East Anglia ONE North and East Anglia TWO Offshore Windfarms

Clarification Note

Noise Modelling

Applicants: East Anglia ONE North Limited and East Anglia TWO Limited
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Applicable to East Anglia ONE North and East Anglia TWO

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Description of Revisions			
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Glossary of Acronyms

AIS	Air-Insultated Switchgear
AJA	Adrian James Acoustic Limited
BS	British Standard
DCO	Development Consent Order
ES	Environmental Statement
ESC	East Suffolk Council
ETG	Expert Topic Group
GIS	Gas-Insulated Switchgear
HVAC	High Voltage Alternating Current
Hz	Hertz
IEMA	Institute of Environmental Management and Assessment
LOAEL	Lowest Observed Adverse Effect Level
NGET	National Grid Electricty Transmission
NOEL	No Observed Effect Level
OAEL	Observed Adverse Effect Level
PRoW	Public Right of Way
SOAEL	Significant Observed Adverse Effect Level
SoCG	Statement of Common Ground

Glossary of Terminology

Applicants	East Anglia TWO Limited / East Anglia ONE North Limited.
Cable sealing end compound	A compound which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
Cable sealing end (with circuit breaker) compound	A compound (which includes a circuit breaker) which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
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.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land, and connect to the onshore cables.
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 cable route	This is the construction swathe within the onshore cable corridor which would contain onshore cables as well as temporary ground required for construction which includes cable trenches, haul road and spoil storage areas.
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 Clarification Note has been prepared by East Anglia TWO Limited and East Anglia ONE North Limited (the Applicants) to clarify aspects of the East Anglia TWO project and East Anglia ONE North project (the Projects) Development Consent Order (DCO) applications (the Applications).

2. This Clarification Note relates to noise and vibration matters. Specifically, it includes the results and discussion of updated noise modelling undertaken to reflect the revised design parameters (including onshore substation footprints and building/external equipment heights) for both Projects as committed to within the ***Project Update Note*** submitted to the Examinations at Deadline 2 (REP2-007) and the ***Deadline 3 Project Update Note*** (REP3-052). This Clarification Note also reflects ongoing engagement with the supply chain and designers regarding the mitigation of noise emissions from operational substation equipment, as described in the ***Deadline 4 Project Update Note*** (document reference ExA.AS-2.D4.V1). This has allowed a reduction of the maximum received operational noise rating levels secured within the ***draft DCO*** (REP3-011) from 34dBA to 32dBA at any time at a free field location immediately adjacent to noise receptors SSR2 and SSR5 NEW.

3. In addition, the Applicants have also committed to an additional noise sensitive location, within the vicinity of SSR3 (Little Moor Farm) being included within Requirement 26 and 27 of the ***draft DCO*** (REP3-011). The maximum operational noise rating limit applied to SSR3 is 31dBA. The ***draft DCO*** (REP3-011) will be updated and submitted at Deadline 5 to reflect these changes.

4. Also within this Clarification Note, the Applicants have sought to address queries raised during the preparation of the Statement of Common Ground (SoCG) with East Suffolk Council and Suffolk County Council (the Councils) and Adrian James Acoustics Limited (AJA), who have been commissioned by East Suffolk Council to provide technical noise and vibration advice during the Examination of the Applications. Herein, AJA are referred to as 'the Council's Consultants'. Information provided within this Clarification Note is also of relevance to the comments on the Applications made by the Councils within their respective Relevant Representations (RR-002 and RR-007) and Joint Local Impact Report (REP1-132). In particular, this document provides:

   - An assessment of operation phase noise upon the local non-residential amenity areas (see ***section 5***);
   - Clarification regarding the context of the background noise within the onshore substation study area (see ***section 6.1***);

- A discussion regarding the operation phase noise limits (see ***section 6.2***);
- Further information in relation to uncertainty in the model calculations (see ***section 6.3***); and
- Indicative details regarding the dimensions of key items of onshore substation plant (see section 6.4).

5. 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 Preliminary Information

2.1 Reduced Footprint and Revised Layout

6. Within the ***Project Update Note*** (REP2-007) submitted to the Examinations at Deadline 2 the Applicants have committed to a reduced onshore substation footprint. Since submission of the Applications, the footprint of both Projects' onshore substations has been reduced from 190m x 190m to 190m x 170m.

7. In addition, within the ***Deadline 3 Project Update Note*** (REP3-052) the Applicants have committed to a reduction in the maximum height of buildings and external equipment comprising the onshore substations.

8. In light of the reduced onshore substation footprints (with the associated shift in the location of plant) and the reduced infrastructure heights, the Applicants have undertaken further modelling of operation phase noise at the noise sensitive receptors identified within ***Chapter 25*** of the ES (APP-073). In undertaking this round of modelling, the Applicants have had regard to the comments raised by the Councils and the Council's Consultants regarding the operation phase noise modelling.

9. ***Section 3*** of this Clarification Note provides information on the parameters of the updated noise model and addresses comments received from the Councils and the Council's Consultants in relation to the operation phase noise model. The outputs of the updated noise model run are then presented and discussed within ***Section 4***. An assessment of operation phase noise on non-residential amenity is provided in ***Section 5*** and further clarification on other outstanding noise and vibration matters is included within ***Section 6***.

2.2 Reduced Sound Power Levels

10. Through ongoing engagement with the supply chain and designers regarding the mitigation of noise emissions from the onshore substation, the Applicants have identified design refinements with the aim of mitigating noise emissions from key items of equipment. The reduced sound power levels from the following items of equipment are as follows:

- STATCOM Air Coolers – 82dBA per bank of five units[1];
- STATCOM Filter Capacitor Banks – 78dBA per phase; and
- STATCOM Air Core Reactors – 78dBA per phase.

[1] Within the ***Table 25.30***, ***Chapter 25*** of the ES (APP-073), the Sound Power Level for Air Coolers was presented per unit (i.e. 80dB(A) per unit). Logarithmically, a bank of 5 units equates to 87dB(A).

11. The above information has been incorporated into the revised noise modelling, as per ***Section 4.1***.

3 Clarification of Model Parameters

3.1 Size and Arrangement of Onshore Substation

12. As per the ***Deadline 3 Project Update Note*** (REP3-052), since submission of the Applications the Applicants have committed to reduced onshore substation building heights and external equipment heights (as shown in ***Table 1***) and revised the estimated finished ground levels of the onshore substations and National Grid substation (as shown in ***Table 2***) in order to establish a maximum height above ordnance datum of buildings and external equipment.

Table 1 Revised Building and External Equipment Heights

Building / External Equipment	Building or External Equipment Height Presented within the Applications	Revised Maximum Building or External Equipment Height Committed to at Deadline 3	Notes
Harmonic filters	18m	**14m**	4m reduction in maximum height achieved
STATCOM building	15m	**12m**	3m reduction in maximum height achieved
Gas-Insulated Switchgear (GIS) building	15m	**14m**	1m reduction in maximum height achieved

Table 2 Revised Finished Ground Levels

Substation	Level on which Photomontages were based (Chapter 29 (APP-077))	Revised Finished Ground Level (Estimated)	Notes
Onshore Substation – Eastern Location*	20.7 AOD	**18.7m AOD**	2.0m reduction in finished ground level achieved
Onshore Substation – Western Location*	18.2m AOD	**18.2m AOD**	No change
National Grid Substation*	18.9m AOD	**18.2m AOD**	0.7m reduction in finished ground level achieved
* Refer to Figure 1 of the Project Update Note (REP2-007) for locations of the substations			

13. The revised noise modelling has been undertaken using the information presented within ***Table 1*** and ***Table 2***. As such, the model outputs presented within ***Section 4*** of this Clarification Note have been calculated using this updated information.

14. The arrangement of the Projects' onshore substations (as revised due to the reduction in footprint) is shown on ***Figure 1***, ***Appendix 1***. An inventory of the Projects' onshore substations equipment that was included within the noise model has been provided within ***Appendix 2***.

3.2 Effect of Humidity upon Corona Noise

15. 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 (NGET) 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.

16. Damp and drizzly weather occurring during the background noise surveys 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.

17. Further review of the weather data collected during the baseline noise survey indicates a wide variation in humidity. However, if corona discharge was a feature of the measured baseline noise levels it would be visible within the graphical measured baseline noise data profiles at each affected monitoring location over specific time periods, as small fluctuations over a small dB range. There are no such fluctuations that fit this description observed within the baseline noise profiles (under appropriate monitoring conditions) for any of the baseline noise monitoring locations. Therefore, noise emissions from the overhead lines associated with corona discharge is not considered to be a feature of the background noise levels, as determined from the data collected during the baseline noise survey.

3.3 Mitigation Options

18. The Applicants note that the onshore substation study area is characteristically rural, with operational noise emissions being a key theme raised by stakeholders and some Interested Parties. The Applicants have committed to a maximum operational noise rating limit of 32dBA at any time at a free field location immediately adjacent to SSR2 and SSR5 NEW, and to 31dBA at any time at a

free field location immediately adjacent to SSR3 (as shown on ***Figure 2***, ***Appendix 1***). An updated ***draft DCO*** (REP3-011) will be submitted at Deadline 5 to reflect this.

19. Through ongoing engagement with the supply chain and the designers, the Applicants have identified additional mitigation measures for specific external equipment which lowers the equipment's sound power level, and results in lower received noise levels. The main equipment identified for mitigation are the STATCOM Air Coolers, STATCOM Filter Capacitor Banks and STATCOM Air Core Reactors, and represent the items of equipment with the more dominant operation phase noise contributions.

20. The achievable level of noise attenuation (over and above that originally modelled) considered feasible for these items of plant is as follows:

- STATCOM Air Coolers mitigated by up to 5dB(A);
- STATCOM Filter Capacitor Banks mitigated by up to 3dB(A); and
- STATCOM Air Core Reactors mitigated by up to 3dB(A).

21. The detailed design of the onshore substations will be developed post consent (as is usual for such nationally significant infrastructure projects). The onshore substation equipment will firstly be specified to meet the DCO noise limits at the nearest residential properties, and secondly be challenged by the design teams to reduce sound power levels further where it is efficient and economical to do so.

3.4 Additional Noise Modelling Location

22. Through discussions with the Councils during the SoCG process, the Applicants also commit to an additional noise sensitive location (in the vicinity of SSR3) being included within Requirements 26 and 27 of the ***draft DCO*** (REP3-011), which will be updated at Deadline 5 to reflect this change. This ensures the thorough regulation of noise emissions from the onshore substations by establishing a triangulation of monitoring locations at the three closest properties to the onshore substations to the north (SSR3), to the south east (SSR2) and to the south west (SSR5 NEW), as illustrated on ***Figure 2***, ***Appendix 1***.

4 Updated Noise Modelling

4.1 Key Model Input Parameters

23. ***Section 4.4*** sets out the revised model results based on the following parameters:

- The revised onshore substation footprints for both Projects and corresponding layout presented within ***Figure 1***, ***Appendix 1***;
- The revised onshore substation buildings and external equipment heights presented within ***Table 1***;
- The revised estimated finished ground levels presented within ***Table 2***;
- A ground coefficient reflective of mixed[2] ground providing a diffuse surface (G=0.5) within the substation compounds;
- A ground coefficient reflective of porous (soft) ground (G=1) outside of the substation compounds; and
- Meteorologically dry conditions, comparable with the baseline noise survey undertaken in accordance with BS4142:2014+A1:2019.

4.2 Model Scenarios

24. Modelling was undertaken for both the unmitigated and mitigated operation of the following scenarios:

- Scenario A – Eastern substation location and National Grid infrastructure operating in parallel;
- Scenario B – Western substation location and National Grid infrastructure operating in parallel; and
- Scenario C – Eastern and western substation and National Grid infrastructure operating in parallel.

25. The revised model results reflect noise attenuation measures applied to the STATCOM Air Coolers, STATCOM Filter Capacitor Bank and the STATCOM Air Core Reactors as described in ***Section 3.3***.

[2] In this context 'mixed' ground does not correspond to a combination of hard and soft ground. The substation areas will be topped with a layer of hardcore which will diffuse instead of attenuate noise. A literature review of the proposed surfacing and its representative porosity indicates that a coefficient of 0.5 would present a conservative but reasonable representation.

4.3 Data Sources and Characteristics

26. Operation phase noise sources incorporated into the noise model have been included as A-weighted noise levels either in a single-figure or octave band format, depending on the availability of frequency data for the identified noise sources.

27. Dry conditions were opted for within the model to ensure the outputs were directly comparable to the background noise levels calculated for each noise sensitive receptor presented within ***Chapter 25*** of the ES (APP-073), which were established by omitting baseline noise survey data recorded during periods of wet or windy weather (see ***section 2.3*** of the ***Noise and Vibration Clarification Note*** submitted at Deadline 2 (REP2-011)).

28. Modelled noise sources are as detailed in ***Table 3*** and ***Table 4*** below. External equipment for which the sound power levels have been reduced from that presented within the Applications, are identified in bold text.

Table 3 Modelled Noise Sources from Onshore Substation

Noise Source	Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)
Main Transformer (with enclosure)	2		58 at 1m from enclosure
Main Transformer (Forced Cooling System adjacent to Main Transformer)	2	81 per unit	
Shunt Reactor	2		62 at 1m from enclosure
STATCOM Air core reactor	**6**	**78/phase**	**-**
STATCOM Filter Air Core Reactor	6	70/phase 75/3 phases	-
STATCOM Filter Capacitor Bank	**6**	**78/phase**	**-**
STATCOM Building (Building Structure Only)	2	n/a	-
Aux. Transformer	2	67 per unit	-
Air Coolers	**2 banks of 5 units**	**82 per bank of 5 units[1]**	**-**
STATCOM High Voltage Alternating Current (HVAC) Units	4	79 per unit	-
Harmonic Filters	2 banks of 3 units	82 per bank of 3 units	-
Extractors (GIS Building)	15	See ***Table 4***	-

29. Extractor vents included in model associated with the onshore substation GIS building design are detailed in ***Table 4*** below.

Table 4 GIS Building Noise Sources

Fan	Model	Location	Sound Pressure Level dB(A)	Height (m)
EF1	Vent Axia (VSP40014)	GIS room (4 units)	46 at 3m	8.2 (lowest point to GFL)
EF2	Vent Axia (VSP25012)	Relay room (1 unit)	50 at 3m	3.5
		Store room (1 unit)		
		Mess room (1 unit)		
		Meter room (1 unit)		
		Generator room 1 (1 unit)		
		Generator room 2 (1 unit)		
EF3	Vent Axia (315-12B)	Store room (2 units)	58 at 3m	3.5
		Cleaner (1 unit)		
EF4	Vent Axia (171 04 020F)	Cleaner (2 units)	34 at 3m	3.5

30. Spectral data for plant included in the model associated with the onshore substation are detailed in ***Table 5***.

Table 5 Frequency Spectrum 1/1 Octave - Plant

Plant	Octave Band Centre Frequency (Hz)/dB(A)							
	63	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**
Auxiliary Transformer	62	63	56	52	49	42	40	58
STATCOM HVAC Units	51	61	73	73	75	70	59	47
STATCOM Air Core Reactor	39	75	40	72	70	13	9	9
STATCOM Filter Capacitor Bank	39	75	40	72	70	13	9	9

Plant	Octave Band Centre Frequency (Hz)/dB(A)							
STATCOM Building (Building Structure Only)	n/a							
Harmonic Filter	43	79	44	76	74	17	13	13
Air Coolers (bank of 5 units)	54	64	76	76	78	73	62	50
Main Transformer Forced Cooling System	53	63	75	75	77	72	61	49
STATCOM Filter Air Core Reactor	31	67	32	64	62	5	1	1
Main Transformer Enclosed	53	62	60	58	49	37	33	49
Shunt Reactor Enclosed	50	69	57	59	49	41	31	29
Extractors (GIS Building)	n/a							

31. Within the model noise sources have been categorised into three types:

- Area sources (a noise source emanating from a panel or other structure comprising a larger area);
- Point sources (a noise source emanating from equipment at a singular point); or
- Industrial Building sources (a noise source emanating from a building).

32. The type of noise source adopted for each item of plant modelled is presented within ***Appendix 2***.

4.3.1 National Grid Infrastructure

33. Various components of the National Grid Infrastructure were also considered within the updated noise modelling exercise. NGET have re-confirmed to the Applicants that there will be minimal reactive (winding) plant at the National Grid substation. As a consequence, minimal noise sources are considered to be present at the site. The items of National Grid substation equipment considered to be noise emitting and considered within the modelling exercise were the Air Insulated Switchgear (AIS) / GIS, the emergency generator and the realignment of overhead lines. These items are discussed below.

4.3.1.1 AIS Switchgear

34. This item of equipment is only activated under an emergency or for occasional testing. Its activation does not form part of the day to day operation of the National Grid substation.

35. Data provided to the Applicants by National Grid regarding the activation of the switchgear at the Necton Substation, Norfolk, showed that (excluding commissioning) there were 26 activations across five items of switchgear over a period of 18 months (either planned or unplanned).The noise source data for both AIS and GIS circuit breakers are based on equipment manufactured by Siemens. To assess a worst-case scenario the louder of the two options was modelled (AIS closing) as point sources with a $L_{AMax,F}$ of 124.6dB.

36. Inclusion of the switchgear points within the model indicated a noise level below background at the closest noise sensitive receptors, as shown in ***Table 6***.

Table 6 Modelled AIS Switchgear Noise Contribution at the Nearest Noise Sensitive Receptors

Receiver	Measured Background Noise Level (LA90 dB)	Switchgear Noise Level (LAeq dB) (External)	Difference in Noise Level (dBA)	Measured Representative Maximum Level	Switchgear Noise Level (LAMax,f dB) (External)	Difference in Noise Level (dBA)
SSR2	31.5	18.4	-13.1	79	57.3	-21.7
SSR3	26	21.9	-4.1	69.8	60.9	-8.9
SSR5 NEW	29	16.8	-12.2	67.9	55.3	-12.6

37. As the predicted noise level generated by the switchgear is below both the prevailing background and the maximum noise levels currently experienced at the agreed noise sensitive locations above, and due to the low occurrence of this item of equipment being operated, this item of National Grid Infrastructure has not been included or assessed further in the updated noise model.

4.3.1.2 Emergency Generator

38. As with the switchgear, the emergency generator is only activated under either emergency or for occasional testing. Its operation does not form part of the day to day operation of the National Gird substation.

39. The noise level of this equipment has been modelled at 80dBA Lw as a point source at 3.5m height, with the results of the noise modelling presented for Scenario C (i.e. the operation of the eastern and western onshore substations with the National Grid substation) within ***Table 7***.

Table 7 Modelled Emergency Generator Noise Contribution at the Nearest Noise Sensitive Receptors (dBA) under Scenario C

Receptor	Without Generator	With Generator	Difference with Generator	Operational Noise Limit	Difference between Operational Noise Limit and 'With Generator' Noise Level
SSR2	31.7	31.7	0	32	0.3dBA below Operational Noise limit
SSR3	30.7	30.7	0	32	1.3dBA below Operational Noise limit
SSR5 NEW	28.2	28.2	0	32	3.8dBA below Operational Noise limit

40. The model outputs presented in ***Table 7*** demonstrate that during typical operational conditions the inclusion of the emergency generator presents a negligible change in the predicted noise level at the agreed noise sensitive receptor locations. This is further supported by comparing each of the scenarios with the proposed operational noise limit whereby all predicted noise levels are below.

41. Therefore, this item of National Grid infrastructure has been scoped out of further modelling and assessment.

4.3.1.3 Overhead line realignment

42. Overhead lines have been modelled both in the existing and proposed realigned layout. The type of pylon and number of overhead lines are proposed to be the same as existing. NGET have advised that this equipment is the quietest technology currently available that is suitable for this site, based upon the requirements of connecting the Projects to the national electricity grid. The model results of the overhead line noise contribution at the nearest noise sensitive receptors are presented within

43. ***Table*** 8.

Table 8 Modelled Overhead Line Noise Contribution at the Nearest Noise Sensitive Receptors (dBA)

Receptor	Contribution from Existing Overhead Line Alignment *	Contribution from Realigned Overhead Line Alignment *
SSR2	20 dBA below 0dBA at the monitoring location	19.4 dBA below 0dBA at the monitoring location
SSR3	14.9 dBA below 0dBA at the monitoring location	16 dBA below 0dBA at the monitoring location
SSR5 New	21.2 dBA below 0dBA at the monitoring location	21 dBA below 0dBA at the monitoring location

44. As the predicted noise level (generated by the overhead lines) at the agreed noise sensitive receptors is significantly below the prevailing background, this item of National Grid Infrastructure has not been included or assessed further in the updated noise model.

4.4 Revised Modelling Results

45. ***Table 9*** to

46.

48. Table 11 below present the model outputs for Scenarios A, B and C. The entries marked in bold represent SSR2, SSR3 and SSR5NEW as these are the closest residential properties to the onshore substations and National Grid substation.

Table 9 Predicted Onshore Substation Operational Noise Impact Scenario A – Night time

Name	Receptor Sensitivity	Measured Baseline Background Noise Level (L_{90} dBA)	Updated Substation Rating Noise Levels (dBA)	Difference Rating Level and Measured Baseline Background (L_{90})	Impact Magnitude (BS4142)	Impact Significance (BS4142)	Operational Noise Rating Limit (dBA)	Difference Rating Limit and Measured Baseline Background (L_{90})	Difference Rating Level and Operational Noise Rating Limit (dBA)	Residual Impact magnitude (Compliance with Operational Noise Rating Limit)	Residual Impact Significance (Compliance with Noise Rating Limit)	PPG/NPSE Category (Compliance with Noise Rating Limit)
SSR1	Medium	33	27.6	-5.4	No Impact	Negligible	32	1	-4.4	No Impact	Negligible	NOEL
SSR2	**Medium**	**31.5**	**29**	**-2.5**	**No Impact**	**Negligible**	**32**	**-0.5**	**-3**	**No Impact**	**Negligible**	**NOEL**
SSR3	**Medium**	**26.1**	**26.6**	**0.6**	**Negligible**	**Minor**	**31**	**-4.9**	**-4.4**	**No Impact**	**Negligible**	**NOEL**
SSR4	Medium	29	18.9	-10.1	No Impact	Negligible	32	-3	-13.1	No Impact	Negligible	NOEL
SSR5 NEW	**Medium**	**29**	**20.2**	**-8.8**	**No Impact**	**Negligible**	**32**	**-3**	**-11.8**	**No Impact**	**Negligible**	**NOEL**
SSR6	Medium	29	19.7	-9.3	No Impact	Negligible	32	-3	-12.3	No Impact	Negligible	NOEL
SSR7	Medium	35	25.3	-9.7	No Impact	Negligible	32	3	-6.7	No Impact	Negligible	NOEL
SSR8	Medium	29	16.1	-12.9	No Impact	Negligible	32	-3	-15.9	No Impact	Negligible	NOEL
SSR9	Medium	29	23.7	-5.3	No Impact	Negligible	32	-3	-8.3	No Impact	Negligible	NOEL
SSR10	Medium	31	10.8	-20.2	No Impact	Negligible	32	-1	-21.2	No Impact	Negligible	NOEL
SSR11	Medium	30	13.5	-16.5	No Impact	Negligible	32	-2	-18.5	No Impact	Negligible	NOEL

Name	Receptor Sensitivity	Measured Baseline Background Noise Level (L_{90} dBA)	Updated Substation Rating Noise Levels (dBA)	Difference Rating Level and Measured Baseline Background (L_{90})	Impact Magnitude (BS4142)	Impact Significance (BS4142)	Operational Noise Rating Limit (dBA)	Difference Rating Limit and Measured Baseline Background (L_{90})	Difference Rating Level and Operational Noise Rating Limit (dBA)	Residual Impact magnitude (Compliance with Operational Noise Rating Limit)	Residual Impact Significance (Compliance with Noise Rating Limit)	PPG/NPSE Category (Compliance with Noise Rating Limit)
SSR12	Medium	29	16.1	-12.9	No Impact	Negligible	32	-3	-15.9	No Impact	Negligible	NOEL

Table 10 Predicted Onshore Substation Operational Noise Impact Scenario B – Night time

Name	Receptor Sensitivity	Measured Baseline Background Noise Level (L_{90} dBA)	Updated Substation Rating Noise Levels (dBA)	Difference Rating Level and Measured Baseline Background (L_{90})	Impact Magnitude (BS4142)	Impact Significance (BS4142)	Operational Noise Rating Limit (dBA)	Difference Rating Limit and Measured Baseline Background (L_{90})	Difference Rating Level and Operational Noise Rating Limit (dBA)	Residual Impact magnitude (Compliance with Operational Noise Rating Limit)	Residual Impact Significance (Compliance with Noise Rating Limit)	PPG/NPSE Category (Compliance with Noise Rating Limit)
SSR1	Medium	33	21.5	-11.5	No Impact	Negligible	32	1	-10.5	No Impact	Negligible	NOEL
SSR2	**Medium**	**31.5**	**23.3**	**-8.2**	**No Impact**	**Negligible**	**32**	**-0.5**	**-8.7**	**No Impact**	**Negligible**	**NOEL**
SSR3	**Medium**	**26.1**	**25.5**	**-0.5**	**No Impact**	**Negligible**	**31**	**-4.9**	**-5.5**	**No Impact**	**Negligible**	**NOEL**
SSR4	Medium	29	25.2	-3.8	No Impact	Negligible	32	-3	-6.8	No Impact	Negligible	NOEL
SSR5 NEW	**Medium**	**29**	**25.4**	**-3.6**	**No Impact**	**Negligible**	**32**	**-3**	**-6.6**	**No Impact**	**Negligible**	**NOEL**
SSR6	Medium	29	29	-5.5	No Impact	Negligible	32	-3	-8.5	No Impact	Negligible	NOEL
SSR7	Medium	35	19.9	-15.1	No Impact	Negligible	32	3	-12.1	No Impact	Negligible	NOEL
SSR8	Medium	29	19.8	-9.2	No Impact	Negligible	32	-3	-12.2	No Impact	Negligible	NOEL
SSR9	Medium	29	24.6	-4.4	No Impact	Negligible	32	-3	-7.4	No Impact	Negligible	NOEL
SSR10	Medium	31	14.5	-16.5	No Impact	Negligible	32	-1	-17.5	No Impact	Negligible	NOEL
SSR11	Medium	30	17.1	-12.9	No Impact	Negligible	32	-2	-14.9	No Impact	Negligible	NOEL

Name	Receptor Sensitivity	Measured Baseline Background Noise Level (L_{90} dBA)	Updated Substation Rating Noise Levels (dBA)	Difference Rating Level and Measured Baseline Background (L_{90})	Impact Magnitude (BS4142)	Impact Significance (BS4142)	Operational Noise Rating Limit (dBA)	Difference Rating Limit and Measured Baseline Background (L_{90})	Difference Rating Level and Operational Noise Rating Limit (dBA)	Residual Impact magnitude (Compliance with Operational Noise Rating Limit)	Residual Impact Significance (Compliance with Noise Rating Limit)	PPG/NPSE Category (Compliance with Noise Rating Limit)
SSR12	Medium	29	19.2	-9.8	No Impact	Negligible	32	-3	-12.8	No Impact	Negligible	NOEL

Table 11 Predicted Onshore Substation Operational Noise Impact Scenario C – Night time

Name	Receptor Sensitivity	Measured Baseline Background Noise Level (L_{90} dBA)	Updated Substation Rating Noise Levels (dBA)	Difference Rating Level and Measured Baseline Background (L_{90})	Impact Magnitude (BS4142)	Impact Significance (BS4142)	Operational Noise Rating Limit (dBA)	Difference Rating Limit and Measured Baseline Background (L_{90})	Difference Rating Level and Operational Noise Rating Limit (dBA)	Residual Impact magnitude (Compliance with Operational Noise Rating Limit)	Residual Impact Significance (Compliance with Noise Rating Limit)	PPG/NPSE Category (Compliance with Noise Rating Limit)
SSR1	Medium	33	28.4	-4.6	No Impact	Negligible	32	1	-3.6	No Impact	Negligible	NOEL
SSR2	**Medium**	**31.5**	**29.9**	**-1.6**	**No Impact**	**Negligible**	**32**	**-0.5**	**-2.1**	**No Impact**	**Negligible**	**NOEL**
SSR3	**Medium**	**26.1**	**29.1**	**3.0**	**Minor**	**Minor**	**31**	**-4.9**	**-1.9**	**No Impact**	**Negligible**	**NOEL**
SSR4	Medium	29	26	-3	No Impact	Negligible	32	-3	-6	No Impact	Negligible	NOEL
SSR5 NEW	**Medium**	**29**	**26.4**	**-2.6**	**No Impact**	**Negligible**	**32**	**-3**	**-5.6**	**No Impact**	**Negligible**	**NOEL**
SSR6	Medium	29	24.9	-4.1	No Impact	Negligible	32	-3	-7.1	No Impact	Negligible	NOEL
SSR7	Medium	35	26.3	-8.7	No Impact	Negligible	32	3	-5.7	No Impact	Negligible	NOEL
SSR8	Medium	29	21.2	-7.8	No Impact	Negligible	32	-3	-10.8	No Impact	Negligible	NOEL
SSR9	Medium	29	27.2	-1.8	No Impact	Negligible	32	-3	-4.8	No Impact	Negligible	NOEL
SSR10	Medium	31	16.1	-14.9	No Impact	Negligible	32	-1	-15.9	No Impact	Negligible	NOEL
SSR11	Medium	30	18.6	-11.4	No Impact	Negligible	32	-2	-13.4	No Impact	Negligible	NOEL

Name	Receptor Sensitivity	Measured Baseline Background Noise Level (L_{90} dBA)	Updated Substation Rating Noise Levels (dBA)	Difference Rating Level and Measured Baseline Background (L_{90})	Impact Magnitude (BS4142)	Impact Significance (BS4142)	Operational Noise Rating Limit (dBA)	Difference Rating Limit and Measured Baseline Background (L_{90})	Difference Rating Level and Operational Noise Rating Limit (dBA)	Residual Impact magnitude (Compliance with Operational Noise Rating Limit)	Residual Impact Significance (Compliance with Noise Rating Limit)	PPG/NPSE Category (Compliance with Noise Rating Limit)
SSR12	Medium	29	20.9	-8.1	No Impact	Negligible	32	-3	-11.1	No Impact	Negligible	NOEL

4.5 Conclusions

49. The revised noise modelling has resulted in a number of changes to the impact magnitude and significance of several noise sensitive receptors when assessed against the respective background noise level as presented within ***Appendix 25.2*** of the Environmental Statement (ES) (APP-523), summarised for Scenario C as followed:

- The predicted noise level received at SSR2 has reduced from an assessed +1.9dBA increase upon the measured background noise level to a -1.6dBA decrease upon the measured background noise level. As such, the impact magnitude has changed from negligible to no impact and the impact significance has changed from minor to negligible at this receptor location.
- The predicted noise level received at SSR5 NEW has reduced from an assessed +1.1dBA increase upon the measured background noise level to a -2.6dBA decrease upon the measured background noise level. Therefore, the impact magnitude has changed from negligible to no impact and the impact significance has changed from minor to negligible at this receptor location.
- When taking account of the corrected background noise level at SSR3 (26.1dBA) (as per the ***Applicants' Response to Appendix 4 of the Local Impact Report*** (REP3-071)), the predicted noise level received at SSR3 has increased from an assessed +2.7dBA (formerly -1.2dBA within ***Table A25.2.10*** of the ES (APP-523)) increase upon the measured background noise level to a +3.0 dBA increase upon the measured background noise level. A +2.7dBA increase upon measured background noise levels would be assessed as a negligible impact magnitude and minor impact significance. A +3.0dBA increase upon measured background noise levels is assessed as a minor impact magnitude and minor impact significance.

50. The Applicants have committed to a maximum operational noise rating limit of 32dBA at any time at a free field location immediately adjacent to SSR2 and SSR5 NEW, and to 31dBA at any time at a free field location immediately adjacent to SSR3 (as shown on ***Figure 2***, ***Appendix 1***). An updated ***draft DCO*** (REP3-011) will be submitted at Deadline 5 to reflect this. When assessed against these revised maximum operational noise rating limits, there has been no change in the assessed impact magnitude (no impact) or significance (negligible) from that presented in ***Appendix 25.2*** of the ES (APP-523).

51. Recognising that the decibels are measured on a logarithmic scale, decreasing the maximum operational phase noise rating level represents a significant, positive change to local residents, particularly for the noise sensitive receptors nearest to the onshore substation. The Applicants have been able to commit to reducing the maximum operational phase noise rating level through design

refinements and identification of additional mitigation. The ***draft DCO*** (REP3-011) will be amended to reflect this change and submitted to the Examinations at Deadline 5.

52. For context, the revisions to the maximum operational phase noise rating level is considered a significant change, particularly when compared to noise rating levels specified in the DCOs for other NSIPs such as:

- Norfolk Vanguard (35dB LAeq (5minutes));
- Dogger Bank A (formerly Dogger Bank Creyke Beck A) and Dogger Bank B (formerly Dogger Bank Creyke Beck B) (both 35dBA); and
- Dogger Bank C (formerly Dogger Bank Teesside A) (42dBA at specified residential receptors).

53. In light of the above, the revised maximum operational phase noise rating limits for the specified receptors is below that adopted for similar projects yet allows the necessary headroom to accommodate operational variability in noise emissions from the onshore substations.

5 Assessment of Non-Residential Amenity

5.1 Background

54. Through the Statement of Common Ground process, the Councils have requested an assessment of noise on non-residential amenity (REP1-072), specifically the potential impact upon users of nearby Public Rights of Way (PRoW). Whilst the assessment of noise included within the Applications does not include an assessment of the impacts of onshore substation noise upon recreational users of nearby PRoW, the Applicants maintain that any noise impact upon users of PRoW within the area will be transient in nature, as PRoW are used in a transient way and onshore substation noise would only be experienced for a short period of time during the day which the user passes by within an audible range of the onshore substations.

55. Nevertheless, the Applicants provide an assessment of operational noise upon non-residential amenity below.

5.2 Scope for the Assessment of Non-residential Amenity Noise Impacts

56. The Applicants consider that amenity is an experiential characteristic provided by publicly accessible areas for recreational use by people including day-time activities such as walking, dog walking, cycling, horse riding etc. As such, the Applicants consider that the noise sensitive receptors (for the purposes of this assessment) are such users of the operational phase local PRoW network (as shown on the ***Permanent Stopping up of Public Right of Way Plan*** submitted to the Examinations at Deadline 3 (REP3-008)). The assessment therefore focuses on the PRoW network within the vicinity of the onshore substation and not on areas with existing land-uses associated with farming or other commercial practices.

57. Considering the temporary nature and reversibility of impacts associated with the construction of the Projects' landfall and onshore cable routes, the impacts associated with the construction and operation of the landfall and onshore cable route have been scoped out of this assessment. Impacts associated with the construction of the Projects' onshore substations and National Grid infrastructure have also been scoped out of further assessment, given the temporary nature of impacts and the temporary stopping-up or diversion of PRoW associated with the construction phase. Therefore, this assessment focuses on the potential long-term impacts upon amenity anticipated to arise from the noise emitted by the operation of the onshore substations and National Grid infrastructure.

58. Within this assessment, the Applicants have considered the predicted source noise from the onshore substations and calculated how this dissipates with distance in the immediate vicinity.

59. Whilst it is noted that there is no statutory guidance regarding the assessment of amenity affected by NSIPs, there are accepted methodologies for assessing noise impacts in general. To undertake the assessment presented below, the Applicants have amended the methodology adopted for the operational phase noise assessment set out in ***Section 25.4, Chapter 25 Noise and Vibration*** of the ES (APP-073) to reflect the transient interaction between the PRoW user and the operational phase noise emissions emanating from the onshore substations.

5.3 Methodology for the Assessment of Non-residential Amenity Noise Impacts

5.3.1 Guidance

60. For publicly accessible amenity areas, guidance from the Institute of Environmental Management and Assessment (IEMA) document "Guidelines for Environmental Noise Impact Assessment" has been used (IEMA, 2014). This document describes the methods for assessing absolute noise change as a result of a development.

61. The methodology adopted for the assessment of non-residential publicly accessible amenity areas around the onshore substation and National Grid infrastructure compares measured absolute outdoor sound levels with those calculated within the noise model. This is considered a precautionary approach to assessing such impacts. The difference between the measured absolute noise level and that calculated through the noise prediction model provides the definition of impact.

5.3.2 Impact Magnitude

62. In terms of absolute noise change, for the purposes of this assessment, ***Table 12*** defines the criteria for which impact magnitude has been measured against.

Table 12 Magnitude criteria for operational noise impacts upon amenity (adapted from Table 7.14 of the IEMA guidance)

Absolute Sound Level Change (dB $L_{Aeq,T}$) (T = either 16h day)	Impact magnitude	PPG/NPSE Category
≥ 0 dBA and < 0.9 dBA	No impact	NOEL
> 1 dBA and < 2.9 dBA	Negligible impact	
> 3 dBA and < 4.9 dBA	Minor adverse	LOAEL
> 5 dBA and < 9.9 dBA	Moderate adverse	OAEL

Absolute Sound Level Change (dB $L_{Aeq,T}$) (T = either 16h day)	Impact magnitude	PPG/NPSE Category
≥10 dB	Major adverse	SOAEL

5.3.3 Receptor Sensitivity

63. As per the definition of receptor sensitivity within ***Chapter 25 Noise and Vibration*** (APP-073), receptor sensitivity was informed by the Planning Practice Guidance (PPG) notes which summarise the noise exposure hierarchy based on the likely average response (see ***Table 13***). For the purposes of this assessment, the receptor sensitivity is defined by the levels presented in ***Table 14***.

Table 13 Definition of Sensitivity Levels for PPG Noise Exposure Hierarchy (reproduced from the National Planning Policy Framework)

Response	Examples of outcomes	Increasing effect levels	Action
No Observed Effect Level			
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect Level	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alterative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that these is a perceived change in the quality of life.	Observed Adverse Effect Level	Mitigate and reduce to a minimum

Response	Examples of outcomes	Increasing effect levels	Action
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where these is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty getting to sleep, premature awakening and difficulty getting back to sleep. Quality of life diminished due to change in acoustic character of area.	Significant Observed Adverse Effect Level	Avoid
Present and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect Level	Prevent

Table 14 Definitions of the Different Sensitivity Levels for a Noise Receptor (ES Chapter 25, Table 25.21 (APP-073))

Sensitivity	Definition	Examples
High	Receptor has very limited tolerance of effect	Noise Receptors have been categorised as high sensitivity where noise may be detrimental to vulnerable receptors. Such receptors include certain hospital wards (e.g. operating theatres or high dependency units) or care homes at night.
Medium	Receptor has limited tolerance of effect	Noise Receptors have been categorised as medium sensitivity where noise may cause disturbance and a level of protection is required but a level of tolerance is expected. Such subgroups include residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities, national parks, (during the day); and temporary holiday accommodation at all times.

Sensitivity	Definition	Examples
Low	Receptor has some tolerance of effect	Noise Receptors have been categorised as low sensitivity where noise may cause short duration effects in a recreational setting although particularly high noise levels may cause a moderate effect. Such subgroups include offices, shops, outdoor amenity areas, long distance footpaths, doctor's surgeries, sports facilities and places of worship.
Negligible	Receptor generally tolerant of effect	Noise Receptors have been categorised as negligible sensitivity where noise is not expected to be detrimental. Such subgroups include warehouses, light industry, car parks, and agricultural land.

5.3.4 Impact Significance

64. Assessing the significance of an impact is a function of both the identified impact magnitude and the sensitivity of the receptor. The matrix as shown in ***Table 15*** is used to identify the impact significance.

Table 15 Impact Significance Matrix

		Magnitude				
		Major/high	**Moderate/medium**	**Minor/low**	**Negligible**	**No impact**
Sensitivity	**High**	*Major*	*Major*	*Moderate*	*Minor*	*Minor*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Negligible*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*

65. It follows that the assessed impact as per the impact significance matrix presented in ***Table 15*** is assessed by the terms of significance defined in ***Table 16***.

Table 16 Impact Significance Definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore no change in receptor condition.

66. This assessment has been undertaken using the modelling parameters as set out in ***section 4*** above, which includes the scoping out of the National Grid infrastructure for the reasons as detailed within ***section 4.3.1***.

5.4 Existing Environment

67. The area surrounding the site of the Projects' onshore substations is rural in nature and has a number of PRoW forming a network within the wider area. As part of the Applications and as specified with the ***draft DCO*** (REP3-011), the Applicants have applied to permanently stop up sections of three PRoW which interact with the site of the onshore substations. Permanent diversions are proposed to these permanently stopped-up PRoW to provide alternative routes and maintain access across the network, as shown on the ***Permanent Stopping up of Public Right of Way Plan*** (REP3-009).

68. Baseline noise monitoring for background noise levels along the local PRoW network has not been undertaken and was not requested during the Expert Topic Group meetings prior to submission of the Applications. As such, for the assessment of operational phase noise impacts upon non-residential amenity, receptor locations along both existing and permanently diverted PRoW routes were selected at a representative point close to noise monitoring locations included within the baseline noise survey undertaken in 2018. These are shown on ***Figure 2***, ***Appendix 1***. This enabled the comparison and calculation of change in noise level at these locations based upon measured background noise levels and the predicted noise levels from the onshore substations.

5.5 Potential Impacts

69. The scenarios and levels of mitigation indicated for each of the tables below are based upon the same parameters as set out in ***Section 4.1***.

5.5.1 Scenario A

70. ***Table 17*** presents the predicted daytime operational phase noise levels that could be experienced at the seven receptor locations on the local PRoW network within the vicinity of the onshore substation. ***Figure 4***, ***Appendix 1*** illustrates the operational phase noise modelled at each of the non-residential amenity noise receptors for scenario A at 1.5m AOD.

Table 17 Predicted Onshore Substation Operational Noise Impact Scenario A – Daytime

Name	Receptor Sensitivity	Measured Daytime LAeq (dB)	Substation Rating Noise Level (dBA)	Cumulative Noise Level (dB Laeq)	Difference Between Measured Noise level and Cumulative (dBA)	Impact Magnitude (IEMA)	Impact Significance (IEMA)
ProW 1	Low	43.5	31	43.7	0.2	No Impact	Negligible
ProW 2	Low	44.5	30.9	44.7	0.2	No Impact	Negligible
ProW 3	Low	44.5	31.4	44.7	0.3	No Impact	Negligible
ProW 4	Low	40.9	22.6	41	0.1	No Impact	Negligible
ProW 5	Low	40.9	20.4	40.9	0	No Impact	Negligible
ProW 6	Low	43.8	23.1	43.8	0	No Impact	Negligible
ProW 7	Low	43	29.5	43.2	0.2	No Impact	Negligible

5.5.2 Scenario B

71. ***Table 18*** presents the predicted daytime operational phase noise levels that could be experienced at the seven receptor locations on the local ProW network within the vicinity of the onshore substation. ***Figure 5***, ***Appendix 1*** illustrates the operational phase noise modelled at each of the non-residential amenity noise receptors for scenario B at 1.5m AOD.

Table 18 Predicted Onshore Substation Operational Noise Impact Scenario B – Daytime

Name	Receptor Sensitivity	Measured Daytime LAeq (dB)	Substation Rating Noise Level (dBA)	Cumulative Noise Level (dB Laeq)	Difference Between Measured Noise level and Cumulative (dBA)	Impact Magnitude (IEMA)	Impact Significance (IEMA)
ProW 1	Low	43.5	24	43.5	0	No Impact	Negligible
ProW 2	Low	44.5	23.5	44.5	0	No Impact	Negligible
ProW 3	Low	44.5	33.4	44.8	0.3	No Impact	Negligible
ProW 4	Low	40.9	30	41.2	0.3	No Impact	Negligible
ProW 5	Low	40.9	28.6	41.1	0.2	No Impact	Negligible
ProW 6	Low	43.8	24.8	43.9	0.1	No Impact	Negligible
ProW 7	Low	43	27.6	43.1	0.1	No Impact	Negligible

5.5.3 Scenario C

72. ***Table 19*** presents the predicted daytime operational phase noise levels that could be experienced at the seven receptor locations on the local ProW network within the vicinity of the onshore substations. ***Figure 6***, ***Appendix 1*** illustrates the operational phase noise modelled at each of the non-residential amenity noise receptors for scenario C at 1.5m AOD.

Table 19 Predicted Onshore Substation Operational Noise Impact Scenario C – Daytime

Name	Receptor Sensitivity	Measured Daytime LAeq (dB)	Substation Rating Noise Level (dBA)	Cumulative Noise Level (dB LAeq)	Difference Between Measured Noise level and Cumulative (dBA)	Impact Magnitude (IEMA)	Impact Significance (IEMA)
PRoW 1	Low	43.5	31.7	43.8	0.3	No Impact	Negligible
PRoW 2	Low	44.5	31.6	44.7	0.2	No Impact	Negligible
PRoW 3	Low	44.5	35.5	45	0.5	No Impact	Negligible
PRoW 4	Low	40.9	30.7	41.3	0.4	No Impact	Negligible
PRoW 5	Low	40.9	29.1	41.2	0.3	No Impact	Negligible
PRoW 6	Low	43.8	37.1	44.6	0.8	No Impact	Negligible
PRoW 7	Low	43	31.7	43.3	0.3	No Impact	Negligible

5.6 Summary of Non-residential Assessment

73. From ***Table 17*** to ***Table 19*** above, the predicted impact on non-amenity receptor locations as a result of the implementation of the Projects has been determined as being negligible in significance.

6 Further Clarification on Outstanding Matters

6.1 Background Noise Level Context

74. In order to characterise the existing noise climate within the noise and vibration study area a baseline noise survey was undertaken at locations representative of the nearest sensitive receptors as agreed with the ESC as the relevant planning authority.

75. The onshore substation study area, within which the onshore substation location falls, is predominantly rural in nature with limited significant background noise sources. In addition, there are a small number of individual residential properties and farmsteads located in the immediate area. The key residential area is the village of Friston to the south of the onshore substation location. There are a number of B-roads within the vicinity of the onshore substation study area along with existing National Grid infrastructure (i.e. two rows of overhead lines) in relatively close proximity to identified noise sensitive receptors.

76. In accordance with BS4142:2014+A1:2019, a baseline noise survey was undertaken over a representative period originally outlined in the pre-survey methodology document shared with stakeholders including ESC during Expert Topic Group (ETG) meetings.

77. The noise climate of the study area fluctuates over a range of values as demonstrated by the post-survey statistical analysis and charts which profile the baseline noise measurements for each specific measurement location over the duration of the baseline noise survey. The purpose of the survey and consultation prior to a survey is to ensure the duration and location would provide representative and repeatable background noise levels to characterise the prevailing noise levels around the study area. It is therefore considered that the data obtained during the baseline noise survey is appropriate and robust for characterising the onshore substation study area.

78. As previously clarified within ***section 3*** of the ***Noise and Vibration Assessment Clarification Note*** submitted at Deadline 2 (REP2-011) and within the ***Applicants' Comments Applicants' Response to Appendix 4 of the Local Impact Report*** submitted at Deadline 3 (REP3-071), the Applicants are confident in their position that the background noise level established for the onshore substation study area is representative of the existing noise climate experienced at the onshore substation location. The representative background noise levels established for the onshore substation study area is based upon robust statistical analysis of the measured baseline noise data at each measurement location (i.e.

graphical distribution plots, calculation of the standard deviation, mode and median baseline noise level), collected through an extensive baseline noise monitoring survey undertaken in 2018. The baseline noise monitoring survey (the methodology of which was agreed with the Expert Topic Group), as well as the statistical analysis of the measured background noise levels, followed the relevant guidance within BS4142:2014+A1:2019. BS4142:2014+A1:2019 is nationally accepted guidance and supports current UK planning guidance and Environment Agency requirements on noise impact assessments.

6.2 Operation Phase Noise Limits

79. The Applicants have committed to a maximum operational noise rating limit of 32dBA at any time at a free field location immediately adjacent to SSR2 and SSR5 NEW. In addition, the Applicants have also committed to an additional noise sensitive location, within the vicinity of SSR3 (Little Moor Farm) being included within Requirement 26 and 27 of the ***draft DCO*** (REP3-011). The maximum operational noise rating limit applied to SSR3 is 31dBA. The ***draft DCO*** (REP3-011) will be updated and submitted at Deadline 5 to reflect these changes.

80. This will ensure that noise levels associated with the operation of the onshore substations must be no greater than 3dBA above the representative background noise level of 29dBA at the receptors specified within the DCO. An increase of 3dBA is considered to be the lowest perceptible level to the human ear (as specified within ***paragraph 33***, ***Chapter 25*** of the ES (APP-073)).

81. The Councils have queried the operational phase rating noise levels secured within the ***draft DCO*** (REP3-011). It is noted that the operational phase noise rating limits secured through Requirement 26 and Requirement 27 of the ***draft DCO*** are derived from the representative background noise level adopted for the onshore substation study area (i.e. being 3dBA above the background noise levels). The Applicants consider the representative background noise level to be robust and reflective of the existing noise climate experienced within the onshore substation study area.

82. As explained within the ***Applicants' Response to Appendix 4 of the Local Impact Report*** (REP3-071), 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 (see further clarification on noise context within ***Section 6.1***) and the results of the background noise monitoring surveys undertaken.

6.3 Dominant Operation Phase Noise Sources

83. With the application of mitigation for the Air Coolers, Air Core Reactors and Filter Capacitor Banks included the revised model runs, the residual dominant

operational phase noise sources identified are those presented in ***Table 20*** below.

Table 20 Dominant Operation Phase Noise Sources of the Onshore Substations

Scenario	SSR2	SSR3	SSR5 NEW
Scenario A	Harmonic Filter (22.4dBA) Harmonic Filter (21dBA)	Auto Transformer Cooler 2 (14dBA) HVAC (13.9dBA)	Harmonic Filter (12.7dBA) Harmonic Filter (12.1dBA)
Scenario B	Harmonic Filter (15.3dBA) Harmonic Filter (14.5dBA)	Auto Transformer Cooler 2 (13.9dBA) Auto Transformer Cooler 1 (13dBA)	Harmonic Filter (16.7dBA) Harmonic Filter (15.4dBA)
Scenario C	Harmonic Filter (22.4dBA) Harmonic Filter (21.3dBA)	Auto Transformer Cooler 2 (14dBA) Auto Transformer Cooler 1 (13.9dBA)	Harmonic Filter (17.6dBA) Harmonic Filter (16.8dBA)

6.4 Uncertainty Budget

84. The Council's Consultants have queried whether the model outputs take account of an uncertainty budget of ±3dB. The noise model has been undertaken using SoundPLAN version 8.2, which is a standard programme for modelling sound propagation and the most up to date version of the software.

85. The Applicants note that uncertainty budget is not a requirement of BS4142:2014+A1:2019 and is not a standard inclusion within noise assessments undertaken for NSIPs.

86. In the event a +/-3dB uncertainty budget is applied to the model results as suggested by the Councils, it is considered that there is an equal possibility of the results being overestimated as they are underestimated. As such, the Applicants believe the operational noise predictions presented within the ES and assessment conclusions are robust irrespective of the application of this uncertainty budget. This position applies to all noise predictions presented within the ES that have been calculated by the noise model generated using SoundPLAN.

6.5 Additional Plant Dimensions

87. The Applicants were requested to provide further details on the dimensions of certain pieces of onshore substation equipment, including shunt reactors and the main transformer. The precise dimensions of these pieces of equipment are not yet known but will be defined at the detailed design stage post-consent. Indicative dimensions of these items of plant are presented within ***Table 21*** below.

Table 21 Onshore Substation Key Equipment Dimensions (Indicative)

Equipment	Height (m)	Length (m)	Width (m)
Main Transformer (with enclosure)	10	16	10
Shunt Reactor	8	12	6

88. Within the updated noise model, both the main transformers and shunt reactors have been modelled as industrial building noise sources (see ***section 4*** and ***Appendix 2***).

7 Conclusion

89. This Clarification Note presents the details and results of the updated noise modelling undertaken during the Projects' Examinations in light of revisions made to the footprint, design and sound power levels of the Projects' onshore substations.

90. Decreasing the operational phase noise rating level represents a significant, positive change to local residents, particularly the noise sensitive receptors nearest to the onshore substation. The Applicants have been able to commit to reducing the operational phase noise rating level through design refinements and identification of additional mitigation. The ***draft DCO*** (REP3-011) will be amended to reflect this change and submitted to the Examinations at Deadline 5.

91. Recognising that noise levels decrease with distance from source (i.e. the substation equipment), with reference to the noise contours shown on ***Figure 4*** to ***Figure 6*** of ***Appendix 1***, the Applicants note that a minimal area south of Church Road (the edge of the village of Friston) will be subject to operational noise levels within the 24.5 < 25.5 dBA range.

92. The results of the updated modelling demonstrate that the predicted operational phase noise levels from the Projects (either singularly or cumulatively) are below the revised maximum operational noise rating limits (32dBA at SSR2 and SSR5 NEW, and 31dBA at SSR3), which will be secured through an updated ***draft DCO*** to be submitted at Deadline 5.

93. Additional scenarios included the assessment of the effect from noise generating National Grid infrastructure proposed to be located at the Friston. The results of these cumulative scenario assessments determined that the predicted noise levels from both the Projects (either singularly or cumulatively) and the National Grid infrastructure are below the revised maximum operational noise rating limits, which will be secured through an updated ***draft DCO*** to be submitted at Deadline 5.

94. An assessment of operational phase noise impacts upon non-residential amenity, including existing and permanently diverted PRoWs within the vicinity of the Projects onshore substations, assessed the significance of potential impacts as no greater than negligible.

Appendix 1 Figures

- Figure 1 Operation Phase Onshore Substation Modelled Noise Sources
- Figure 2 Operation Phase Noise Sensitive Receptor Locations
- Figure 3 Non Residential Amenity Noise Receptor Locations
- Figure 4 Scenario A Mitigated Operation Phase Noise Emission Contour Bands[3]
- Figure 5 Scenario B Mitigated Operation Phase Noise Emission Contour Bands[3]
- Figure 6 Scenario C Mitigated Operation Phase Noise Emission Contour Bands[3]

[3] Figures 4, 5 and 6 are presented at a grid spacing of 15m (i.e. resolution). The Applicants note that the structures within the vicinity of the onshore substation included within the calculation area are observed to provide screening effects of the noise propagated from the Projects' onshore substations.

N

Reference	Equipmemt
A	Air Coolers
B	Auto Transformer
C	Auto Transformer Cooler
D	Auxiliary Transfomer
E	GIS Building
F	Harmonic Filter
G	HVAC
H	Shunt Reactor
I	STATCOM Aircore Reactors
J	STATCOM Building
K	STATCOM Filter Aircore Reactors
L	STATCOM Filter Capacitor Bank

Legend

- Western Substation
- Eastern Substation

Note: Areas based on revised substation footprint as presented in ***Project Update Note*** submitted at Deadline 2 (REP2-007)

Rev	Date	By	Comment		
2	11/01/2021	AB	Second Issue.	Prepared:	AB
1	06/01/2021	AB	First Issue.	Checked:	HM
				Approved:	BD

1:2,000 Scale @ A3

0 50 100 Metres

East Anglia ONE North and TWO

Operation Phase Onshore Substation Modelled Noise Sources

Drg No	EA1N-EA2-DEV-DRG-IBR-001261
Rev	2
Date	11/01/21
Figure	1

Coordinate System: BNG Datum: OSGB36

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N

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

Legend

- Onshore Development Area
- Western Substation
- Eastern Substation
- Agreed Noise Sensitive Receptor Locations (as per Figure 25.2 of the ES (APP–305))

Note: Areas based on revised substation footprint as presented in ***Project Update Note*** submitted at Deadline 2 (REP2-007)

SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment
1	11/01/2021	AB	First Issue.

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1:10,000
Scale @ A3

0 250 500 Metres

East Anglia ONE North and TWO

Noise Sensitive Receptor Locations

Drg No	EA1N-EA2-DEV-DRG-IBR-001269
Rev	1
Date	11/01/21
Figure	2

Coordinate System: BNG
Datum: OSGB36

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N

Redhouse Farm

Owl's Hole

Pond House

Moor Farm

Drain

Fristonmoor

Little Moor Farm

Fareacres

Pear tree Farm

Fristonmoor Covert

Laurel Covert

Old World Wood

Manor Farm

Woodside Cottages

Grove Wood

Track

GROVE ROAD

The Lindens

SAXMUNDHAM ROAD

Friston House

Friston House Wood

Woodside Farm

CHURCH ROAD

PW

Church

6

7

1

2

3

4

5

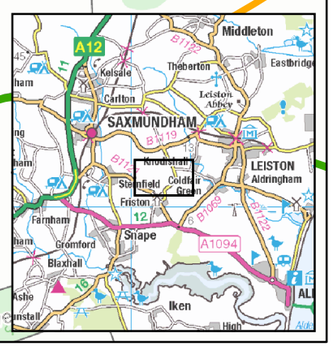
Legend

- Western Substation
- Eastern Substation
- Non-Residential Amenity Noise Receptor Locations
- Permanent Diversions

Public Right of Way Status

- Footpath
- Bridleway

Note: Areas based on revised substation footprint as presented in ***Project Update Note*** submitted at Deadline 2 (REP2-007)



SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment		
2	11/01/2021	AB	Second Issue.	Prepared:	AB
1	08/01/2021	AB	First Issue.	Checked:	HM
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1:6,000
Scale @ A3

Metres
0 150 300

East Anglia ONE North and TWO

Non Residential Amenity Noise Receptor Locations

Drg No	EA1N-EA2-DEV-DRG-IBR-001268
Rev	2
Date	11/01/21
Figure	3

Coordinate System: BNG Datum: OSGB36

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N

Legend

- Eastern Substation
- Non-Residential Amenity Noise Receptor Locations
- Background Noise Level (29dBA)
- Permanent Diversions

Public Right of Way Status

- Footpath
- Bridleway

dBA at 1.5m AOD

- 25.5 < 26.5
- 26.5 < 27.5
- 27.5 < 28.5
- 28.5 < 29.5
- 29.5 < 30.5
- 30.5 < 31.5
- 31.5 < 32.5
- 32.5 < 33.5
- 33.5 < 34.5
- 34.5 < 35.5
- 35.5 < 36.5
- 36.5 < 37.5
- 37.5 < 38.5
- 38.5 < 39.5
- 39.5 <

25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5 35.5 36.5 37.5 38.5 39.5

1 2 3 4 5 6 7

Redhouse Farm
Owl's Hole
Track
Drain
Fristonmoor
Fristonmoor Covert
Little Moor Farm
Pearetree Farm
Pareacres
Manor Farm
Old Wood
Woodside Cottages
Friston Wood
Woodside Farm
Friston House
Friston House Wood
The Lindens
SAXMUNDHAM ROAD
CHURCH ROAD
PW
Church
Eastbridge
Middleton
Theberton
Leiston Abbey
Carlton
Kelsale
SAXMUNDHAM
Knodishall
Stenfield
Coldfair Green
LEISTON
Aldringham
Friston
Farnham
Snape
Gromford
Blaxhall
Ashe
Iken
A12
A1094
B1122
B1069
B1119

Note: Areas based on revised substation footprint as presented in ***Project Update Note*** submitted at Deadline 2 (REP2-007)

SCOTTISHPOWER RENEWABLES

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2	11/01/2021	AB	Second Issue.	Prepared:	AB
1	08/01/2021	AB	First Issue.	Checked:	HM
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1:6,000 Scale @ A3

0 150 300 Metres

East Anglia ONE North and TWO

Scenario A Operation Phase Noise Emission Contour Bands

Drg No	EA1N-EA2-DEV-DRG-IBR-001267
Rev	2
Date	11/01/21
Figure	4

Coordinate System: BNG Datum: OSGB36

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N

Legend

- Western Substation
- Non-Residential Amenity Noise Receptor Locations
- Background Noise Level (29dBA)
- Permanent Diversions

Public Right of Way Status

- Footpath
- Bridleway

dBA at 1.5m AOD

- 25.5 < 26.5
- 26.5 < 27.5
- 27.5 < 28.5
- 28.5 < 29.5
- 29.5 < 30.5
- 30.5 < 31.5
- 31.5 < 32.5
- 32.5 < 33.5
- 33.5 < 34.5
- 34.5 < 35.5
- 35.5 < 36.5
- 36.5 < 37.5
- 37.5 < 38.5
- 38.5 < 39.5
- 39.5 <

Note: Areas based on revised substation footprint as presented in ***Project Update Note*** submitted at Deadline 2 (REP2-007)

SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment		
2	11/01/2021	AB	Second Issue.	Prepared:	AB
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				Approved:	BD

1:6,000 Scale @ A3

Metres 0 150 300

East Anglia ONE North and TWO

Scenario B Operation Phase Noise Emission Contour Bands

Drg No	EA1N-EA2-DEV-DRG-IBR-001265
Rev	2
Date	11/01/21
Figure	5

Coordinate System: BNG Datum: OSGB36

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N

Legend

- Western Substation
- Eastern Substation
- Non-Residential Amenity Noise Receptor Locations
- Background Noise Level (29dBA)
- Permanent Diversions

Public Right of Way Status

- Footpath
- Bridleway

dBA at 1.5m AOD

- 24.5 < 25.5
- 25.5 < 26.5
- 26.5 < 27.5
- 27.5 < 28.5
- 28.5 < 29.5
- 29.5 < 30.5
- 30.5 < 31.5
- 31.5 < 32.5
- 32.5 < 33.5
- 33.5 < 34.5
- 34.5 < 35.5
- 35.5 < 36.5
- 36.5 < 37.5
- 37.5 < 38.5
- 38.5 < 39.5
- 39.5 <

25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5 35.5 36.5 37.5 38.5 39.5

1 2 3 4 5 6 7

Redhouse Farm
Drain
Track
Fristonmoor
Little Moor Farm
Fareacres
Pear Tree Farm
Fristonmoor Covert
Manor Farm
Old Wood
Woodside Cottages
Grove Wood
The Lindens
SAXMUNDHAM ROAD
Friston House
Friston House Wood
Woodside Farm
CHURCH ROAD
PW
Church

Note: Areas based on revised substation footprint as presented in ***Project Update Note*** submitted at Deadline 2 (REP2-007)

Middleton, A12, Kelsale, Thorpeton, Eastbridge, Carlton, Leiston Abbey, SAXMUNDHAM, LEISTON, Aldringham, Knodishall, Stonfield, Coldfair Green, Friston, Farnham, Snape, Gromford, Blaxhall, A1094, Ilken

2	11/01/2021	AB	Second Issue.	Prepared:	AB	1:6,000 Scale @ A3
1	08/01/2021	AB	First Issue.	Checked:	HM	0 150 300 Metres
Rev	**Date**	**By**	**Comment**	Approved:	BD	

East Anglia ONE North and TWO

Scenario C Operation Phase Noise Emission Contour Bands

Drg No	EA1N-EA2-DEV-DRG-IBR-001263
Rev	2
Date	11/01/21
Figure	6

Coordinate System: BNG
Datum: OSGB36

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Appendix 2 Modelled Onshore Substation Equipment

The table below should be read in conjunction with ***Figure 1***, ***Appendix 1***.

Corresponding Reference on Figure 1, Appendix 1	Noise Source	Number of Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Modelled Type (Area/Point/Industrial Building)	Height (m)
B	Main Transformer (with enclosure)	2		66	Industrial Building	10
C	Main Transformer (Forced Cooling System adjacent to Main Transformer)	2	81 per unit	-	Horizontal Area Sources on top and below floating Industrial Building	5.88m and 1.46m AOD
H	Shunt Reactor	2		70	Industrial Building	8
I	STATCOM Air core reactor	6	78/phase	-	Point	2
K	STATCOM Filter Air Core Reactor	6	70/phase 75/3 phases	-	Point	At three heights: 2m; 4m and 6m
L	STATCOM Filter Capacitor Bank	6	78/phase	-	Point	At three heights: 2m; 4m and 6m
D	Aux. Transformer	2	67 per unit	-	Point	2
A	Air Coolers	2 banks of 5 units	82 per bank of 5 units	-	Horizontal Area Source on top of Industrial Building	5
G	STATCOM HVAC Units	4	79 per unit	-	Point	2

Corresponding Reference on Figure 1, Appendix 1	Noise Source	Number of Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Modelled Type (Area/Point/Industrial Building)	Height (m)
F	Harmonic Filters	2 banks of 3	82 per bank	-	Point	14
J	STATCOM Building	2	n/a	n/a	Building Structure Only	12
E	GIS Building	1	n/a	n/a	Industrial Building	14
	GIS Building - Extractors	15	See ***Table 4***	-	All extracts modelled as Point sources	-