured at position SSR5 are presented in Figure 8 and RH DHV's modal distribution plot is shown in Figure 8. The original analysis resulted in a modal background noise level of 29 dB $L_{Af90,5mins}$ and a mean level of 27.9 dB $L_{Af90,5mins}$. In their clarification note RH DHV state that : *"Similarly, the modal value was identified as the most representative noise value at noise receptor SSR5 due to its distinct unimodal peak."*	A further review of the graphical plots in ***Appendix 3*** for the night-time reference period was undertaken following the comments made by the Council's Consultant. The graph shows the baseline noise levels at SSR5 range from 20dB to 37dB(A) and a modal baseline noise level around 29dB. The background noise level at SSR5 and SSR7 was determined to be 29dB(A) and 35dB(A) respectively. SSR5 is approximately 400m away from the existing overhead transmission lines, whereas SSR7 is approximately 60m. The noise climates of these two baseline noise monitoring locations compared by the Council's Consultant are considered to be dissimilar with regard to potential contribution from the existing overhead transmission lines and the Applicants consider these locations are not comparable.

LIR topic	Applicants' Comments
We agreed that the model distribution of the available data shows 29 dB $L_{Af90,5mins}$ to be the typical background noise level measured by RH DHV at this position. However, this measurement period corresponds with the measurements at SSR7 when background sound levels were raised by corona discharge from transmission lines. It is therefore likely that background sound levels would be substantially lower at this location in the absence of noise from transmission lines.	The Applicants note that the Council's Consultant has not substantiated their assumption that baseline noise levels measured at different receptors have been affected by localised noise from transmission lines. No evidence has been supplied to confirm this statement and this is contradictory to the Council's Consultant's earlier statement that *"There was little or no corona discharge noise audible when we visited the site and without information on how regularly the overhead power lines generate noise it is not possible to determine whether it is appropriate to include this source within the "typical" background noise climate at the receptors"*. As stated above, the Applicants therefore believe that the repeated reference to the level of influence on the background noise levels from corona discharge is unfounded and misleading. The graphical plots in ***Appendix 3*** do not show the variation that would be expected as a result of influence from corona discharge noise emanating from the existing overhead transmission lines.
5. Revised Noise Limit	
As discussed, a review of the supplied raw background noise data shows that noise from existing transmission lines is likely to have had a significant effect on the background noise climate at the receptors. There is not sufficient information to determine whether this occurs sufficiently regularly to be considered a permanent part of the noise climate in the area. If noise from overhead transmission lines were excluded from the assessment the "typical" background sound levels could be substantially lower, as shown at SSR9 where a modal level of 18 dB $L_{Af90,5mins}$ was measured. However, in the absence of any information on the noise from overheard transmission lines and based solely on the data supplied by RH DHV we	The Applicants note that the Council's Consultant has not substantiated their assumption that baseline noise levels measured at different receptors have been affected by localised noise from transmission lines. No evidence has been supplied to confirm this statement and this is contradictory to the Council's Consultant's earlier statement that *"There was little or no corona discharge noise audible when we visited the site and without information on how regularly the overhead power lines generate noise it is not possible to determine whether it is appropriate to include this source within the "typical" background noise climate at the receptors"* Additionally, the Council's Consultant states *"If noise from overhead transmission lines were excluded from the assessment the "typical"*

LIR topic	Applicants' Comments
consider that the "typical" noise levels at the three monitoring positions including corona discharge noise should be as follows: • SSR2 – 27 dB $L_{Af90,5mins}$ • SSR3 – 24 dB $L_{Af90,5mins}$ • SSR5 – 29 dB $L_{Af90,5mins}$ According to the methodology set out in the ES, the noise limit in Requirement 26 should be determined by the lowest of these values, the level at SSR3. This would result in a 5 dB reduction in the noise limit set within Requirement 26 (excluding separate discussions of the appropriate LOAEL value).	*background sound levels could be substantially lower, as shown at SSR9 where a modal level of 18 dB $L_{Af90,5mins}$ was measured."* As stated previously, the Applicants therefore consider that the repeated reference to the level of influence on the background noise levels from corona discharge is unfounded and misleading. Without evidence, the Applicants consider that the claim that corona discharge noise associated with the existing overhead transmission lines affects the baseline noise survey measurements should be disregarded. With reference to the graphs presented within ***section 25.3.7***, ***Appendix 25.3*** of the ES (APP-524), the Applicants note that whilst a modal peak is observed, only 24% of the cumulative sampled noise levels are equal to or below this noise level. A second peak centred around 35-36 dB $L_{Af90,5mins}$ is observed with an aggregation of measured noise levels ranging between 33–37 dB $L_{Af90,5mins}$ (shown as clearly defined peaks). It was therefore considered more appropriate to use the arithmetic average of the two modal peaks which centres around 31dB $L_{Af90,5mins}$. This average value is also observed as having 50% of the cumulative sampling which in this case is considered to be more statistically robust and repeatable. The Applicants therefore consider that the use of 27 dB $L_{Af90,5mins}$ as suggested by the Council's Consultant is not appropriate. A further review of the graphical plots in ***Appendix 3*** for the night-time reference period was undertaken following the comments made by the Council's Consultant. The graph shows the baseline noise levels at SSR3 range from 18dB to 39dB(A). Whilst the Applicants agree there is a modal value around 24dB baseline noise level, there are other significant peaks around 30dB(A). As a result of this bi-modal distribution it is considered to be inappropriate to use the modal value suggested by the Council's Consultant.

LIR topic	Applicants' Comments
	For consistency the same statistical analysis methodology was employed at SSR2 as was used in the analysis of SSR3 (i.e. using the arithmetic average value between the two modal peaks). The Applicants agree that a mean noise level of 26.1 dB $L_{Af90,5mins}$ is appropriate at this location. A further review of the graphical plots in ***Appendix 3*** for the night-time reference period was undertaken following the comments made by the Council's Consultant. The graph shows the baseline noise levels at SSR5 range from 20dB to 37dB(A) and a modal baseline noise level around 29dB. The Applicants do not consider it appropriate to have differing noise limit levels at different receptors and that the proposed background noise level of 29dB is wholly appropriate given the context of the Projects' specific study area. It should be noted that other DCO applications of a similar nature do not have individual limits at individual receptors (for example offshore wind farms East Anglia ONE and THREE, Hornsea One Offshore Windfarm, Hornsea Two Offshore Windfarm and Dogger Bank Creyke Beck). Historically, this has been demonstrated to be the case even when taking into account the variance in measured background noise levels for each specific project. Furthermore BS 4142:2014 details that *"absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This especially true at night".* The World Health Organisation (WHO) Night time Noise Guidelines for Europe (NNG) was published to complement the WHO Guidelines for Community Noise and introduced additional research on the effects of night-time noise exposure. In summary, the NNG found that below the level of 30dB(A) Lnight outside there are no observed effects on sleep. Furthermore, there is no evidence that biological effects observed at levels below 40dB(A) Lnight outside are harmful to health. At levels above 55dB(A) Lnight outside, the NNG detailed that adverse health effects occur frequently and there is limited

LIR topic	Applicants' Comments
	evidence that the cardio-vascular system is coming under stress. Therefore, based on the NNG, the following effect levels for assessing against the Noise Policy Statement for England (NPSE) categories are: • <30dBA Lnight outside – NOEL; • <40dBA Lnight outside – LOAEL; and • >55dBA Lnight outside – SOAEL. Following the BS4142:2014+A1:2019 guidance and taking into account the NNG effect level of LOAEL, the predicted rating level at any of the noise sensitive receptors is not significant in EIA terms. However, in order to present a conservative and robust assessment the Applicants have followed the guidance detailed in BS4142:2014+A1:2019 to determine a reasonable operational noise rating level of 34dB (which includes acoustic characteristic corrections) which is secured through Requirement 26 and Requirement 27 of the ***draft DCO*** (APP-023). This level is significantly below the NNG LOAEL guidance and therefore aligns with the guidance presented in the NPSE and PPG: Noise. In light of the arguments made within this response, the Applicants believe that the measured baseline noise survey data and its subsequent analysis are reasonable and appropriately characterises the existing noise environment of the onshore substation locations in accordance with current relevant guidance.

3 Conclusion

6. In light of the Councils' Consultants comments and the Applicants' responses above, the Applicants consider that:

- Prior to undertaking the baseline survey within the onshore substation study area, appropriate consultation was undertaken with the ETG (including the relevant planning authority and Environment Agency) through the issuance of a Method Statement, outlining a detailed survey approach in order to ensure the survey duration and geographical extent was appropriate and aligned with expectations;
- The baseline noise monitoring survey was undertaken in line with the methodology agreed with relevant stakeholders through ETG meetings and adheres to the relevant guidance;
- The statistical analysis methodology for establishing background noise levels is in line with the relevant guidance and robustly justified; and
- The statistical analysis undertaken to establish background noise levels at each respective receptor location and the overall background noise level adopted for the onshore substation locations is robust and representative.

7. The representative background noise level used for the onshore substation location was derived from statistical analysis of night-time baseline noise levels at each monitoring location. This is considered to be a precautionary approach and robust in ascertaining the existing noise climate with the onshore substation study area. It is the professional opinion of Royal HaskoningDHV that the baseline noise survey undertaken for the Projects goes above what is required by the relevant industry-accepted guidance (in terms of survey duration and integration period), and that the background noise level derived for the onshore substation location is considered to be an honest, representative value of the existing noise conditions experienced within the onshore substation study area.

8. It follows that the Applicants believe that the background noise level established for the onshore substation site remains valid and representative of the existing noise climate at onshore substation site.

Appendix 1 As-Surveyed Baseline Noise Monitoring Coordinates

Table A1 As-Surveyed Baseline Noise Monitoring Coordinates

Receptor	X	Y
SSR1	641610	261663
SSR2	641827	261140
SSR3	641254	261736
SSR5	641172	260798
SSR7	641880	261642
SSR9	640717	261915
SSR10	639933	260365
SSR11	640518	260293
SSR12	640244	261820

Appendix 2 Figures

N

SSR9
SSR12
SSR3
SSR1
SSR7
SSR2
SSR8
SSR5
SSR4
SSR5 New
SSR6
SSR10
SSR11

Legend

- East Angia ONE North and East Anglia TWO Onshore Development Area
- As-Surveyed Baseline Noise Monitoring Locations
- Agreed Noise Sensitive Receptor Locations (as per Figure 25.2 of the ES (APP–305))

SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment
1	14/12/2020	AB	First Issue.

Prepared: AB
Checked: BD
Approved: FM

1:10,000 Scale @ A3

0 200 400 Metres

East Anglia ONE North and East Anglia TWO

Noise Sensitive Receptor Locations and As-Surveyed Baseline Noise Monitoring Locations

Drg No	EA1N-EA2-DEV-DRG-IBR-001258
Rev	1
Date	14/12/20
Figure	1

Coordinate System: BNG Datum: OSGB36

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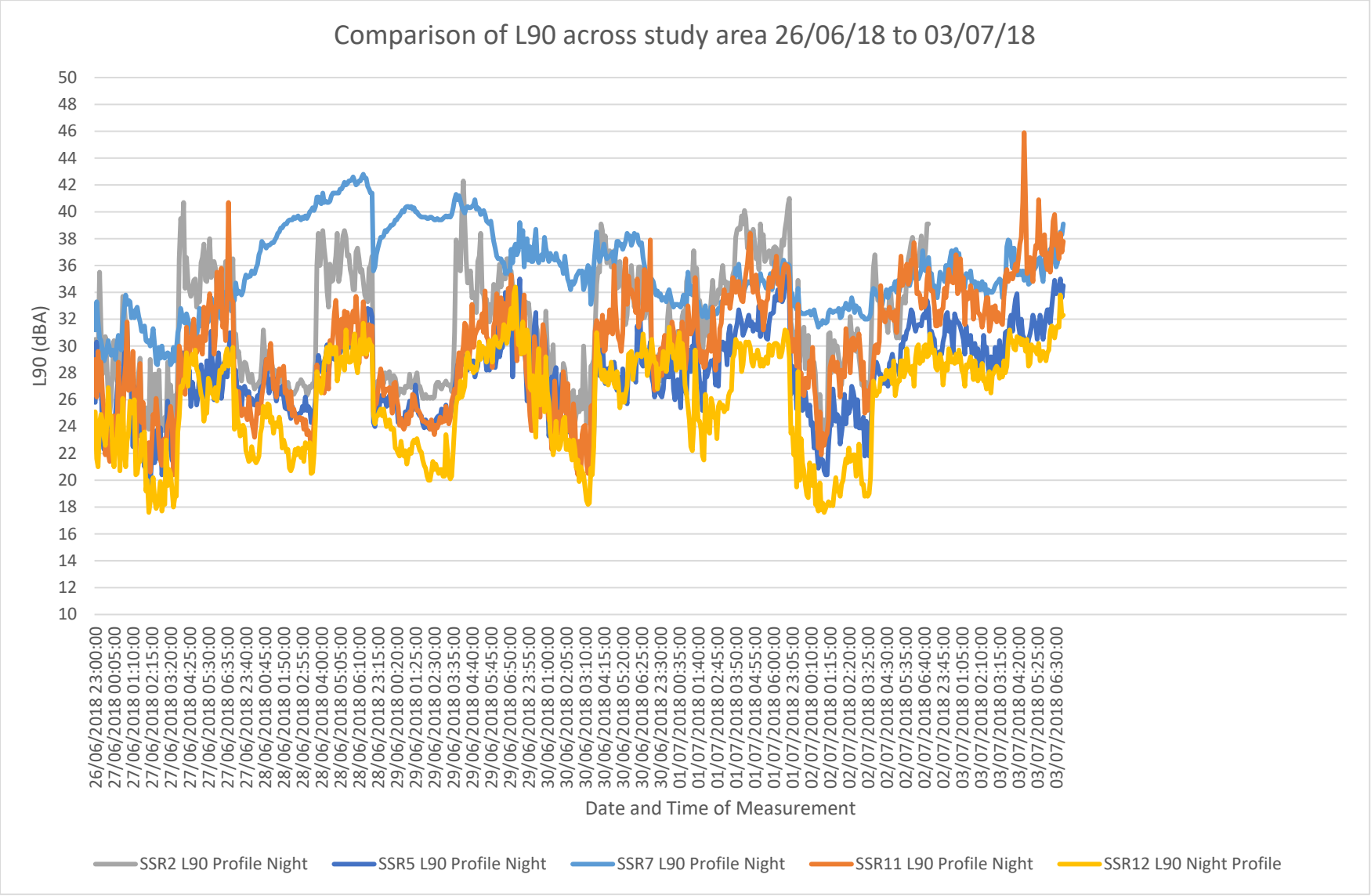
Appendix 3 Baseline Noise Data Graphical Outputs


Comparison of L90 across study area 26/06/18 to 03/07/18
L90 (dBA)
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12
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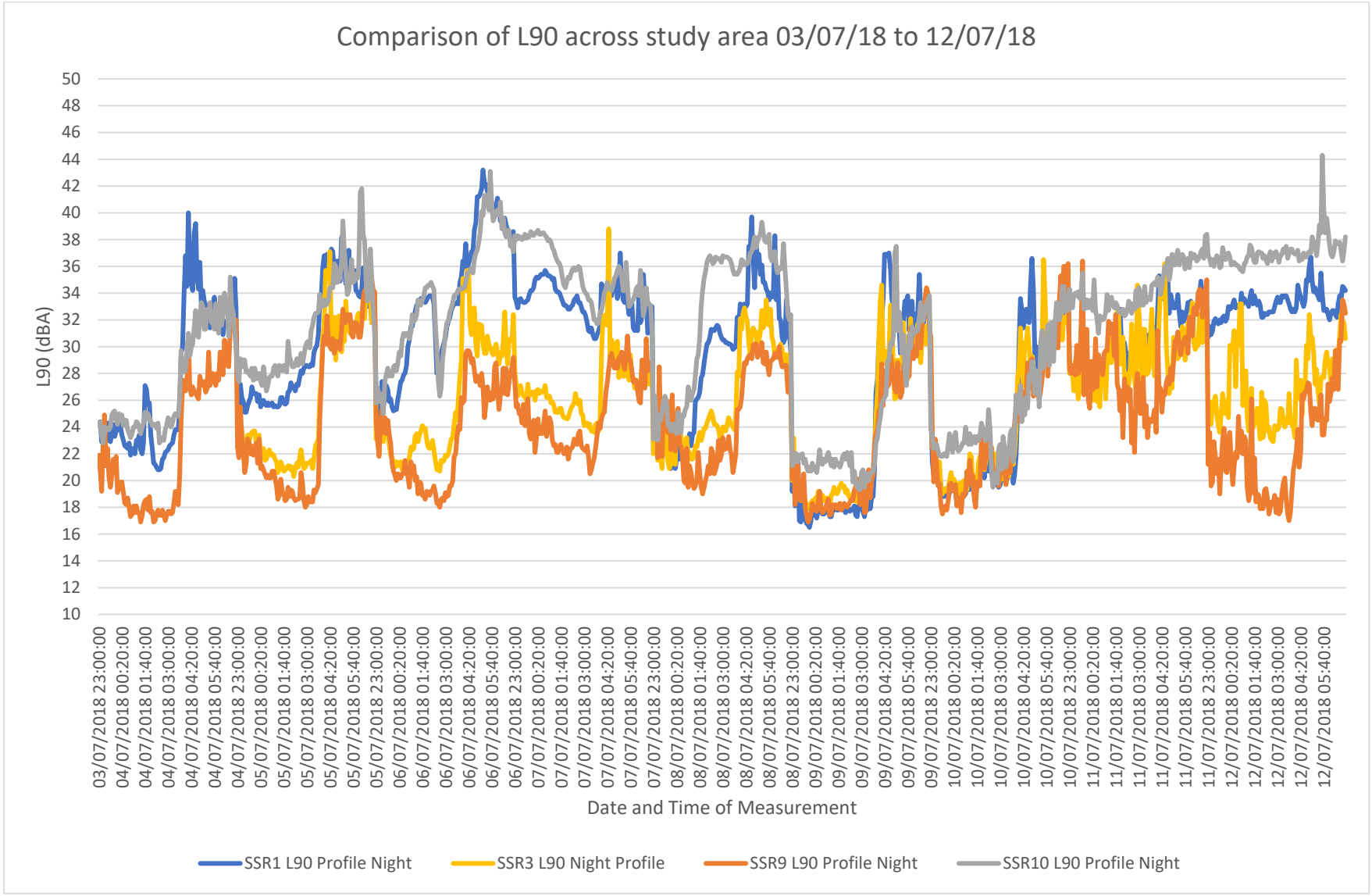
03/07/2018 02:10:00
03/07/2018 03:15:00
03/07/2018 04:20:00
03/07/2018 05:25:00
03/07/2018 06:30:00
Date and Time of Measurement
SSR2 L90 Profile Night
SSR5 L90 Profile Night
SSR7 L90 Profile Night
SSR11 L90 Profile Night
SSR12 L90 Night Profile


Comparison of L90 across study area 03/07/18 to 12/07/18
L90 (dBA)
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12/07/2018 04:20:00
12/07/2018 05:40:00
Date and Time of Measurement
SSR1 L90 Profile Night
SSR3 L90 Night Profile
SSR9 L90 Profile Night
SSR10 L90 Profile Night