WHITE CROSS

White Cross Offshore Windfarm Environmental Statement

Chapter 18: Noise and Vibration

Document Code:	FLO-WHI-REP-0016-22	
Contractor Document Number:	PC2978-RHD-ZZ-XX-RP-Z-0413	
Version Number:	00	
Date:	*Issue Date 14/08/2023*	
Prepared by:	NH	*Electronic Signature*
Checked by:	TB	*Electronic Signature*
Owned by:	CB	*Electronic Signature*
Approved by Client :	OG	*Electronic Signature*

Version Number	**Reason for Issue / Major Changes**	**Date of Change**
00	For issue	14/08/2023

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Glossary of Acronyms

Acronym	Definition
AAWT	Annual Average Weekday Traffic
BNL	Basic Noise Level
BPM	Best Practicable Means
BS	British Standards
BSI	British Standards Institution
CEA	Cumulative Effect Assessment
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CoPA	Control of Pollution Act 1974
CRTN	Calculation of Road Traffic Noise
CTMP	Construction Traffic Management Plan
dB	Decibels
DMRB	The Design Manual for Roads and Bridges
EA	Environment Agency
EEA	European Economic Area
EIA	Environmental Impact Assessment
ES	Environmental Statement
ETG	Expert Topic Group
GRP	Glass Reinforced Plastic
HGV	Heavy Goods Vehicle
IEMA	Institute of Environmental Management and Assessment
ISO	International Organisation for Standardisation
LOAEL	Lowest Observed Adverse Effect Level
LPA	Local Planning Authority
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MW	Megawatts
NNG	Night Noise Guidelines
NOEL	No Observed Effect Level
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Project
NVSR	Noise and Vibration Sensitive Receptor
OWF	Offshore Wind Farm
WCOWL	White Cross Offshore Windfarm Limited

Acronym	Definition
PDE	Project Design Envelope
PPV	Peak Particle Velocity
SNCB	Statutory Nature Conservation Bodies
SOAEL	Significant Observed Adverse Effect Level
SSSI	Site of Special Scientific Interest
TRRL	Transport and Road Research Laboratory
UK	United Kingdom
WHO	World Health Organisation

Glossary of Terminology

Defined Term	Description
Applicant	White Cross Offshore Windfarm Limited
Cumulative effects	The effect of the Project taken together with similar effects from a number of different projects, on the same single receptor/resource. Cumulative Effects are those that result from changes caused by other past, present or reasonably foreseeable actions together with the Project.
Environmental Impact Assessment (EIA)	Assessment of the potential impact of the proposed Project on the physical, biological and human environment during construction, operation and decommissioning.
Export Cable Corridor	The area in which the export cables will be laid, either from the Offshore Substation or the inter-array cable junction box (if no offshore substation), to the NG Onshore Substation comprising both the Offshore Export Cable Corridor and Onshore Export Cable Corridor.
In-combination effects	In-combination effects are those effects that may arise from the development proposed in combination with other plans and projects proposed/consented but not yet built and operational.
Jointing bay	Underground structures constructed at regular intervals along the Onshore Export Cable Corridor to join sections of cable and facilitate installation of the cables into the buried ducts
Landfall	Where the offshore export cables come ashore
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing electrical earthing links
Mean high water springs	The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean low water springs	The average tidal height throughout a year of two successive low waters during those periods of 24 hours when the range of the tide is at its greatest.
Mitigation	Mitigation measures have been proposed where the assessment identifies that an aspect of the development is likely to give rise to significant environmental impacts, and discussed with the relevant authorities and stakeholders in order to avoid, prevent or reduce impacts to acceptable levels. For the purposes of the EIA, two types of mitigation are defined: • Embedded mitigation: consisting of mitigation measures that are identified and adopted as part of the evolution of the project design, and form part of the project design that is assessed in the EIA • Additional mitigation: consisting of mitigation measures that are identified during the EIA process specifically to reduce or eliminate any predicted significant impacts. Additional mitigation is therefore subsequently adopted by OWL as the EIA process progresses.

Defined Term	Description
National Grid Onshore Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of the electrical transformers.
National Grid Connection Point	The point at which the White Cross Offshore Windfarm connects into the distribution network at East Yelland substation and the distributed electricity network. From East Yelland substation electricity is transmitted to Alverdiscott where it enters the national transmission network.
the Offshore Project	The Offshore Project for the offshore Section 36 and Marine Licence application includes all components offshore of MHWS. This includes the infrastructure within the windfarm site (e.g. wind turbine generators, substructures, mooring lines, seabed anchors, inter-array cables and Offshore Substation Platform (as applicable)) and all infrastructure associated with the export cable route and landfall (up to MHWS) including the cables and associated cable protection (if required).
Onshore Development Area	The onshore area above MLWS including the underground onshore export cables connecting to the White Cross Onshore Substation and onward to the NG grid connection point at East Yelland. The onshore development area will form part of a separate Planning application to the Local Planning Authority (LPA) under the Town and Country Planning Act 1990.
Onshore Export Cables	The cables which bring electricity from MLWS at the Landfall to the White Cross Onshore Substation and onward to the NG grid connection point at East Yelland.
Onshore Export Cable Corridor	The proposed onshore area in which the export cables will be laid, from MLWS at the Landfall to the White Cross Onshore Substation and onward to the NG grid connection point at East Yelland.
Onshore Infrastructure	The combined name for all infrastructure associated with the Project from MLWS at the Landfall to the NG grid connection point at East Yelland. The onshore infrastructure will form part of a separate Planning application to the Local Planning Authority (LPA) under the Town and Country Planning Act 1990
Onshore Transmission Assets	The aspects of the project related to the transmission of electricity from MLWS at the Landfall to the NG grid connection point at East Yelland including the Onshore Export Cable, the White Cross Onshore Substation and onward connection to the NG grid connection point at East Yelland.
the Onshore Project	The Onshore Project for the onshore TCPA application includes all components onshore of MLWS. This includes the infrastructure associated with the offshore export cable (from MLWS), landfall, onshore export cable and associated infrastructure and new Onshore Substation (if required).
White Cross Offshore Windfarm Ltd	White Cross Offshore Windfarm Ltd (WCOWL) is a joint venture between Cobra Instalaciones Servicios, S.A., and Flotation Energy Ltd.
the Project	the Project is a proposed floating offshore windfarm called White Cross located in the Celtic Sea with a capacity of up to 100MW. It encompasses the project as a whole, i.e. all onshore and offshore infrastructure and activities associated with the Project.

Defined Term	Description
Project Design Envelope	A description of the range of possible components that make up the Project design options under consideration. The Project Design Envelope, or 'Rochdale Envelope' is used to define the Project for Environmental Impact Assessment (EIA) purposes when the exact parameters are not yet known but a bounded range of parameters are known for each key project aspect.
Transition joint bay	Underground structures at the Landfall that house the joints between the offshore export cables and the onshore export cables
Transition piece	The transition piece includes various functionalities such as access for maintenance, cable connection for the energy of the turbine and the corrosion protection of the entire foundation
White Cross Offshore Windfarm	100MW capacity offshore windfarm including associated onshore and offshore infrastructure
White Cross Onshore Substation	A new substation built specifically for the White Cross project. It is required to ensure electrical power produced by the offshore windfarm is compliant with NG electrical requirements at the grid connection point at East Yelland.
Windfarm Site	The area within which the wind turbines, Offshore Substation Platform and inter-array cables will be present
Works completion date	Date at which construction works are deemed to be complete and the windfarm is handed to the operations team. In reality, this may take place over a period of time.

18. Noise and Vibration

18.1 Introduction

1. This chapter of the Environmental Statement (ES) presents the potential impacts on noise and vibration of the White Cross Offshore Windfarm Project (the Onshore Project). Specifically, it considers impacts landward of Mean Low Water Springs (MLWS) during its construction, operation and maintenance, and decommissioning phases.

2. The ES has been finalised with due consideration of pre-application consultation to date (see **Chapter 7: Consultation**) and the ES will accompany the application to North Devon Council for planning permission under the Town and Country Planning Act 1990.

3. The components of the White Cross Offshore Windfarm Project seaward of Mean High Water Springs (MHWS) ('the Offshore Project') are subject to a separate application for consent under Section 36 of the Electricity Act 1989, and for Marine Licences under the Marine and Coastal Access Act 2009. These applications are supported by a separate ES covering all potential impacts seaward of MHWS.

4. This assessment has been undertaken with specific reference to the relevant policy, legislation and guidance, which are summarised in **Section 18.2** of this chapter. Further information on the international, national and local planning policy and legislation relevant to the Onshore Project is provided in **Chapter 3: Policy and Legislative Context**.

5. Details of the methodology used for the Environmental Impact Assessment (EIA) and Cumulative Effect Assessment (CEA), are presented in **Section 18.3** of this chapter and **Chapter 6: EIA Methodology**.

6. This assessment has been informed by impacts assessed in **Chapter 19: Traffic and Transport** and impacts assessed in this chapter inform the following linked ES chapters:

   - **Chapter 21: Socio-economics (including Tourism and Recreation)**
   - **Chapter 22: Human Health**.

7. Inter-relationships with these chapters are further described in **Section 18.10**.

8. Additional information to support the noise and vibration assessment includes description of the noise modelling undertaken, along with associated detailed results, as presented in:

- **Appendix 18.A: Baseline Noise Survey**
- **Appendix 18.B: Construction Noise and Vibration Predictions**
- **Appendix 18.C: Construction Traffic Noise Predictions**
- **Appendix 18.D: Operational Noise Predictions**
- **Appendix 18.E: Acoustic Terminology** (provides a glossary of acoustic terminology used in this assessment).

9. This ES chapter:

- Presents the existing environmental baseline established from desk studies and baseline noise surveys, and consultation
- Presents the potential environmental effects on noise and vibration arising from the Onshore Project, based on the information gathered and the analysis and assessments undertaken
- Identifies any assumptions and limitations encountered in compiling the environmental information
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

18.2 Policy, Legislation and Guidance

10. **Chapter 3: Policy and Legislative Context** describes the wider policy and legislative context for the Onshore Project. The principal policy and legislation used to inform the assessment of potential impacts on noise and vibration for the Onshore Project are outlined in this section.

18.2.1 Policy

18.2.1.1 National Planning Policy Framework

11. The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, updated July 2021) is the primary source of national planning guidance in England. Sections relevant to this aspect of the ES are summarised below in **Table 18.1**.

Table 18.1 Summary of NPPF Policy relevant to noise and vibration

Summary	How and where this is considered in the ES
"Planning policies and decisions should contribute to and enhance the natural and local environment by:	**Sections 18.5**, **18.6** and **18.7** include assessment of potential noise effects of the Onshore Project and show that unacceptable

Summary	How and where this is considered in the ES
e)……preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution…" - **NPPF Paragraph 174**	levels of noise pollution are not anticipated.
"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: (a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life (b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason." - **NPPF Paragraph 185**	These aims are met by adoption of the embedded and proposed mitigation as discussed above. As discussed in **Section 18.3.4**, avoidance of significant adverse impacts is interpreted to avoid effects above the Significant Observed Adverse Effect Level (SOAEL) and mitigate and minimise other adverse impacts is interpreted to relate to effects above the Lowest Observed Adverse Effect Level (LOAEL). **Sections 18.5**, **18.6** and **18.7** include assessment of potential effects against the identified SOAEL and LOAELs and shows that exceedances of the applicable SOAEL are not anticipated, and any exceedances of the LOAEL are mitigated and minimised.

18.2.1.2 Local Policies

12. This section considers local policies and their relevance to the noise and vibration assessment. A summary of the local policies is provided in **Table 18.2**.

Table 18.2 Summary of Local Policies relevant to noise and vibration

Policy Name	Summary	How and where this is considered in the ES
North Devon and Torridge Local Plan		
Policy DM01: Amenity Considerations Paragraph 13.3	Amenity considerations relating to the extent that people are entitled to enjoy their own homes or public places without undue disturbance or intrusion from neighbouring uses include… (c) noise and vibration: it is particularly important to minimise the impact of noise and vibrations in sensitive locations and buildings such as residential areas, hospitals, schools and areas valued for their tranquillity including Sites of Special Scientific Interest, the Area of Outstanding Natural Beauty, Heritage Coast and the wider countryside. Noise and vibration problems may be resolved by careful attention to site layout, sound insulation measures and barriers including the orientation of buildings, vegetation and bunds;	Noise and vibration impacts on residential receptors and other sensitive locations have been assessed for the construction (**Section 18.5**), operation and maintenance (**Section 18.6**) and decommissioning (**Section 18.7**) phases of the Onshore Project. Receptor types considered in the assessment are identified and classified in **Section 18.3.2.2**. Mitigation is described in **Section 18.3.4**.
Policy DM02: Environmental Protection Hazards Pollution (2)	Development will be supported where it does not result in unacceptable impacts to:… (c) noise or vibration;	The term 'unacceptable' in this policy is interpreted to mean significant in the context of the EIA Regulations. All residual effects are identified as not significant in EIA terms, as summarised in **Section 18.12**.
Braunton Parish Neighbourhood Plan		
The **Braunton** Parish **Neighbourhood Plan** does not contain any policies relevant to the noise and vibration assessment		

18.2.1.3 National Policy Statement

13. The assessment of potential impacts upon noise and vibration has been made with specific reference to the relevant National Policy Statement (NPS). NPSs are statutory documents which set out the government's policy on specific types of

Nationally Significant Infrastructure Projects (NSIPs) and are published in accordance with the Planning Act 2008.

14. Although the Offshore Project is not an NSIP, it is recognised that due to its size of up to 100MW and its location in English waters, certain NPSs are considered relevant to the Offshore Project. Therefore, to align with the approach to the assessment of the Offshore Project, certain NPS are also considered as part of the Onshore Project.

15. The provisions relevant to noise and vibration that are included within the NPS for Energy (EN-1) are summarised in **Table 18.3**. The NPS for Renewable Energy Infrastructure (EN-3) and NPS for Electricity Networks Infrastructure (EN-5) do not contain any additional information which is considered relevant to this assessment. Reference to the requirement's location within the NPS and to where within this ES chapter or wider ES it has been addressed has also been provided.

Table 18.3 Summary of NPS EN-1 provisions relevant to noise and vibration

Summary	How and where this is considered in the ES
NPS for Energy (EN-1)	
"Factors that will determine the likely noise impact include: • The inherent operational noise from the proposed development, and its characteristics • The proximity of the proposed development to noise sensitive premises (including residential properties, schools and hospitals) and noise sensitive areas (including certain parks and open spaces) • The proximity of the proposed development to quiet places and other areas that are particularly valued for their soundscape or landscape quality • The proximity of the proposed development to sites where noise may have an adverse impact on protected species or other wildlife" - **paragraph 5.12.5.**	Refer to **Section 18.3** for the assessment methodology for assessing potential noise and vibration impacts. **Section 18.4** provides details on the existing noise environment including the identification of noise and vibration sensitive receptors (NVSRs).
"Where noise impacts are likely to arise, the applicant should include: • A description of the noise generating aspects of the development proposal leading to noise impacts including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise • Identification of noise sensitive premises and noise sensitive areas that may be affected • The characteristics of the existing noise environment • A prediction of how the noise environment will change with the proposed development • In the shorter term such as during the construction period • In the longer term during the operating life of the infrastructure • At particular times of the day, evening and night (and weekends) as appropriate, and at different times of year. • An assessment of the effect of predicted changes in the noise	Refer to **Section 18.3** for the assessment methodology for assessing potential noise and vibration impacts. **Section 18.4** provides details on the existing noise environment including the identification of NVSRs. **Sections 18.5, 18.6 and 18.7** detail the impact assessments of any changes in noise levels during the construction, operation and decommissioning phases of the Onshore Project, and any mitigation measures are identified.

Summary	How and where this is considered in the ES
environment on any noise-sensitive receptors, including an assessment of any likely impact on health and well-being where appropriate, and noise-sensitive areas • If likely to cause disturbance, an assessment of the effect of underwater or subterranean noise • Measures to be employed in mitigating the effects of noise using best available techniques to reduce noise impacts" **- paragraph 5.12.6.**	
The nature and extent of the noise assessment should be proportionate to the likely noise impact." **- paragraph 5.12.7**	
"Applicants should consider the noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation." - **paragraph 5.12.8**	Refer to **Section 18.5.4** where any changes in noise levels as a result of the increased road traffic associated with the Onshore Project are assessed.
"Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. Further information on assessment of particular noise sources may be contained in the technology specific NPSs. In particular, for renewables (EN-3) and electricity networks (EN-5) there is assessment guidance for specific features of those technologies. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies." - **paragraph 5.12.9**	The assessment of operational noise impacts due to the Onshore Project is described in **Section 18.6**, and any potential effects and mitigation measures are identified. The current relevant British Standards (BS) have been used within this assessment, as detailed in **Section 18.2**.
"Some noise impacts will be controlled through environmental permits and parallel tracking is encouraged where noise impacts determined by an environmental permit interface with planning issues (i.e. physical design and location of development). The applicant should consult Environment Agency (EA) and/or the SNCB, as necessary, and in particular regarding assessment of noise on protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be considered." - **paragraph 5.12.10**	The Onshore Project is not anticipated to require an environmental permit controlling noise impacts. Noise effects on terrestrial protected species are considered within **Chapter 16: Onshore Ecology and Ornithology**.

Summary	How and where this is considered in the ES
"In the marine environment, applicants should consider noise impacts on protected species, both at the individual project level and in-combination with other marine activities." - **paragraph 5.12.11**	Noise impacts in the marine environment are considered in **Chapter 11: Marine Mammal and Marine Turtle Ecology**
"Applicants should submit a detailed impact assessment and mitigation plan as part of any development plan, including the use of noise mitigation and noise abatement technologies during construction and operation. The project should demonstrate good design through selection of the quietest cost-effective plant available; containment of noise within buildings wherever possible; optimisation of plant layout to minimise noise emissions; and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. The Secretary of State should consider whether mitigation measures are needed both for operational and construction noise over and above any which may form part of the project application. In doing so the Secretary of State may wish to impose mitigation measures. Any such mitigation measures should take account of the NPPF or any successor to it and planning practice guidance on noise. Mitigation measures may include one or more of the following: • Engineering: reducing the noise generated at source and/or containing the noise generated • Lay-out: where possible, optimising the distance between the source and noise-sensitive receptors and/or incorporating good design to minimise noise transmission through the use of screening by natural or purpose-built barriers, or other buildings • Administrative: using planning conditions/obligations to restrict activities allowed on the site at certain times and/or specifying permissible noise limits/ noise levels, differentiating as appropriate between different times of day, such as evenings and late at night, and taking into account seasonality of wildlife in nearby designated sites • Insulation: mitigating the impact on areas likely to be affected by noise including through noise insulation when the impact is on a	The embedded mitigation measures described in **Section 18.3.4.1** and proposed mitigation measures described in **Section 18.3.4.2**, which have been selected after considering all of the options identified within the NPSE and demonstrate good design has been adopted.

Summary	How and where this is considered in the ES
building. The project should demonstrate good design through selection of the quietest or most acceptable cost-effective plant available; containment of noise within buildings wherever possible, taking into account any other adverse impacts that such containment might cause (e.g. on landscape and visual impacts; optimisation of plant layout to minimise noise emissions; and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission)." **- paragraph 5.12.12 to 5.12.15**	
"A development must be undertaken in accordance with statutory requirements for noise. Due regard must be given to the relevant sections of the Noise Policy Statement for England, the NPPF, and the government's associated planning guidance on noise. In Wales the relevant policy will be PPW and the TANs, as well as the Welsh Government's Noise and Soundscape Action Plan. The Scretary of State should not grant development consent unless it is satisfied that the proposals will meet the following aim**s, through the effective management and control of noise**: • avoid significant adverse impacts on health and quality of life from noise • mitigate and minimise other adverse impacts on health and quality of life from noise • where possible, contribute to improvements to health and quality of life through the effective management and control of noise." **- paragraph 5.12.16 to 5.12.17.**	Due regard is given to statutory requirements and the quoted policy, as described in **Section 18.2.** These aims are met by adoption of the embedded and proposed mitigation as discussed above. As discussed in **Section 18.3.4**, avoidance of significant adverse impacts is interpreted to avoid effects above the SOAEL and mitigate and minimise other adverse impacts is interpreted to relate to effects above the LOAEL. **Sections 18.5**, **18.6** and **18.7** include assessment of potential effects against the identified SOAEL and LOAELs and shows that exceedances of the applicable SOAEL are not anticipated, and any exceedances of the LOAEL are mitigated and minimised.
"When preparing the development consent order, the Secretary of State should consider including measurable requirements or specifying the mitigation measures to be put in place to ensure that noise levels do not exceed any limits specified in the development consent. These requirements or mitigation measures may apply to the construction, operation, and decommissioning of the energy infrastructure development." **– paragraph 5.12.18**	**Table 18.15** and **Table 18.16** identify the embedded and additional mitigation measures respectively, and how they will be secured in the planning consent.

18.2.1.4 Noise Policy Statement for England

16. The Noise Policy Statement for England (NPSE) document was published by Defra in 2010. Paragraph 1.7 states three policy aims:

17. "Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life
- Mitigate and minimise adverse impacts on health and quality of life
- Where possible, contribute to the improvement of health and quality of life."

18. The Explanatory Note contained within the NPSE introduces the following concepts to aid in the establishment of significant effects:

- No Observed Effect Level (NOEL): the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established
- Lowest Observable Adverse Effect Level (LOAEL): the level above which adverse effects on health and quality of life can be detected
- Significant Observed Adverse Effect Level (SOAEL): the level above which significant adverse effects on health and quality of life occur.

19. The aims of the NPSE can therefore be interpreted as follows (within the context of Government policy on sustainable development):

- The first aim is to avoid noise levels above the SOAEL
- To consider situations where noise levels are between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur.

20. The NPSE states:

"*It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations*". (Paragraph 2.22, NPSE, March 2010).

21. Furthermore, paragraph 2.22 of the NPSE acknowledges that:

"*Further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise*".

18.2.2 Legislation

18.2.2.1 Environmental Protection Act 1990

22. The Environmental Protection Act 1990 prescribes 'noise (and vibration) emitted from premises (including land) so as to be prejudicial to health or a nuisance' as a statutory nuisance.

23. Local Authorities are required to investigate any public complaints of noise and if they are satisfied that a statutory nuisance exists, or is likely to occur or recur, they must serve a noise abatement notice. A notice is served on the person responsible for the nuisance. It requires either the abatement of the nuisance; or works to abate the nuisance to be carried out; or it prohibits or restricts the activity. Contravention of a notice without reasonable excuse is an offence. A right of appeal to the Magistrates Court exists within 21 days of the service of a noise abatement notice.

24. No statutory noise limits exist for determining a nuisance; therefore, the Local Authority can take account of various guidance documents and existing case law when investigating complaints. Lower noise level limits are generally applied when considering the acceptability of a planning permission than those which would be used when considering whether an existing noise source amounts to a statutory nuisance. Demonstrating the use of Best Practical Means (BPM) to minimise noise levels is an accepted defence against a noise abatement notice.

25. When considering a planning application, Local Authority Environmental Health Officers are obliged to consider whether the development under consideration has the potential to cause a statutory nuisance and to use the planning process to avoid this outcome if possible.

18.2.2.2 Control of Pollution Act 1974

26. The Control of Pollution Act 1974 (CoPA) requires that BPM (as defined in Section 72 of CoPA) are adopted to control construction noise on any given site as far as reasonably practicable. Sections 60 and 61 of the CoPA provide the main legislation regarding enabling works and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by Tendring District Council with instructions to cease work until specific conditions to reduce noise have been adopted.

27. Section 61 of the CoPA provides a means to apply for prior consent to carry out noise generating activities during construction. Once prior consent has been

agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on-site.

28. Whilst construction noise and vibration are factors which can be considered during the planning process, Local Authorities have alternative powers under Sections 60 and 61 of CoPA to regulate these issues if complaints arise.

18.2.2.3 The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015

29. The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015 identifies BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 1: Noise and BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 2: Vibration as the approved codes of practice for the control of construction noise and vibration, under the powers afforded to the Secretary of State by Section 71 of CoPA.

18.2.3 Guidance

30. In demonstrating adherence to industry good practice, this chapter has been compiled in accordance with the following relevant standards and guidance:

- Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2019). National Planning Practice Guidance – Noise
- British Standards Institute (BSI) (2019). BS 4142:2014+A1:2019 Method for Rating and Assessing Industrial and Commercial Sound
- BSI (2014). BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 1: Noise
- BSI (2014). BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 2: Vibration
- BSI (1993). BS 7385-2:1993 Evaluation and measurement for vibration in buildings - Guide to damage levels from ground-borne vibration
- International Organization for Standardization (ISO) (2010). ISO 4866: 2010 Mechanical vibration and shock — Vibration of fixed structures — Guidelines for the measurement of vibrations and evaluation of their effects on structures
- BSI (2014). BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings
- BSI (2003). BS 7445-1:2003 Description and measurement of environmental noise. Guide to quantities and procedures

- BSI (1991).BS 7445-2:1991 Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use
- BSI (2008). BS 6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings
- Department for Transport Welsh Office (1988). Calculation of Road Traffic Noise (CRTN)
- Highways England, Transport Scotland, Welsh Assembly, Department for Infrastructure, Northern Ireland (2020). Design Manual for Roads and Bridges LA 111, Noise and Vibration, Revision 2
- World Health Organization (WHO) (1999). Guidelines for Community Noise
- WHO (2009). Night Noise Guidelines for Europe
- WHO (2018). Environmental Noise Guidelines for the European Region, 2018
- Planning Inspectorate (2020) Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping, (Version 7)
- Institute of Environmental Management & Assessment (IEMA) (2016). Guidelines for Environmental Noise Impact Assessment
- IEMA. (2016) Environmental Impact Assessment. Guide to Delivering Quality Development.

18.3 Assessment Methodology

18.3.1 Study Area

31. Details of the location of the Onshore Project and the onshore components are set out within **Chapter 5: Project Description.**

32. The noise and vibration study area is defined by the distance over which impacts on noise and vibration from all the onshore project components (i.e. Landfall, Onshore Export Cable Corridor, Compounds, Access Routes and Onshore Substation) may occur and by the location of any receptors that may be affected by those potential impacts.

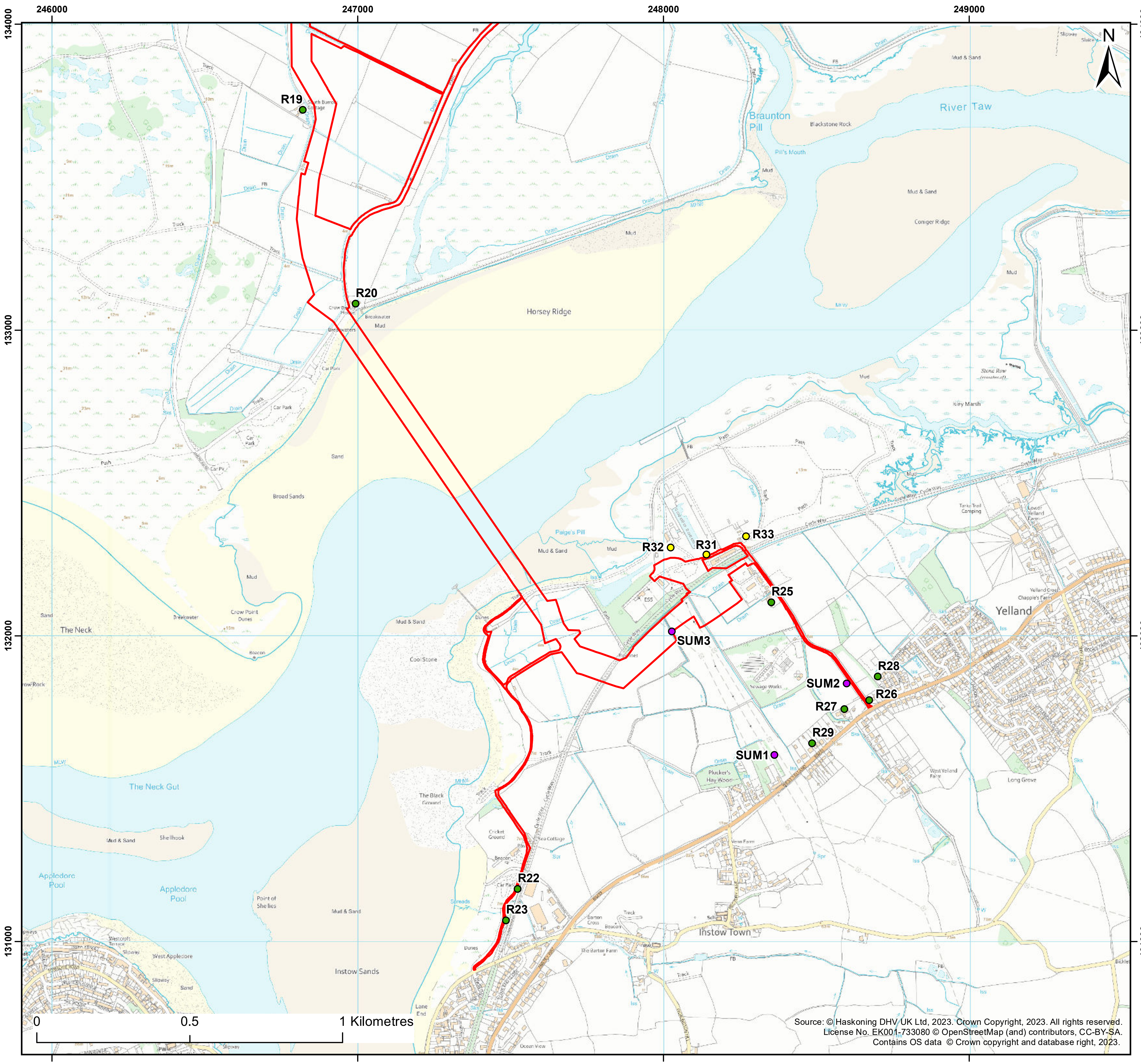
33. The direct noise and vibration effects study area extends from the onshore project components to the nearby NVSRs. The maximum distances to NVSRs at which effects will be considered depend on the Proposed Development phase as follows:

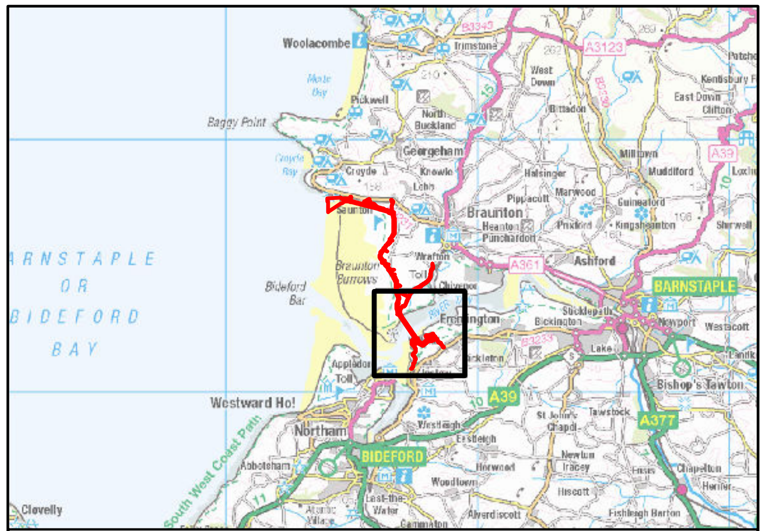
- Construction – in accordance with the guidance in The Design Manual for Roads and Bridges (DMRB) LA111 Noise and Vibration Rev 2, construction impacts would only be assessed at NVSRs which are no further than 300 m from the onshore project components for noise, and 100 m from the onshore project components for vibration

- Operation – only the Onshore Substation is anticipated to have the potential to emit audible levels of operational noise at receptors. Onshore Substation operational noise level predictions (as described in **Section 18.3.2.1.4**), have been used to identify that noise levels at NVSRs further than 500m from the Onshore Substation will be very low, such that significant effects will not occur. Hence, this distance has been used as the operational noise study area for direct effects.

34. The direct construction noise, construction vibration and operational noise study areas are shown in **Figure 18.1**.

35. The indirect noise effects study area relates to potential impacts due to changes in road traffic noise levels. In accordance with the DMRB, it incorporates the closest NVSRs (which are no more than 50m away) to the roads on which the Proposed Development traffic is anticipated to result in noise level changes of at least 1 dB(A).





Legend:

- Onshore Development Area
- Noise Monitoring Locations
- Existing Noise and Vibration Sensitive Receptors (NVSR)
- Consented NVSRs

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Noise Monitoring and Receptor Locations
Sheet 1 of 2

Figure:	18.1	Drawing No:	PC2978-RHD-ZZ-XX-DR-Z-0605		
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P03	09/08/2023	AB	BC	A3	1:12,500
P02	07/06/2023	AB	DE	A3	1:12,500

Co-ordinate system: British National Grid

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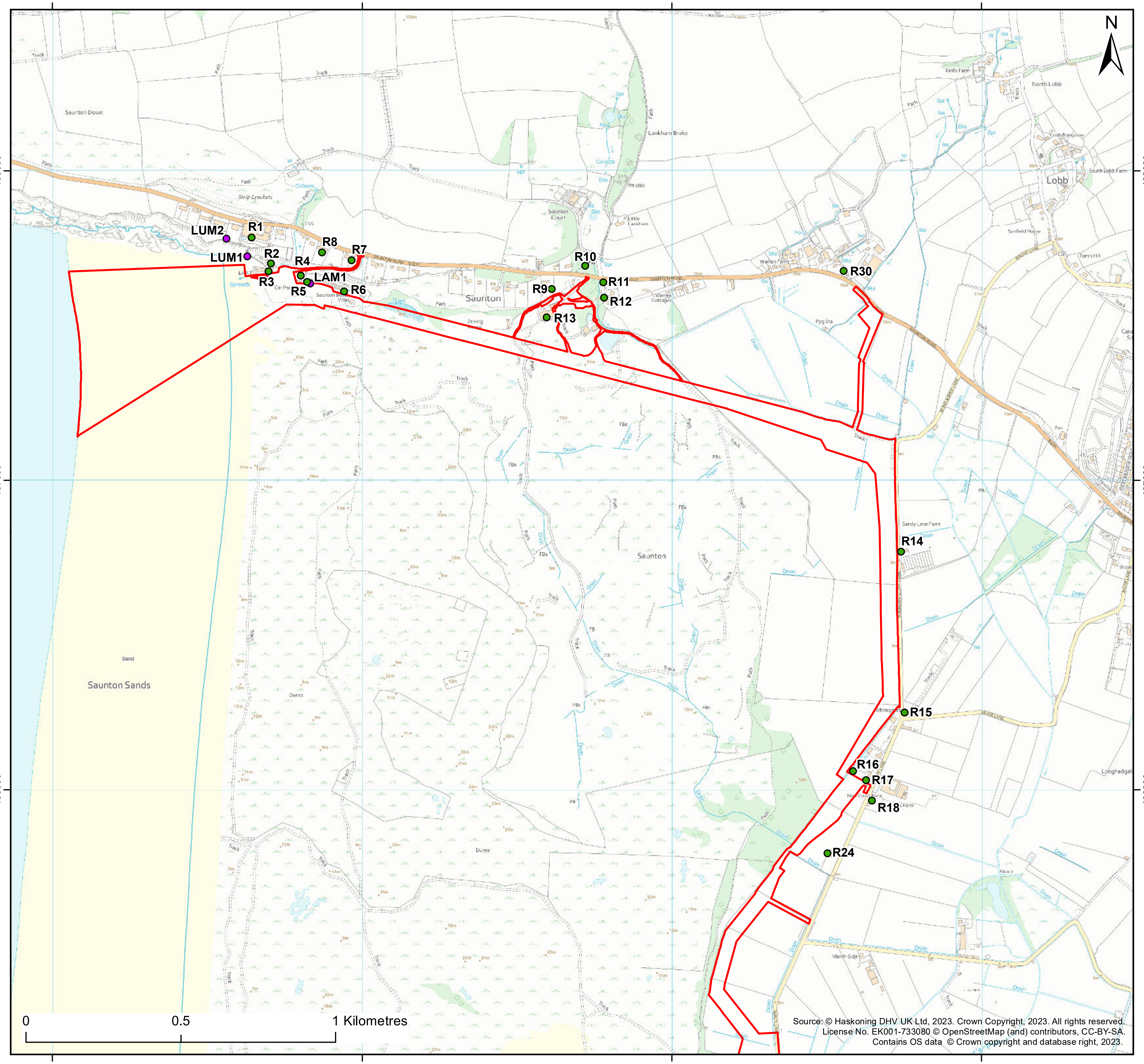

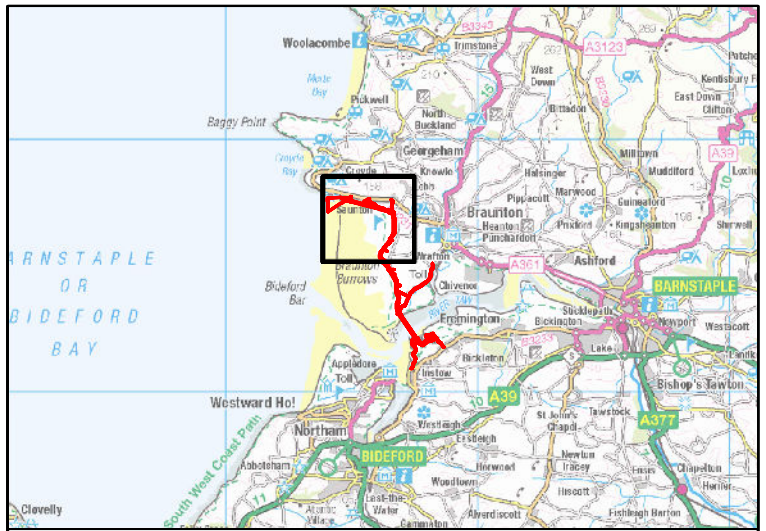

Legend:

- Onshore Development Area
- Noise Monitoring Locations
- Existing Noise and Vibration Sensitive Receptors (NVSR)
- Consented NVSRs

Client: Offshore Wind Ltd.	Project: White Cross Offshore Windfarm

Title: Noise Monitoring and Receptor Locations
Sheet 2 of 2

Figure: 18.1 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0605

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P03	09/08/2023	AB	BC	A3	1:12,500
P02	07/06/2023	AB	DE	A3	1:12,500

Co-ordinate system: British National Grid

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18.3.2 Approach to Assessment

36. **Chapter 6: EIA Methodology** provides a summary of the general impact assessment methodology applied to the Onshore Project. The methodology used to assess the potential effects on noise and vibration broadly follows the methodology in **Chapter 6: EIA Methodology**. However, there are some differences where necessary, as outlined in the following sections.

18.3.2.1 Definitions of magnitude of impact

37. For each of the impacts assessed in this Environmental Statement, a magnitude has been assigned. In doing so the spatial extent, duration, frequency and reversibility of the impact from the construction, operation and maintenance, or decommissioning phase of the Onshore Project has been considered, where applicable.

38. The terms used to define magnitude of impact are outlined in **Table 18.4.**

Table 18.4 Definition of terms relating to magnitude of an impact

Magnitude	Definition
High	Fundamental, permanent/irreversible changes, over the whole receptor, and/or fundamental alteration to key characteristics or features of the particular receptor's character or distinctiveness.
Medium	Considerable, permanent/irreversible changes, over the majority of the receptor, and/or discernible alteration to key characteristics or features of the particular receptor's character or distinctiveness.
Low	Discernible, short term/temporary (events over part of the project duration) change, over a minority of the receptor, and/or limited but discernible alteration to key characteristics or features of the particular receptor's character or distinctiveness.
Negligible	Discernible, short term/temporary (events over part of the project duration) change, or barely discernible change for any length of time, over a small area of the receptor, and/or slight alteration to key characteristics or features of the particular receptor's character or distinctiveness.

39. Where the assessment identifies that there is no loss or alteration of characteristics, features or components, or no observable impact in either direction upon a given receptor or group of receptors from an impact, for example due to implication of embedded mitigation or through an assessment of the

potential pathway, then the assessment for that Impact upon those receptor(s) will be **No Change.**

40. Impacts assessed as **No Change** have no potential for a significance of effect and therefore are not assessed further.

18.3.2.1.1 Magnitude of impact: construction noise

41. A quantitative assessment of construction noise impacts is proposed based on estimates of reasonable worst case construction noise levels at the closest identified potentially sensitive receptors to the works. Reasonable worst case construction noise levels will be estimated in accordance with the methodology in BS 5228-1. Construction noise levels between the LOAEL and the SOAEL have the potential to result in adverse effects but would not normally be classed as significant adverse effects. However, noise mitigation measures are still applied in such locations to seek to keep all effects to a minimum, as per the second aim of the NPSE. **Table 18.5** sets out the construction noise SOAEL and LOAEL proposed for the assessment of impacts on residential receptors.

Table 18.5 Construction noise SOAEL and LOAEL for all receptors

Magnitude of Impact	Construction noise level (dB LAeq,T)			NPSE/PPG category
	Daytime*	Evenings and weekends**	Night-time***	
High	≥80	≥70	≥60	-
Medium	≥75 to <80	≥65 to <70	≥55 to <60	Lower end of range is equivalent to SOAEL
Low	≥65 to <75	≥55 to <65	≥45 to <55	Lower end of range is equivalent to LOAEL
Negligible	<65	<55	<45	-
*07:00 to 19:00 weekdays and 07:00 to 13:00 Saturdays **19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays ***23:00 to 07:00				

42. The identified SOAEL and LOAEL values in **Table 18.5** are considered applicable to other receptor types of similar sensitivity to residential dwellings. It is apparent that, for less sensitive receptors, the SOAEL and LOAEL values should be higher than those in **Table 18.5**. Alternative SOAEL and LOAEL values have not been identified for non-residential receptors, due to a lack of available guidance on what these should be.

43. BS 5228-1 states that: "*If the site noise level exceeds the appropriate category [threshold] value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect*." The following demonstrates how these other factors can be considered to determine the effect significance:

- the predicted construction noise level and change in noise level during the works at the receptor
- the duration of the impact. Construction noise levels equating to impacts of medium significance for less than one month would not normally be considered significant, to accord with the 5 dB change method in BS 5228-1
- the timing of the impact, night time impacts being more likely to be considered significant than daytime impacts
- the location of the impact at the NVSR, for example, a receptor may contain areas which are more or less sensitive than others, for example in a school, office spaces or kitchens would be considered less sensitive than classrooms
- the nature, times of use and design of the receptor, for example a NVSR which is not used at night would not be considered sensitive to night-time construction works.

44. Baseline noise levels are not required to identify the LOAEL and SOAEL values for this assessment.

45. Noise levels for the construction phase have been calculated using the methods and guidance in BS 5228-1. The standard provides methods for predicting receptor noise levels from construction works based on the number and type of construction plant and activities operating on site, with corrections to account for:

- The 'on-time' of the plant, as a percentage of the assessment period
- Distance from source to receptor
- Acoustic screening by barriers, buildings or topography
- Ground type.

46. A construction contractor has provided assumed plant requirements and a preliminary construction schedule, to allow the construction noise predictions to be undertaken. The post-consent final design, and appointment of a principal contractor, may change the data on which the construction noise predictions have been based; hence, the predictions are only considered indicative of the likely construction noise impacts.

47. Eight scenarios have been identified from the construction schedule which are anticipated to result in the worst-case noise impacts at the identified NVSRs. Assumptions regarding construction plant for each activity are provided in **Appendix 18.B: Construction Noise and Vibration Predictions** in addition to the predicted noise level at each NVSR. Separate noise models were created to predict the impact of each identified scenario.

18.3.2.1.2 Magnitude of impact: off-site construction road traffic noise

48. Construction off-site traffic noise impacts along existing roads have been estimated based on the CRTN methodology for the calculation of the Basic Noise Level (BNL) at a reference distance of 10m from the nearside carriageway. Calculations have been undertaken for both the 'with' and 'without' construction traffic scenarios for the peak construction year, for each road link in the construction traffic model.

49. To undertake the BNL calculations, details of the road network study area for the construction phase traffic assessment were provided by the traffic EIA specialists, along with Annual Average Weekday Traffic (AAWT) 18hr flows, % Heavy Goods Vehicles (HGVs) and speed data for each road link, as detailed in **Chapter 19: Traffic and Transport** and **Appendix 19.A: Transport Assessment**.

50. In order to determine impacts, the assessment of construction traffic noise compares the calculated BNLs with and without the construction traffic. Any changes in day or night-time noise levels due to a corresponding change in volume and composition have been assessed using the impact magnitude criteria detailed in **Table 18.6**, which is reproduced from Table 3.17 of the DMRB.

Table 18.6 Magnitude criteria for relative change due to construction road traffic

Magnitude of impact	Increase in BNL of closest public road used for construction traffic (dB)
High	≥5.0
Medium	≥3.0 and <5.0
Low	≥1.0 and <3.0
Negligible	<1.0

51. The LOAEL and SOAEL for construction traffic noise during the daytime period are defined in the DMRB as 55dB $L_{A10,18hr}$ and 68dB $L_{A10,18hr}$ respectively.

52. For temporary impacts due to construction traffic noise, predicted 'with project' road traffic noise levels which are less than the LOAEL are considered to represent

an impact of no worse than minor magnitude (i.e. not significant), irrespective of the change in BNL. For effects between the LOAEL and SOAEL, the duration of the impact must be considered, in addition to the magnitude of the change, when determining whether an impact is significant.

18.3.2.1.3 Magnitude of impact: construction vibration

53. Ground-borne vibration can result from construction works and may lead to perceptible levels of vibration at nearby receptors which, at higher levels, can cause annoyance to residents. In extreme cases, cosmetic or structural building damage can occur, but only at extremely high vibration levels and such cases are rare.

54. Typically, perceptible ground-borne vibration is only emitted by 'heavy' construction works such as piling, deep excavation, or dynamic ground compaction.

55. The response of a building to ground-borne vibration is affected by the type of foundation, ground conditions, the building construction and the condition of the building. BS 7385-2 provides guide values for transient vibration which are "judged to give a minimal risk… of vibration-induced damage." and is referenced in BS 5228-2, as shown in **Table 18.7**. BS 5228-2 states that for continuous vibration (such as that induced by vibratory compaction), the thresholds might need to be reduced by up to 50%.

Table 18.7 Transient vibration guide values at the building foundation for cosmetic damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 $mm.s^{-1}$ at 4 Hz and above	
Un-reinforced or light framed structures Residential or light commercial type buildings	15 $mm.s^{-1}$ at 4 Hz increasing to 20 $mm.s^{-1}$ at 15 Hz	20 $mm.s^{-1}$ at 15 Hz increasing to 50 $mm.s^{-1}$ at 40 Hz and above
Note 1: Values referred to are at the base of the building. Note 2: For unreinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6mm (zero to peak) is not to be exceeded.		

56. BS 7385-2 states that minor damage occurs at a vibration level twice that of cosmetic damage and major damage occurs at a vibration twice that of minor damage. The values in **Table 18.7** refer to the likelihood of cosmetic damage. ISO 4866:2010 '*Mechanical Vibration and Shock – Vibration of Fixed Structures – Guidelines for the Measurement of Vibrations and Evaluation of Their Effects on Structures'* defines three different categories of building damage:

- Cosmetic – formation of hairline cracks in plaster or drywall surfaces and in mortar joints of brick/concrete block constructions
- Minor – formation of large cracks or loosening and falling of plaster or drywall surfaces or cracks through brick/block
- Major – damage to structural components, cracks in support columns, loosening of joints, splaying of masonry cracks.

57. This guidance can be used to define the potential impact as identified in **Table 18.8** for continuous vibration for unreinforced or light framed structures and residential or light commercial buildings. Using the below criteria, reinforced or framed structures, industrial and heavy commercial buildings would be classified as of 'low' sensitivity to vibration damage. Unreinforced or light framed structures and residential or light commercial buildings are classified as of medium sensitivity to structural vibration damage.

Table 18.8 Construction vibration criteria for assessing building damage

Damage risk	Impact magnitude	Continuous vibration level (ppv, $mm.s^{-1}$) at the building foundation		
		Frequency of 4 Hz	Frequency of 15Hz	Frequency of 40 Hz and above
Major	**High**	≥30	≥40	≥100
Minor	**Medium**	15 to <30	20 to <40	50 to <100
Cosmetic	**Low**	6 to <15	10 to <20	25 to <50
Negligible	**Negligible**	<6	<10	<25

58. The vibration level and effects presented in **Table 18.9** are taken from Table B-1 of BS 5228-2. These levels and effects are based on human perception of vibration in residential environments.

Table 18.9 Construction vibration criteria for assessing human perception in buildings

Vibration limit PPV ($mm.s^{-1}$)	Interpreted significance to humans	Magnitude of impact	NPSE/PPG Category
>10.0	Vibration is likely to be intolerable for any more than a brief exposure to this level	High	
1.0 to <10.0	It is likely that vibration at this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents	Medium	Lower end of range is SOAEL
0.3 to <1.0	Vibration might just be perceptible in residential environments	Low	Lower end of range is LOAEL
0.14 to <0.3	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction	Negligible	Lower end of range is NOEL
<0.14	Vibration unlikely to be perceptible		

59. Predicted construction vibration levels at receptors which exceed a value of 1 $mm.s^{-1}$ have the potential to result in a significant effect. However, the same additional project-specific factors which can influence the construction noise effect significance (as discussed in **Section 18.3.2.1.1**) are considered relevant to vibration impacts. Hence, the same process for considering these other factors should be used to determine the vibration effect significance.

60. Comparison of the criteria in **Table 18.8** and **Table 18.9** shows that the levels at which building damage may occur are significantly above those which are considered tolerable by the occupants. The assessment therefore applies the criteria for human annoyance. Assuming that the vibration impacts will be controlled to avoid significant annoyance effects, then building damage is not anticipated.

61. Annex E of BS 5228-2:2009+A1:2014 contains empirical formulae derived by Hiller and Crabb (2000) from field measurements relating to resultant Peak Particle Velocity (PPV), with several other parameters for vibratory compaction, dynamic compaction, percussive and vibratory piling, the vibration of stone columns and tunnel boring operations. Use of these empirical formulae enables resultant PPV to be predicted and for some activities (vibratory compaction, vibratory piling and vibrated stone columns) they provide an indicator of the probability of these levels of PPV being exceeded.

62. Consequently, calculations following these methodologies were carried out for the anticipated construction activities with the potential to result in perceptible vibration at receptors. Reasonable worst-case assumptions were applied regarding ground conditions and energy levels to determine set-back distances at which critical vibration levels may occur, as detailed in **Appendix 18.B: Construction Noise and Vibration Predictions.**

18.3.2.1.4 Magnitude of impact: operational noise

63. Operational noise from the proposed Onshore Substation has been assessed in accordance with BS 4142:2014+A1:2019 which is the accepted UK standard for rating and assessing the impact of sound of an industrial and/or commercial nature and is referred to in NPS EN-1.

64. BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature using outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a residential dwelling upon which sound is incident.

65. The basis of BS 4142 is a comparison between the *background sound level* in the vicinity of residential locations and the *rating level* of the noise source under consideration. The relevant parameters in this instance are as follows:

- *Background sound level* – $L_{A90,T}$ – defined in the standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F (Fast) and quoted to the nearest whole number of decibels
- *Specific sound level* – $L_{Aeq,Tr}$ – the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a reference time interval, T_r (1 hour during the daytime hours (07:00 to 23:00 hours) and 15 minutes during night-time hours (23:00 to 07:00 hours))
- *Residual Sound Level* - $L_{Aeq,T}$ – the equivalent continuous 'A' weighted sound pressure level at the assessment location in the absence of the specific sound source under consideration, over a given time interval, T
- *Rating level* – $L_{Ar,Tr}$ – the *specific sound level* plus a "character correction" if required for the acoustic features of the noise such as tonality, impulsivity and intermittency.

66. When comparing the *background sound* and the *rating* levels, the standard states that:

"a) Typically, the greater the difference, the greater the magnitude of impact

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context

c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context

d) The lower the rating level relative to the measured background sound level the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context".

67. When assessing the noise from a source, it is necessary to have regard to the acoustic features that may be present in the source noise at the receptors. Section 9.1 of BS 4142 states:

"*Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level*'.

68. For clarity, an explanation of each character correction type (taken from BS 4142:2014+A1:2019, pages 13 and 14) is provided here:

- Tonality - for sound ranging from not tonal to prominently tonal a correction of between 0dB and +6dB for tonality can be applied. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible
- Impulsivity - a correction of up to +9dB can be applied for sound that is impulsive. Subjectively, this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible
- Intermittency - when the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied

- Other sound characteristics - where the specific sound feature characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied.

69. The Onshore Substation operational noise levels have been predicted at the identified receptors using 3-D noise modelling software, configured to implement the ISO 9613-2 prediction methodology. The model incorporates proposed buildings and noise sources located at the Onshore Substation, as well as nearby residential dwellings and other buildings in the study area, intervening ground cover and topographical information.

70. During consultation in the Expert Topic Group (ETG), North Devon Council expressed a preference for a criterion that, to protect residential amenity, the *rating level* of the substation sound should be at least 5dB below the representative *background sound level*. It was also stated that in some cases a *rating level* of at least below the representative *background sound level* would be acceptable. Nonetheless, the former simple criterion of 5dB below background has been used herein.

71. The magnitude of impact of the predicted substation sound levels has been based on a quantitative assessment of noise impact using BS 4142, based on North Devon Council's preferred criterion, as shown in **Table 18.10**. Separate assessments are undertaken of day and night-time impacts; the overall magnitude of impact is based on the worst-case time period.

Table 18.10 Operational noise magnitude of impact criteria

Rating level dB $L_{Ar,Tr}$	Magnitude of Impact	NPSE/PPG Category
< Measured L_{A90} – 5dB	**Negligible**	-
= Measured L_{A90} – 5dB	**Low**	LOAEL
> Measured L_{A90} – 5dB to < Measured L_{A90}		-
= Measured L_{A90}	**Medium**	-
> Measured L_{A90} to Measured L_{A90} + 5dB		-
> Measured L_{A90} + 5dB	**High**	SOAEL

72. Operational noise effects may be considered significant depending on the margin by which the *rating level* of the specific sound source exceeds the *background sound level* and the context in which the sound occurs.

73. BS 4142 also requires that the context is considered. Of particular relevance to this assessment is the absolute sound level; on this point Section 11 'Assessment of the impacts' of the standard states that "*Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*" The standard offers no guidance about what *background* and *rating levels* are considered low; however, the 1997 version of the standard stated that *background sound levels* below around 30dB L_{A90}, and *rating levels* below around 35dB L_{ArTr}, were considered very low and therefore outside the scope of the assessment method. The Association of Noise Consultants produced guidance on the application of BS 4142 (BS 4142:2014+A1:2019 Technical Note, Association of Noise Consultants, March 2020) which states (Section 11 'Assessment of impacts' under subheading 'Context', 'Subclause 11(1)') that "*similar values* [i.e. *background sound levels* below around 30dB L_{A90}, and *rating levels* below around 35dB L_{ArTr}] *would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate.*"

74. The WHO Night Noise Guidelines for Europe (NNG) have been used to establish alternative LOAEL and SOAEL values for night-time operational noise which could be applied when *background sound levels* are low. In summary, the NNG found that below the level of 30dB(A) $L_{night,outside}$ (equivalent to a free-field $L_{Aeq,23:00\ to\ 07:00}$) there are no observed effects on sleep. Furthermore, there is no evidence that biological effects observed at levels below 40dB(A) $L_{night,outside}$ are harmful to health. However, the NNG found that "*closer examination of the precise impact will be necessary in the range between 30dB and 55dB as much will depend on the detailed circumstances of each case*" (Section 5.6 'Recommendations for health protection') and Table 5.2 of the document states that the threshold for the wellbeing effect of "*complaints*" is 35dB $L_{night,outside}$. At levels above 55dB(A) $L_{night,outside}$, the NNG detailed that adverse health effects occur frequently and there is limited evidence that the cardio-vascular system is coming under stress.

75. Therefore, based on the NNG, the following effect levels for assessing against the NPSE categories are applicable:

- 30dB(A) $L_{night,outside}$ - NOEL
- 35dB(A) $L_{night,outside}$ - LOAEL
- 55dB(A) $L_{night,outside}$ – SOAEL.

76. In accordance with the stated scope of the standard, the methodology in BS 4142 has been used for the assessment of operational noise effects on residential

NVSRs. For the assessment of operational noise effects on non-residential NVSRs, appropriate noise level criteria have been adapted from the relevant standards and guidance specified in **Section 18.2.3**.

18.3.2.2 Definitions of receptor sensitivity/value

77. The sensitivity level of the receptor to noise and/or vibration impacts is justified within the assessment and is dependent on the following factors:

- Adaptability – The degree to which a receptor can avoid or adapt to an effect
- Tolerance – The ability of a receptor to accommodate temporary or permanent change without a significant adverse effect
- Recoverability – The temporal scale over and extent to which a receptor will recover
- Value – A measure of the receptor importance and rarity.

78. The terms used to define sensitivity/value are outlined in **Table 18.11**.

Table 18.11 Definition of terms relating to receptor sensitivity/ value

Sensitivity	Definition	Examples
High	Receptors where noise or vibration level changes may significantly affect their usage.	Certain hospital wards (e.g. operating theatres or high dependency units), auditoria, laboratories with highly vibration sensitive equipment or buildings which are structurally unsound or identified as requiring special protection by cultural specialists (for example some historical/listed buildings or scheduled monuments).
Medium	Receptors where noise and/or vibration level changes may cause disturbance, protection is required but some tolerance is expected.	Residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities and national parks (during the day).
Low	Receptors where noise and/or vibration level changes may cause some distraction or disturbance.	Commercial premises, offices, shops (including cafes), outdoor amenity areas during the day (including recreation, public amenity space/play areas), long distance footpaths (including PRoW, dog walking routes, bird watching areas, footpaths and other walking routes, visitor attractions, cycling routes including rural roads), doctor's surgeries, sports facilities and places of worship.

Sensitivity	Definition	Examples
Negligible	Receptors where noise and/or vibration level changes are not expected to be detrimental.	Warehouses, light industry, car parks, and agricultural land.

18.3.2.3 Significance of effect

79. The potential significance of effect for a given impact, is a function of the sensitivity of the receptor and the magnitude of the impact (see **Chapter 6: EIA Methodology** for further details). A matrix is used (**Table 18.12**) as a framework to determine the significance of an effect.

80. Definitions of each level of significance are provided in **Table 18.13**, based on the National Planning Policy Guidance (NPPG) and IEMA Guidelines. Impacts and effects may be deemed as being either positive (beneficial) or negative (adverse).

81. In all cases, the evaluation of receptor sensitivity, impact magnitude and significance of effect has been informed by professional judgement and is underpinned by narrative to explain the conclusions reached.

Table 18.12 Significance of an effect - resulting from each combination of receptor sensitivity and the magnitude of the impact upon it

		Adverse Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Negligible	Negligible	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 18.13 Definitions of effect significance for noise

Significance	Definition
Major	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.
Moderate	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area
Minor	Noise can be heard and causes small changes in behaviour, attitude or other

Significance	Definition
	physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative 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 there is a small actual or perceived change in the quality of life.
Negligible	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.
No change	No impact, therefore, no change in receptor condition.

82. Potential effects are described, followed by a statement of whether the effect is significant in terms of the EIA regulations. Potential effects identified within the assessment as major or moderate are regarded as significant in terms of the EIA regulations. Whilst minor effects (or below) are not significant in EIA terms in their own right, it is important to distinguish these, as they may contribute to significant effects cumulatively or through interactions.

83. Following initial assessment, if the effect does not require additional mitigation (or none is possible), the residual effect will remain the same. If, however, additional mitigation is proposed, there will be an assessment of the post-mitigation residual effect.

18.3.3 Worst-Case Scenario

84. In accordance with the assessment approach to the 'Rochdale Envelope' set out in **Chapter 6: EIA Methodology**, the impact assessment for noise and vibration has been undertaken based on a realistic worst-case scenario of predicted impacts. The Project Design Envelope for the Project is detailed in **Chapter 5: Project Description**.

85. The realistic worst-case scenario (having the most impact) for each individual impact is derived from the Project Design Envelope (PDE) to ensure that all other design scenarios will have less or the same impact. **Table 18.14** presents the realistic worst-case scenario components considered for the assessment of noise and vibration.

Table 18.14 Definition of realistic worst-case scenario details relevant to the assessment of impacts in relation to noise and vibration

Impact	Realistic worst-case scenario	Rationale
Construction		
Construction works causing noise or vibration level increases at sensitive receptors	Standard working hours are 07:00 to 19:00 hours Monday to Friday and 07:00 to 13:00 on Saturday, with no activities on Sundays or bank holidays. Night-time works may be required for concrete pouring to construct the Onshore Substation and for the major trenchless technique. Major trenchless technique works could require up to 7 days of continuous working per drill (a total of 28 days at the Saunton Sands Car Park and 14 days at the crossing of the Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge)). **Landfall trenchless technique (temporary works) physical parameters:** Trenchless technique horizontal length = 1650m Trenchless technique temporary works area (launch) = 4,500m^2 Transition joint bay size = 20 x 8m No. of transition joint bays = 1 Number of simultaneous trenchless techniques = 1 Number of drives = 2 Construction duration = 5 months (of which the trenchless technique = 4 months) **Golf Course trenchless techniques (temporary works) physical parameters:** Trenchless technique horizontal length = 1300m Trenchless technique temporary works area (launch) = 2,500m^2 Trenchless technique temporary works area (reception) = 2,500m^2 Number of simultaneous trenchless techniques = 1	The significance of a construction noise effect depends on the noise level and duration of exposure. Consideration should be given to both the spatial impacts (proximity to receptors) and temporal (duration) aspect of each of the activities. Construction works noise emissions are primarily a function of the type and number of plant required, as detailed in **Appendix 18.B: Construction Noise and Vibration Predictions**. Construction noise levels at NVSRs around the landfall have been calculated assuming all construction plant is operating simultaneously in the landfall compound area. Cable installation at the landfall option 3 (trenchless technique duct with offshore exit) is considered to represent the worst-case impacts, as it involves the longest duration of trenchless technique working.

Impact	Realistic worst-case scenario	Rationale
	Number of drives = 2 Construction duration = 7 months (of which trenchless technique = 6 months) **River Taw trenchless techniques (temporary works) physical parameters:** Trenchless technique horizontal length = 1300m Trenchless technique temporary works area (launch) = 2,500m^2 Trenchless technique temporary works area (reception) = 2,500m^2 Number of simultaneous trenchless techniques = 1 Number of drives = 2 Construction duration = 7 months (of which the trenchless technique = 6 months) **Onshore Export Cable Corridor construction physical parameters:** Working width = 30m open trench, 15m (max.) at trenchless crossings Corridor length = 6km Cable trench width (max.) = 3m No. of trenches = 2 Approximate cable trench depth = 1.9m Haul road width = 5m Temporary construction compound requirements = 1 main compound (footprint 50 x 50m) and 3 secondary compounds (30 x 20m). Number of trenchless crossings = 12 Trenchless launch pit dimensions = 4m x 5m Overall duration = 18 months Minor trenchless crossings = 2 months total i.e. approx. 5 days per crossing	Construction noise levels due to Onshore Export Cable works have been calculated assuming all construction plant is operating simultaneously in a 60m wide area at the closest approach of the Onshore Export Cable representing a monthly average noise level. Overall duration of Cable Corridor works includes establishing / reinstating temporary construction compounds and haul roads, cable installation (trench excavation, duct installation, cable jointing), trenchless technique (includes compound establishment, trenchless technique, and reinstatement).

Impact	Realistic worst-case scenario	Rationale
	Onshore Substation (temporary works) physical parameters: Construction compound footprint = 100 x 50m Construction duration = 11 months	
Operation		
Onshore Substation operation causing noise level increases at sensitive receptors	**Onshore Substation physical parameters:** Permanent substation footprint = 100 x 64m Structure to consist of lightweight Glass Reinforced Plastic (GRP) material providing a low attenuation of Rw=10dB, including roof. No other attenuation included. Plant noise levels for the worst-case substation design option being considered have been used.	Operational noise emissions depend on the number and type of plant proposed at the Onshore Substation, as well as construction of the enclosure/building.

Impact	Realistic worst-case scenario	Rationale
Decommissioning		
Decommissioning works causing noise or vibration level increases at sensitive receptors	The decommissioning policy for the Onshore Project infrastructure is not yet defined however it is anticipated that some infrastructure would be removed, reused or recycled; other infrastructure could be left in situ. The following infrastructure is likely be removed, reused, or recycled where practicable: • Onshore Substation • Export Cables The following infrastructure is likely to be decommissioned and could be left in situ depending on available information at the time of decommissioning: • Transition joint bays • Cable joint bays • Cable ducting	The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time. Decommissioning arrangements will be detailed in a Decommissioning Plan, which will be drawn up and agreed with the relevant consenting body/stakeholder prior to decommissioning. For the purposes of the worst-case scenario, it is anticipated that the impacts will be comparable to those identified for the construction phase.

18.3.4 Summary of Mitigation

86. This section outlines the mitigation relevant to the noise and vibration assessment, which has been incorporated into the design of the Onshore Project. Further information is detailed in **Chapter 5: Project Description**.

18.3.4.1 Embedded Mitigation

87. The embedded mitigation measures are those defined in the IEMA guidance as either primary or tertiary mitigation. Those measures relevant to the noise and vibration assessment are summarised in **Table 18.15**.

88. As these measures have been embedded the assessment of effects is undertaken on the basis that these forms of mitigation will definitely be delivered. Therefore, any effects that might have arisen without these forms of mitigation do not need to be identified as 'potential effects', as there should be no potential for them to arise.

Table 18.15 Embedded mitigation measures relevant to the noise and vibration assessment

Component/Activity/Impact	Mitigation embedded into the design of the Onshore Project
Mitigation by site selection	The Onshore Project has been defined following an extensive site selection process, which has accounted for environmental, engineering, planning and land requirements to identify an optimal project location. The site selection process is described in detail in **Chapter 4: Site Selection and Assessment of Alternatives**. The site selection process has included consideration of the nearby residential properties and other NVSRs, and distances to these have been maximised, particularly in relation to the location of the Onshore Substation.
Construction phase noise and vibration	Commitment to BPM implemented during the construction phase, detailed in the Construction Noise and Vibration Management Plan (CNVMP) which will be included as part of the Construction Environmental Management Plan (CEMP) secured through a planning condition. An Outline CEMP has been submitted with the planning application.
Construction phase road traffic noise	An Outline Construction Traffic Management Plan (CTMP) is included in **Appendix 19.B: Outline CTMP**. The plan outlines methods to manage peak construction traffic flows and minimise significant traffic and transport impacts. The CTMP will also serve to reduce the associated construction traffic noise and the relative noise change. Traffic management measures are provided in **Chapter 19:**

Component/Activity/Impact	Mitigation embedded into the design of the Onshore Project
	Traffic and Transport.
Operational substation noise	The design includes for an enclosing structure, the attenuating effects of which have been included in the noise modelling.
Operational substation vibration	The substation plant will be designed and installed as to minimise vibration transmission from any plant items which might generate vibration. This control of vibration at source is necessary to maximise life of the plant and minimise maintenance. Typically, placing vibration isolation mounts into concrete pads would ensure that ground-borne vibration is not perceptible beyond the immediate area of the substation.

18.3.4.2 Additional Mitigation

89. In addition to the embedded mitigation measures as outlined above, the Applicant has also committed to the following further mitigation measures summarised in **Table 18.16**. These are those identified within the IEMA guidance as secondary mitigation, and includes measures identified where potentially significant effects have been assessed.

Table 18.16 Further mitigation measures relevant to the noise and vibration assessment

Component/Activity/Impact	Additional Mitigation
Impact 1: Noise of construction works at the landfall location	Temporary screening between the landfall compound and the nearby NVSRs
Impact 2: Noise of cable corridor construction	Temporary screening between the haul road and NVSRs R14 and R16
Impact 6: Operational noise	Based on the current design and operational plant assumptions, acoustic attenuation is required to reduce the sound emissions of substation ventilation plant. Depending on the final design of the substation, alternative mitigation measures may be required, such as locating the ventilation plant on the façades of the building facing away from the nearby NVSRs, acoustic screening and plant enclosures. Final mitigation measures will be determined during the detailed design of the substation. A planning condition requiring submission of, and compliance with, an updated operational noise assessment in accordance with BS 4142:2014+A1:2019 will be required, reflecting

Component/Activity/Impact	Additional Mitigation
	the detailed design of the substation and incorporating the mitigation measures required to ensure that residual effects are not significant.

18.3.5 Baseline Data Sources

18.3.5.1 Desktop Study

90. A desktop study was undertaken to obtain information pertinent to the noise and vibration assessment. Data relating to the study area were acquired through a detailed desktop review of existing studies and datasets. Agreement was reached with all consultees that the data collected, and the sources used to define the baseline characterisation for noise and vibration, are fit for the purpose of the EIA (see **Table 18.21** Consultation responses).

91. The sources of information presented in **Table 18.17** were consulted to inform the noise and vibration assessment.

Table 18.17 Data sources used to inform the noise and vibration assessment

Source	Summary
Google Maps aerial photography	Aerial photography of the noise and vibration study area, used to identify and classify NVSRs
Environment Agency Lidar topographical data	Topography of the noise and vibration study area, used to undertake 3-d noise propagation modelling
Ordnance Survey mapping	Mapping of the noise and vibration study area, used to identify and classify NVSRs

18.3.5.2 Site Specific Survey

92. To inform the EIA, site-specific surveys were undertaken, as agreed with the statutory consultees. A summary of surveys is outlined in **Table 18.18**.

Table 18.18 Summary of site-specific survey data

Survey name and year	Summary
Baseline noise survey, 2023	Baseline survey at locations representative of receptors potentially affected by noise from the landfall and Onshore Substation, conducted during June 2022, as described in **Section 18.4.1**. The scope and extent of the baseline survey was agreed with North Devon Council.

18.3.6 Data Limitations

93. In the absence of detailed information from a principal construction contractor, assumptions have been made about the types of plant and equipment which are likely to be used for the construction works. These assumptions are considered representative of a reasonably foreseeable worst-case.

94. Similar limitations apply to operational noise due to the proposed substation. No detailed design yet exists and the construction of the enclosure building has been modelled using pessimistic assumptions following available information. Noise levels for the substation plant are based upon the worst-case option being considered. However, a planning condition requiring submission of, and compliance with, an updated operational noise assessment in accordance with BS 4142:2014+A1:2019 will be required, reflecting the detailed design of the substation, ensuring that no significant effect results.

95. Any measurement of existing ambient or *background sound levels* will be subject to a degree of uncertainty. Environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a sample of the ambient levels. Every effort is made to ensure that measurements are undertaken in such a way as to provide a representative sample of conditions, such as avoiding periods of adverse weather conditions, and school holiday periods (which are often considered to result in atypical sound levels). However, a small degree of uncertainty will always remain in the values taken from such a measurement survey.

18.3.7 Scope

96. Upon consideration of the baseline environment, the project description outlined in **Chapter 5: Project Description**, and Scoping Opinion (Case reference: EIA/2022/00002), potential impacts upon noise and vibration have been scoped in or out. These impacts are outlined, together with a justification for why they are or are not considered further, in **Table 18.19** and **Table 18.20** respectively. In scoping potential impacts in or out reference is made to the embedded mitigation measures outlined above in **Table 18.15**.

Table 18.19 Summary of impacts scoped in relating to noise and vibration

Potential Impact	Justification
Noise from construction of the Onshore Project	Noise from construction of the landfall and Onshore Export Cable Corridor Cable and Onshore Substation is considered to have the potential to disturb occupants of nearby NVSRs

Potential Impact	Justification
Vibration from construction of the Onshore Project	Vibration from the construction of the landfall and Onshore Export Cable Corridor Cable is considered to have the potential to disturb occupants of nearby NVSRs
Construction traffic noise	Increases in road traffic noise levels is considered to have the potential to disturb occupants of NVSRs near to roads used by construction traffic
Noise from operation of the Onshore Substation plant	Noise from the operation of the Onshore Substation is considered to have the potential to disturb occupants of nearby NVSRs

Table 18.20 Summary of impacts scoped out relating to noise and vibration

Potential Impact	Justification
Noise from construction of the Offshore Project	No offshore construction works are anticipated at locations closer to the shore line than the trenchless technique tunnel exit. The length of the landfall trenchless technique is 680m and the exit of the trenchless technique tunnel will be around 400m offshore. Hence, any offshore construction works will be further than 300m from the NVSRs and, in accordance with the DMRB LA111, associated noise and vibration effects are therefore excluded from the assessment scope.
Construction traffic vibration	The DMRB LA111 states that "a maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects". On this basis, and as agreed in consultation with the ETG, the assessment of vibration impacts due to construction traffic using public roads has been excluded from the assessment scope.
Operational vibration	Whilst the selection of the final Onshore Substation electrical plant has not yet been made, some of it is likely to be vibration sensitive; hence, to prevent damage, the Onshore Substation will be designed to achieve very low levels of ground-borne vibration within the substation itself. This will be achieved using industry standard mitigation measures applied to items of plant with the potential to generate significant levels of vibration, such as vibration isolation pads/mounts for proposed super grid transformers. In terms of the potential for impacts at receptors, these very low levels of vibration within the Onshore Substation will be further attenuated due to propagation with distance. The closest existing NVSR is at least 300m from the Onshore Substation zone, and the closest potential NVSR with consent to be constructed is at least 100m away. This further attenuation will ensure that the operation of the substation will not result in perceptible levels of vibration at receptors and no further assessment of operational phase vibration impacts is required.
Noise associated with operational maintenance	The only anticipated source of noise due to operational maintenance is the associated road traffic flows, which will be minimal. Hence, no operational maintenance noise effects are anticipated.

18.3.8 Consultation

97. Consultation has been a key part of the development of the Onshore Project. Consultation regarding noise and vibration has been conducted throughout the EIA. An overview of the project consultation process is presented within **Chapter 7: Consultation**.

98. A summary of the key issues raised during consultation specific to noise and vibration is outlined below in **Table 18.21**, together with how these issues have been considered in the production of this ES.

Table 18.21 Consultation responses

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
Scoping Opinion Response			
North Devon Council	North Devon Council Pre-application enquiry response, 5 April 2022	The Scoping Report appears to provide no consideration of noise and vibration on ecological receptors and in particular overwintering birds associated with the Taw Torridge Site of Special Scientific Interest (SSSI)	Noise and vibration effects on ecological receptors are assessed in **Chapter 16: Onshore Ecology and Ornithology**.
ETG Meetings			
North Devon Council	16/06/2022	North Devon Council were presented with the proposed data collection and assessment methodologies in this meeting. This was followed up with Technical note on Noise Assessment / Noise Monitoring Methodologies and Proposed Monitoring Locations issued to North Devon Council on 21st July 2022. No comments were provided.	N/A
North Devon Council	23/05/2023	Agreement of BS4142 noise criteria to be used for assessment of proposed operational substation noise, including agreement of representative background sound levels. Consideration of existing substation noise.	**Section 18.3.2.1.4** describes the operational noise assessment methodology which has been based on the interpretation of BS4142 provided by North Devon Council.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		Confirmation of agreement to scope out construction noise for substation.	**Section 18.5.3** identifies that there are no NVSRs with the potential to be adversely affected by substation construction noise.
		Some discussion of night-time working during cable construction works.	**Sections 18.5.1** and **18.5.2** describe the assessments of construction noise, which include consideration of impacts from night-time working.

18.4 Existing Environment

99. This section describes the existing environment in relation to noise and vibration within the Onshore Project study area. It has been informed by a review of the sources listed in **Table 18.17**.

18.4.1 Current Baseline

100. Thirteen existing NVSR locations at the landfall, have been identified, eleven with the potential to be impacted by construction traffic, and seven at the Onshore Substation. These are presented in **Table 18.22** and shown in **Figure 18.1**.

Table 18.22 Onshore NVSRs included in the assessment

NVSR identifier	Coordinates		Classification	Sensitivity
	X	Y		
R1	244644	137783	Hotel	Low
R2	244707	137699	Office	Low
R3	244698	137674	Commercial	Low
R4	244802	137660	Residential	Medium
R5	244823	137639	Holiday let	Low
R6	244942	137609	Holiday let	Low
R7	244967	137709	Residential	Medium
R8	244871	137735	Residential	Medium
R9	245613	137617	Residential	Medium
R10	245721	137692	Residential	Medium
R11	245780	137638	Residential	Medium
R12	245781	137589	Residential	Medium
R13	245597	137525	Recreational	Low
R14	246741	136768	Residential	Medium
R15	246752	136249	Residential	Medium
R16	246586	136060	Residential	Medium
R17	246628	136031	Residential	Medium
R18	246647	135964	Residential	Medium

NVSR identifier	Coordinates		Classification	Sensitivity
R19	246821	133719	Residential	Medium
R20	246994	133085	Residential	Medium
R22	247525	131172	Residential	Medium
R23	247486	131069	Residential	Medium
R24	246504	135794	Residential	Medium
R25	248353	132109	Commercial	Low
R26	248674	131788	Residential	Medium
R27	248592	131759	Residential	Medium
R28	248702	131866	Residential	Medium
R29	248487	131648	Residential	Medium
R30	246555	137675	Residential	Medium

101. R21 has been intentionally removed from **Table 18.22** as, after it was initially identified, it was discovered to be an unoccupied shed.

102. In addition to the above, a total of 12 PRoW and one National Trail (South West Coastal Path) are in the vicinity of the Project, identified in **Chapter 15: Land Use**. These are not identified in **Table 18.22** as they do not have a specific grid reference.

18.4.1.1 Survey procedures

103. The baseline noise survey involved unattended measurements conducted over a 13-day period at both the landfall and the Onshore Substation. Additionally, a single 30-minute attended measurement was taken at the landfall location at night. Measurements were conducted in accordance with current guidance including BS 4142 and BS 7445.

104. Measurement locations (representative of individual or groups of NVSRs) were identified and agreed with North Devon Council, as provided in **Table 18.23** and displayed in **Figure 18.1**. Also displayed is the NVSR represented by the measurement location.

Table 18.23 Baseline sound survey measurement locations

NVSR identifier	Coordinates		Represented Receptors
	X	Y	
Landfall locations			
LAM1	244833	137634	R5 and R6
LUM1	244630	137722	R2
LUM2	244562	137779	R1
Onshore Substation locations			
SUM1	248364	131610	R29

NVSR identifier	Coordinates X	Coordinates Y	Represented Receptors
SUM2	248600	131843	R26
SUM3	248028	132014	Consented residential development known as Yelland Quay

105. Details of the baseline survey sound procedures are provided in **Appendix 18.A: Baseline Noise Survey**.

18.4.1.2 Survey results

106. The purpose of the baseline noise measurement survey at the landfall was to enable the assessment of potential landfall construction noise impacts. To inform the assessment, the measured L_{Aeq} levels have been separated into the daytime, evening and weekends, and night-time periods specified in BS 5228-1, as shown in **Table 18.24**.

Table 18.24 Measured baseline sound levels for construction assessment – landfall

Measurement Location	Start Date and Time (dd/mm/yy, hh:mm)	End Date and Time (dd/mm/yy, hh:mm)	LAeq (dB) Daytime	Evenings and Weekends	Night-time
LAM1	04/04/23, 00:33	04/04/23, 01:03	-	-	37
LUM1	22/03/23, 14:00	02/04/23, 08:45	62	61	60
LUM2	22/03/23, 14:00	04/04/23, 09:45	57	57	57

107. It was not possible to identify secure monitoring locations representative of R5 and R6 at which unattended monitoring could be undertaken. Hence, attended monitoring was undertaken at night at LAM1, which is representative of these NVSRs. The night-time ambient sound levels at LAM1 are around 20 dB lower than those at LUM1 and LUM2. The reason for this is that the dominant sound source, at all locations, was ocean waves, and LAM1 is much further away from the ocean than LUM1 and LUM2. It is reasonable to assume that this difference is also present in the daytime baseline sound levels.

108. The purpose of the baseline noise measurement survey at the Onshore Substation was to enable the assessment of potential Onshore Substation construction and operational noise impacts. To inform a construction assessment, the measured L_{Aeq} levels have been separated into the daytime, evening and weekend, and

night-time periods specified in BS 5228-1, as shown in **Table 18.25**. To inform the operational noise assessment, the measured L_{Aeq} and representative L_{A90} levels have been separated into the daytime and night-time periods specified in BS 4142, as shown in **Table 18.26**.

Table 18.25 Measured baseline sound levels for construction noise assessment – Onshore Substation site

Measurement Location	Start Date and Time (dd/mm/yy, hh:mm)	End Date and Time (dd/mm/yy, hh:mm)	L_{Aeq} (dB)		
			Daytime	Evenings and Weekends	Night-time
SUM1	22/03/23, 14:00	03/04/23, 15:45	54.0	50.0	49.9
SUM2	22/03/23, 14:15	03/04/23, 16:00	53.6	48.8	49.5
SUM3	22/03/23, 14:00	03/04/23, 15:30	49.1	47.8	48.2

Table 18.26 Measured baseline sound levels for operational noise assessment – Onshore Substation site

Measurement Location	L_{Aeq} (dB)		L_{A90} (dB)	
	Daytime	Night-time	Daytime	Night-time
SUM1	53	50	41	31
SUM2	52	50	37	30
SUM3	49	49	35	32

18.4.2 Baseline Vibration Environment

109. No significant sources of vibration have been identified in the vicinity of the Onshore Project; hence, baseline vibration levels are assumed to be negligible. The adopted construction vibration assessment criteria, described in **Section 18.3.2.1.3**, are independent of the baseline vibration levels; therefore, an understanding of the baseline vibration environment is not required.

18.4.3 Do Nothing Scenario

110. The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 require that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the ES (EIA Regulations, Schedule 4, Paragraph 3). From the point of assessment, over the course of the development and operational lifetime of the Onshore Project

(operational lifetime anticipated to be 50 years), long-term trends mean that the condition of the baseline environment is expected to evolve. This section provides a qualitative description of the evolution of the baseline environment, on the assumption that the Onshore Project is not constructed, using available information and scientific knowledge of noise and vibration.

111. As discussed in **Section 18.2**, UK planning policy such as the NPPF (para. 185) requires that new development incorporates mitigation measures to reduce potential adverse noise impacts to a minimum; hence, in general, developments which significantly increase noise in the study area would not be expected to be granted consent. In addition to planning controls there is a clear trend for noise from vehicle, commercial and industrial sources to be driven down in compliance with stricter legislation and guidance as well as consumer expectations.

112. The baseline noise monitoring survey identifies the existing soundscape within the study area and the sources which are contributing to it. In the absence of evidence to the contrary, it is reasonable to assume that the contributing noise sources will not change over time. Hence, changes in future baseline noise levels will depend on the change in noise emissions from the identified sources.

113. In general, the dominant sources contributing to the baseline sound climate were aircraft, road traffic and sounds typical of a rural environment, such as bird calls and farm machinery. Ocean waves were also noted to be significant.

114. Road traffic and aircraft noise levels depend on road traffic flows and individual vehicle noise levels. Traffic flows and aircraft movements are generally expected to increase in line with expectations for macro-economic expansion; however, as discussed above, vehicle and aircraft noise levels are expected to reduce over time. Farm machinery noise levels would also be expected to reduce as old equipment is replaced with newer, quieter versions. No change is anticipated regarding noise generated by ocean waves.

115. There is a consented mixed-use development known as Yelland Quay to the north of the proposed Onshore Substation. This development is likely to introduce additional road traffic and other potential noise sources in the area. To assess the potential worst-case impacts of the proposed development, the associated potential increase in baseline noise levels has been discounted from this assessment.

116. Disregarding the consented Yelland Quay development, it is reasonable to anticipate that the trend for increased economic activity to increase baseline noise levels would be balanced out by the effect of planning controls and reductions in

source noise emissions. This would result in no change in overall baseline noise conditions in the study area.

117. The Yelland Quay development, once constructed and occupied, will introduce new residential properties which will be the closest medium sensitivity NVSRs to the Onshore Substation. There is inevitably inherent uncertainty in the development layout and therefore the location of the sensitive receptors, but the proposed masterplan includes residential properties close to the redline boundary. Hence, receptors are highly unlikely to be any closer to the Onshore Substation and the assessment therefore considers a robust worst-case.

Table 18.27 Onshore NVSRs included in the assessment

NVSR identifier	Coordinates		Classification	Sensitivity
	X	Y		
Substation – consented development at Yelland Quay				
R31	248141	132265	Residential	Medium
R32	248024	132288	Residential	Medium
R33	248271	132324	Residential	Medium

18.5 Potential Impacts During Construction

118. The potential impacts during construction of the Onshore Project have been assessed for noise and vibration. A description of the potential effect on NVSRs caused by each identified impact is given in this section.

18.5.1 Impact 1: Noise of construction works at the landfall

119. The noisiest onshore works at the landfall will comprise site preparation, excavation of transition bays and the trenchless technique works. As discussed in **Table 18.20**, impacts from offshore construction works are excluded from the assessment scope.

120. Impacts are assessed at the identified NVSRs near the landfall location (R1 to R8).

18.5.1.1 Magnitude of impact

121. Most construction works at the landfall will be undertaken during the BS 5228-1 daytime reference period only. As a worst-case, both major trenchless techniques (i.e. the landfall and under the golf course) could require up to 7 days per drill i.e. a total of 28 days of continuous activities i.e. extending into the evening/weekend and night time reference periods.

122. The maximum predicted construction noise levels at R1 to R8 are provided in **Table 18.28**. Also shown is the anticipated magnitude of impact, in accordance with the criteria in **Table 18.5**.

Table 18.28: Predicted landfall construction noise impacts

NVSR	Distance to landfall compound (m)	Maximum predicted construction noise level (dB $L_{Aeq,T}$)		Magnitude of impact		
		Daytime	Continuous works	Daytime	Evenings and weekends	Night-time
R1	177	55	36	**Negligible**	**Negligible**	**Negligible**
R2	110	57	36	**Negligible**	**Negligible**	**Negligible**
R3	98	58	37	**Negligible**	**Negligible**	**Negligible**
R4	33	68	48	**Low**	**Negligible**	**Low**
R5	11	74	55	**Low**	**Low**	**Medium**
R6	35	68	47	**Low**	**Negligible**	**Low**
R7	117	57	38	**Negligible**	**Negligible**	**Negligible**
R8	113	59	39	**Negligible**	**Negligible**	**Negligible**

123. The results in **Table 18.28** show that the predicted impact magnitude of the construction noise from the works at the landfall is no worse than low, except at R5, where the impact of night-time works is **medium**.

124. The landfall is also close to the South West Coast Path, which is to the north, at a minimum distance of approximately 49m. This NVSR is further from the landfall than the R4, R5 and R6. Impacts at R5 and R6 are no worse than low magnitude; hence, impacts on this PRoW are also considered no worse than low magnitude.

18.5.1.2 Significance of effect

125. NVSRs R1 to R3, R5 and R6 are of low sensitivity; hence, the predicted negligible impacts result in effects of negligible significance and the impacts of low or medium magnitude result in effects of minor significance, i.e. not significant in EIA terms. This is also the case for the identified PRoW. The remaining NVSRs are of **medium sensitivity** and the predicted impacts are of **negligible or low magnitude**; hence, the resultant effects are of **minor significance**, i.e. not significant in EIA terms.

126. Noise levels are predicted to be above the LOAEL and therefore as per NPSE guidance, all reasonable steps should be taken to minimise effects. At R5, night-

time noise levels are equal to the SOAEL for residential receptors, but this receptor is not residential. As discussed in **Section 18.3.2.1.1**, it has not been possible to define SOAEL and LOAEL values for construction noise impacts on non-residential receptors; however, as the sensitivity of R5 is low, these values should be higher than those which apply to residential (i.e. medium sensitivity) NVSRs. As the predicted construction noise level at R5 is equal to the SOAEL for residential NVSRs, it follows that it will be less than the applicable SOAEL at R5.

127. The predicted construction noise levels at R4, R5 and R6 are likely to be at least 10 dB above the ambient sound levels at these locations. The duration of the daytime working noise impact is also likely to be at least two months. Hence, while the identified effects are not significant, to demonstrate compliance with applicable policy by mitigating and minimising exceedances of the LOAEL, temporary screening is proposed along the boundary of the compound with these NVSRs (this is described below). This screening will also mitigate impacts at the identified PRoW.

18.5.1.3 Further mitigation

128. The anticipated effects due to landfall construction are no more than **minor adverse (not significant)**. Exceedances of the LOAEL can be mitigated through implementation of the BPM noise control measures outlined within the CNVMP in the CEMP (see embedded mitigation in **Table 18.15**).

129. In addition, to comply with policy requirements to minimise exceedances of the LOAEL, a 2m high temporary screen is proposed between the landfall compound and R4, R5 and R6. According to BS 5228-1, it is likely that such a barrier would reduce the construction noise levels by around 10 dB.

18.5.1.4 Residual effect

130. After implementation of the noise control measures in the CNVMP, and on the basis that a 10dB noise reduction is achievable with screening, the magnitude of the impact would be reduced to negligible during the day and evenings and weekends, and at night, impacts would be negligible at all NVSRs except R5, where impacts would be **low**. These equate to residual effects of **negligible** or **minor significance**, which is not significant in EIA terms.

18.5.2 Impact 2: Noise of cable corridor construction works

131. The onshore cable construction works includes the establishment and use of temporary compounds, trenchless crossings, open-cut trench works (excavation,

duct and cable installation and backfill), jointing bay construction and construction and use of temporary haul roads.

132. Most construction works along the cable corridor will be undertaken during the BS 5228-1 daytime reference period only.

133. As a worst-case, the major trenchless technique at the Taw Estuary Crossing could require a total of up to 14 days per drill of continuous activities i.e. extending into the evening/weekend and night-time reference periods. The Taw Estuary Crossing trenchless technique entry pit is over 650 m from the closest identified NVSR (R25). This is further than the minimum distance of 300m for the construction noise study area. Hence, noise impacts from the works at the Taw Estuary Crossing trenchless technique entry pit are excluded from the assessment scope.

134. Impacts are assessed at the identified NVSRs near the Onshore Cable Corridor (R9 to R24) and the identified PRoW.

18.5.2.1 Magnitude of impact

135. The maximum predicted construction noise levels, due to all cable corridor construction activities except the open-cut trench works, are provided in **Table 18.29**. Also shown is the anticipated magnitude of impact, in accordance with the criteria in **Table 18.5**.

Table 18.29 Predicted cable corridor construction noise impacts

NVSR	Maximum predicted construction noise level (dB $L_{Aeq,T}$)		Magnitude of impact		
	Daytime	Continuous works	Daytime	Evenings & weekends	Night-time
R9	57	19	Negligible	Negligible	Negligible
R10	55	19	Negligible	Negligible	Negligible
R11	50	18	Negligible	Negligible	Negligible
R12	52	21	Negligible	Negligible	Negligible
R13	58	17	Negligible	Negligible	Negligible
R14	69	26	Low	Negligible	Negligible
R15	74	21	Low	Negligible	Negligible
R16	70	21	Low	Negligible	Negligible
R17	72	21	Low	Negligible	Negligible
R18	63	22	Negligible	Negligible	Negligible
R19	65	29	Low	Negligible	Negligible
R20	73	36	Low	Negligible	Negligible

NVSR	Maximum predicted construction noise level (dB $L_{Aeq,T}$)		Magnitude of impact		
R22	39	24	Negligible	Negligible	Negligible
R23	50	30	Negligible	Negligible	Negligible
R24	67	23	Low	Negligible	Negligible

136. The results in **Table 18.29** show that the predicted impact magnitude of the construction noise from the works at the landfall is no worse than **low**.

137. The predictions reported in **Table 18.29** do not include the open-cut trenching works, as these are linear in nature and will not be undertaken at one location for predictions such as these to be undertaken. Instead, simplified calculations of potential worst-case noise levels (disregarding potential attenuation due to ground absorption and screening) from the backfilling works have been undertaken. According to the construction plant information supplied, the highest noise level from open-cut trench works activity is due to backfilling works. The predicted construction noise levels are 65 dB L_{Aeq} (the onset of low impacts) when the works are 97m from an NVSR and 75 dB L_{Aeq} (the onset of medium impacts) when the works are 31m from an NVSR. Most of the identified NVSRs near the Onshore Cable Corridor are further than 97m from the Onshore Cable Corridor; hence, the noise impact of open-cut trenching works will be negligible. NVSRs R15, R17 to R20 and R24 are between 31 and 97m from the Onshore Cable Corridor; hence, impacts of low magnitude are predicted. R14 and R16 are less than 31m from the Onshore Cable Corridor; hence, impacts of medium magnitude are predicted at these NVSRs.

18.5.2.2 Significance of effect

138. R13 is of low sensitivity, the remaining NVSRs affected by noise of Onshore Cable Corridor construction works are of **medium sensitivity**.

139. The predicted construction noise impacts due to the establishment and use of temporary compounds, trenchless crossings, jointing bay construction and construction and use of temporary haul roads are of **low** or **negligible** magnitude, resulting in effects of **minor** significance at all NSRs except R13. At R13, the noise impact of daytime working is of **low** magnitude; hence, the resultant effect is of **minor** significance, and the noise impact of working outside of daytime hours is **negligible**, resulting in an effect of **negligible** significance. As these effects are of no worse than **minor** significance, they are not significant in EIA terms.

140. The noise impacts of open-cut trenching works at R9 to R13 and R21 to R23 are **negligible**; hence, the resultant effects are of **minor** significance, except at R13, where they are **negligible** i.e. not significant in EIA terms.

141. The effect significance of the predicted open-cut trenching noise impacts at R14 to R20 and R24 have been determined by identifying the likely duration of periods of high construction noise levels from the works, as follows.

142. The total length of the open-cut trench sections of the cable corridor is around 4.3km. All proposed trench excavation works are anticipated to take 60 working days to complete. These works will be followed by duct and cable installation (80 working days) and backfilling (60 working days). The duct and cable installation and backfilling works will overlap, with a total combined duration of around 100 working days. At locations where no other works are proposed, the trench excavation works will therefore be followed by a gap of around 60 days and the gap from the duct and cable installation works to the backfilling will vary between 20 and 40 working days.

143. Based on the above information, the trench excavation and backfilling works are anticipated to progress at a rate of around 72m per day (380m per week or 1.5km per month), and around 54m per day (290m per week or 1.1km per month) for cable installation.

144. The length of the Onshore Cable Corridor that is within these distances has been identified, along with the durations of the works within these distances, as shown in **Table 18.18.30**.

Table 18.18.30 Distances (in m) from NVSR to onshore cable corridor at which impacts are predicted and durations of predicted impacts (in days)

<table>
<tr><th rowspan="2">NVSR</th><th colspan="2">Distance (m) from backfilling works at which impacts are predicted</th><th colspan="2">Duration (days) of impact due to backfilling works</th><th colspan="2">Duration (days) of impact due to cable installation works</th></tr>
<tr><th>Low</th><th>Medium</th><th>Low</th><th>Medium</th><th>Low</th><th>Medium</th></tr>
<tr><td>R14</td><td>188</td><td>43</td><td>2.7</td><td>0.6</td><td>3.3</td><td>0.8</td></tr>
<tr><td>R15</td><td>156</td><td>N/A*</td><td>2.2</td><td>N/A*</td><td>2.5</td><td>N/A*</td></tr>
<tr><td>R16</td><td>207</td><td>66</td><td>3.0</td><td>0.9</td><td>3.9</td><td>1.2</td></tr>
<tr><td>R17</td><td>187</td><td rowspan="5">N/A*</td><td>2.7</td><td rowspan="5">N/A*</td><td>3.5</td><td rowspan="5">N/A*</td></tr>
<tr><td>R18</td><td>82</td><td>1.2</td><td>2.9</td></tr>
<tr><td>R19</td><td>204</td><td>2.9</td><td>3.8</td></tr>
<tr><td>R20</td><td>51</td><td>0.7</td><td>3.5</td></tr>
<tr><td>R24</td><td>104</td><td>1.5</td><td>1.5</td></tr>
</table>

NVSR	Distance (m) from backfilling works at which impacts are predicted	Duration (days) of impact due to backfilling works	Duration (days) of impact due to cable installation works
* N/A as NVSR is further than 31m from the Onshore Cable Corridor; hence, medium impacts are not anticipated			

145. **Table 18.18.30** shows that the impacts of low magnitude are anticipated to last for no more than 3 days due to backfilling, and 3.9 days due to cable installation (due to its slower rate of progression). Predicted impacts of medium magnitude are anticipated to last for no more than 0.9 days for backfilling and 1.2 days for cable installation. Due to the short duration of these impacts (much less than one month), the effect of the predicted noise impacts is **not significant** in EIA terms.

146. Construction noise effects could also occur at identified PRoW in proximity to the Onshore Cable Corridor, but these would be temporary and very short-term as the user passes the works. It is also anticipated that, at some locations, PRoW may be temporarily provided with alternative routes; thereby avoiding the potential noise impact on users. Further details are provided in **Chapter 15: Land Use**. Impacts will be minimised through the implementation of BPM, which is embedded mitigation as described in **Table 18.15**. Hence, the effect of direct construction noise impacts on PRoW users is considered no worse than **minor** i.e. **not significant** in EIA terms.

18.5.2.3 Further mitigation

147. The anticipated effects due to cable corridor construction are no greater than **minor adverse (not significant)**. Exceedances of the LOAEL can be mitigated through implementation of the BPM noise control measures outlined within the CNVMP in the CEMP.

148. Nevertheless, the predicted low magnitude impacts equate to exceedances of the LOAEL and therefore, to comply with policy, all reasonable steps should be taken to minimise these effects. Regarding the effect of works except open-cut trenching, the activities responsible for the predicted exceedances of the LOAEL have been identified, as follows:

- R14 – jointing bay construction and vehicles on haul road
- R15 – jointing bay construction
- R16 – vehicles on haul road
- R17 – compound construction
- R20 – jointing bay construction
- R24 – jointing bay construction.

149. To determine whether further mitigation is required, the duration of the above activities has been identified as follows.

150. All four compounds will be constructed within a total of 15 days, so around 4 days per compound. Hence, the effect of compound construction on R17 does not warrant further mitigation.

151. A total of 11 jointing bays are proposed and jointing bay construction works will last a total of 45 days i.e. approximately 4 days per bay. Hence, the effect of jointing bay construction does not warrant further mitigation.

152. The haul road is likely to be used for much of the onshore construction works. The predictions of haul road noise impacts have been based on the likely vehicle numbers in the worst-case month; the average vehicle numbers are much lower. Nevertheless, as the duration of the worst-case impact is at least one month, it is considered that further mitigation should be implemented, where feasible, to minimise the anticipated adverse effect cause by the exceedance of the LOAEL.

153. A 2m high temporary screen is therefore proposed between the haul road and R14 and R16. According to BS 5228-1, it is likely that such a barrier would reduce the construction noise levels by around 10 dB.

18.5.2.4 Residual effect

154. After implementation of the noise control measures in the CNVMP, and on the basis that haul road noise levels are reduced by 10dB with screening, the magnitude of the impacts at R14 and R16 are likely to be reduced to no worse than low. These equate to residual effects of **minor** significance, which are **not significant** in EIA terms. The policy requirement to take all reasonable steps to minimise exceedances of the SOAEL is also complied with.

18.5.3 Impact 3: Noise of Onshore Substation construction works

155. The closest existing NVSR identified in **Table 18.22** to the proposed Onshore Substation is more than 350m away. This is outside the construction noise study area; hence, Onshore Substation construction noise impacts are not assessed at these NVSRs.

156. The proposed Onshore Substation is around 170m from the closest PRoW; hence, there is the potential for construction noise impacts to occur at this NVSR. As with noise from construction of the Onshore Cable Corridor, these impacts would be temporary and very short-term, and PRoW may be temporarily provided with

alternative routes if required. Impacts will be minimised through the implementation of BPM, which is embedded mitigation. Hence, the effect of direct construction noise impacts on PRoW users is considered no worse than **minor** i.e. **not significant** in EIA terms.

18.5.4 Impact 4: Noise from off-site construction traffic

18.5.4.1 Magnitude of Impact

157. Road links required to be used by construction traffic for the Onshore Project are presented in **Chapter 19: Traffic and Transport**. These road links were assessed by undertaking BNL calculations, which are provided in full in **Appendix 18.C: Construction Traffic Noise Predictions**.

158. The construction road traffic noise assessment predicts changes in road traffic noise levels due to construction traffic peak flows. The results are that, on 10 of the links, the noise impact will be **negligible**, and on two links, the noise impact will be **low**.

18.5.4.2 Significance of Effect

159. No high sensitivity receptors have been identified close to any of the road links that will be used by the Onshore Project construction traffic. To assess a potential worst-case, it has been assumed that there are nearby NVSRs of medium sensitivity. Therefore, effects are of no worse than **minor** significance i.e. **not significant.**

160. Calculations of likely road traffic noise levels at NVSRs have not been undertaken; hence, comparison with the identified LOAEL and SOAEL values has not been possible. To consider a potential worst-case, it is considered possible that the LOAEL is exceeded; hence, to comply with policy, all reasonable steps should be taken to minimise effects.

18.5.4.3 Mitigation and Residual Significance of Effect

161. The effects due to road traffic noise impacts of the Onshore Project are not predicted to be significant. Implementation of agreed traffic measures within the Outline CTMP (see embedded mitigation **Table 18.15**) is considered to represent all reasonable steps to minimise effects due to potential exceedances of the LOAEL. Hence, no noise-related mitigation is proposed and residual effects are **not significant.**

18.5.5 Impact 5: Construction vibration

18.5.5.1 Magnitude of Impact – All Scenarios

162. The operation of trenchless technique rigs and ancillary equipment would produce the greatest vibration impact along the onshore export cable corridor, and is therefore taken forward as the worst case for the vibration assessment.

163. The construction actvities with the potential to emit significant vibration have been identified. **Table 18.31** lists the minimum set-back distances at which the vibration level criteria relevant to the potential for human annoyance and cosmetic building damage (for transient vibration at a frequency of 4 Hz) may occur for these activities. Set back distances were derived using the calculation methods provided in BS 5228-2.

164. The calculations for impacts upon humans (i.e. PPV levels 0.3 to 10 $mm.s^{-1}$) assume a frequency independent vibration transfer function (level multiplied by 1.8) between outdoors and indoors, based upon measurements by D.J Martin (1980) described in the Transport and Road Research Laboratory (TRRL) report 'Ground vibrations from impact pile driving during road construction'. There is a 5% probability that the predicted vibration levels are exceeded. Further detail on the assumptions made to undertake these calculations is provided in **Appendix 18.C: Construction Traffic Noise Predictions**.

Table 18.31: Predicted Distances at which Vibration Levels may Occur

Activity	Set-back distance at which vibration level (PPV) occurs			
	$0.3\ mm.s^{-1}$	$1.0\ mm.s^{-1}$	$10\ mm.s^{-1}$	$15\ mm.s^{-1}$
Rotary Piling (trenchless technique) based on Ref.106 Table D.6 BS 5228	15.1m	4.5m	0.45m	0.3m

165. The closest identified NVSR to a trenchless crossing location is R5, at around 11m from the closest approach of the Onshore Cable Corridor. Assuming that equipment is positioned at the closest approach to R5, the predicted PPV levels are between 0.3 and $1.0mm.s^{-1}$. For human receptors, the criteria in **Table 18.9** shows that these predicted vibration levels have the potential to cause an impact of low magnitude.

166. If impact piling is required to construct the substation, this activity would be likely to emit the highest vibration levels from the construction works. As there are no NVSRs within 100 m of the substation site, this impact is scoped out.

18.5.5.2 Significance of effect

167. Vibration impacts are predicted to be no greater than low impact. The NVSRs within 100m of the trenchless technique locations are, in the worst-case, of medium sensitivity. This represents an effect of no greater than **minor** significance i.e. **not significant** in EIA terms.

168. Nevertheless, the predicted vibration levels exceed the identified LOAEL and therefore all reasonable steps should be taken to minimise adverse effects.

18.5.5.3 Mitigation and Residual Significance of Effect

169. The effects due to construction vibration impacts of the Onshore Project are not predicted to be significant. Implementation of the agreed mitigation measures to minimise the effects of vibration contained within the Outline CNVMP is considered to represent all reasonable steps to minimise effects due to potential exceedances of the LOAEL. Hence, no noise-related mitigation is proposed and residual effects are **not significant**.

18.6 Potential Impacts During operation and maintenance

170. The potential impacts of the operation and maintenance of the Onshore Project have been assessed for noise and vibration. A description of the potential effect on NVSRs caused by each identified impact is given in this section.

18.6.1 Impact 6: Operational noise

171. The proposed Onshore Substation will emit noise during the Operational Phase. The sound emissions from the substation plant will be present 24/7 with very little fluctuation over time.

172. As discussed in **Section 18.3.2.1.4**, a 3-D noise model has been used to predict substation sound levels at the existing NVSRs near to the substation (R25 to R29). The assessment also considers potential receptors in the consented development known as Yelland Quay (R31 to R33).

173. Full details regarding assumptions and operational noise sources included in the assessments and the predicted specific sound levels at each NVSR are provided in **Appendix 18.D: Operational Noise Predictions**.

174. The first stage in the BS 4142 assessment is to determine the *background sound levels* at the residential NVSRs. SUM1 is representative of R29, SUM2 is representative of R26 to R28 and SUM3 is representative of R25 and R31 to R33. Hence, the *background sound levels* at these NVSRs are:

- R29 – daytime 41 dB $L_{A90,1h}$, night-time 31 dB $L_{A90,15min}$
- R26 to R28 – daytime 37 dB $L_{A90,1h}$, night-time 30 dB $L_{A90,15min}$
- R31 to R33 – daytime 35 dB $L_{A90,1h}$, night-time 32 dB $L_{A90,15min}$

175. As R25 is a commercial receptor, a criterion of 55 dB L_{Aeq} for the predicted *specific sound level* has been applied at this NVSR, adopted from the WHO Community Noise Guidelines. This criterion is also deemed applicable for the identified PRoW.

176. As discussed in **Section 18.3.2.1.4**, the next stage in the BS 4142 assessment is to consider whether any character corrections (for tonality, intermittency, impulsivity or other sound characteristics) should be applied to the predicted *specific sound levels* to determine the *rating levels* for comparison with the measured *background sound levels*.

177. Whilst the sound emitted by some of the substation plant is likely to include tonal components, the embedded mitigation measures within the detailed design phase will minimise the eventual tonality of the overall substation sound emissions. With these measures installed, tonality is unlikely to be audible outside the substation boundary. Any remaining tonality will be further attenuated by propagation with distance to receptors. It is therefore highly unlikely that tonality will be perceptible at the NVSRs. Nevertheless, a +2dB acoustic character correction (BS 4142 subjective method – 'just perceptible') has been applied to the *specific sound level* to determine the *rating level*.

178. The sound emissions from the proposed Onshore Substation plant and equipment will be present 24/7 and are very steady; hence, no penalty corrections for intermittency or impulsivity are required. As a penalty is applied for tonality, it would not be appropriate to apply a penalty for other sound characteristics.

179. With regard to the presence of noise from the existing substation, the *background sound levels* used in this assessment were measured in locations so as to exclude this source. The only potential effect of the presence of any such noise at an NVSR would be to increase the background sound level from which the assessment criteria are derived, reducing any impact. The assessment here thus represents a worst-case.

18.6.1.1 Magnitude of impact

180. The predicted unmitigated *specific sound level* and *rating level* at each NVSR are presented in **Section 18.5.1**. Also presented is the magnitude of impact using the Local Planning authority (LPA) preferred BS 4142 criterion presented in **Table**

18.10, and a comparison with the identified NOEL, LOAEL and SOAEL values for the night-time, taken from the WHO NNG, provided in **Section 18.3.2.1.4**.

Table 18.32 Operational Noise Assessment – Unmitigated, Residential NVSRs

NVSR	Predicted specific sound level (dB $L_{Aeq,T}$)	Rating level (dB $L_{Ar,T}$)	Difference between $L_{Ar,T}$ and L_{A90} (dB)	Magnitude of impact (BS 4142 criteria)	Comparison with NNG effect level criteria
Daytime (07:00 – 23:00)					
R26	22	24	-13	Negligible	N/a
R27	22	24	-13	Negligible	
R28	22	24	-13	Negligible	
R29	22	24	-17	Negligible	
R31	40	42	7	High	
R32	34	36	1	Medium	
R33	35	37	2	Medium	
Night-time (23:00 – 07:00)					
R26	22	24	-6	Negligible	< NOEL
R27	23	25	-5	Low	< NOEL
R28	23	25	-5	Low	< NOEL
R29	23	25	-6	Negligible	< NOEL
R31	40	42	10	High	> LOAEL & < SOAEL
R32	36	38	6	High	> LOAEL & < SOAEL
R33	36	38	6	High	> LOAEL & < SOAEL

181. Operational noise levels at R25 and the closest PRoW have been predicted to be 37 dB L_{Aeq} and 33 dB L_{Aeq} respectively. These are below the adopted limit of 55 dB LAeq, indicating a magnitude of impact at these NVSRs of no worse than **low**.

182. The predicted unmitigated *rating levels* $L_{Ar,T}$, at all existing residential NVSRs, are at least 5 dB below the *background sound levels*, indicating a **negligible** or **low** magnitude of impact during the day and night-time. Predicted unmitigated noise levels are also below the night-time NOEL identified in the WHO NNG.

183. The predicted unmitigated rating levels at NVSRs R32 and R33 are less than 5 dB above the criterion sound level during the day, indicating a **medium** magnitude of impact, and at R31, they are more than 5 dB above, the criterion, indicating a **high** impact. At night, unmitigated impacts at R31, R32 and R33 are of **high** magnitude. Predicted unmitigated noise levels are also between the night-time LOAEL and SOAEL identified in the WHO NNG.

18.6.1.2 Significance of effect

184. NVSRs potentially subject to noise from the proposed substation are identified to be of medium sensitivity; hence, the predicted operational noise impacts at existing NSRs result in effects of **minor** significance, i.e. not significant in EIA terms. At the consented NSRs, the predicted operational noise impacts at result in effects of **moderate** or **major** significance, i.e. **significant** in EIA terms.

18.6.1.3 Mitigation and Residual Significance of Effect

185. Without mitigation, based on the current design, the predicted operational noise effects of the Onshore Project are anticipated to be significant. Hence, noise mitigation is required.

186. Based on the current design and operational plant assumptions, acoustic attenuation is required to reduce the sound emissions of substation ventilation plant on the façade of the substation building facing towards the consented NVSRs, as described in **Appendix 18.D: Operational Noise Predictions**. Depending on the final design of the substation, alternative mitigation measures may be required, such as locating the ventilation plant on the façades of the building facing away from the nearby NVSRs, acoustic screening and plant enclosures. Final mitigation measures will be determined during the detailed design of the substation.

187. Updated predictions have been undertaken with this mitigation in place and the results are presented in **Table 18.33**.

Table 18.33: Operational Noise Assessment – Mitigated, Residential NVSRs

NVSR	Predicted specific sound level (dB $L_{Aeq,T}$)	Rating level (dB $L_{Ar,T}$)	Difference between $L_{Ar,T}$ and L_{A90} (dB)	Magnitude of impact (BS 4142 criteria)	Comparison with NNG effect level criteria
Daytime (07:00 – 23:00)					
R26	21	23	-14	Negligible	N/a
R27	22	24	-13	Negligible	
R28	21	23	-14	Negligible	
R29	22	24	-17	Negligible	
R31	35	37	2	Medium	
R32	32	34	-1	Low	
R33	31	33	-2	Low	
Night-time (23:00 – 07:00)					
R26	21	23	-7	Negligible	< NOEL

NVSR	Predicted specific sound level (dB $L_{Aeq,T}$)	Rating level (dB $L_{Ar,T}$)	Difference between $L_{Ar,T}$ and L_{A90} (dB)	Magnitude of impact (BS 4142 criteria)	Comparison with NNG effect level criteria
R27	23	25	-5	Low	< NOEL
R28	23	25	-5	Low	< NOEL
R29	23	25	-6	Negligible	< NOEL
R31	35	37	5	High	= LOAEL
R32	34	36	4	Medium	< NOEL
R33	33	35	3	Medium	< NOEL

188. With mitigation, operational noise levels at R25 and PRoW have been predicted to be 37 dB L_{Aeq} and 30 dB L_{Aeq} respectively.

189. The mitigation has reduced the magnitude of impact to no worse than **low** during the daytime at all NVSRs, and during the night at all NVSRs except R32 and R33. Whilst the predicted impacts at R31 and R32 are of medium magnitude at night, the predicted *specific sound levels* are no higher than 35 dB L_{Aeq} i.e. the LOAEL is not exceeded. On that bais, residual effects are no worse than **minor** i.e. **not significant** in EIA terms.

190. As there is considerable uncertainty in final substation design, effects will be controlled by a pre-commencement planning condition requiring submission of, and compliance with, an operational noise assessment in accordance with BS 4142:2014+A1:2019, ensuring that no significant effect results.

18.7 Potential Impacts During Decommissioning

191. No decision has been made regarding the final decommissioning policy for the Onshore Project as it is recognised that industry best practice, rules and legislation change over time.

192. The anticipated decommissioning activities are outlined in **Section 18.3.3**. The potential impacts of the decommissioning of the Onshore Project have been assessed for noise and vibration on the assumption that decommissioning methods will be similar or of a lesser scale than those deployed for construction. The types of impact would be comparable to those identified for the construction phase:

- Impact 7: Noise from decommissioning works (comparable to impacts 1 to 3)
- Impact 8: Noise from off-site decommissioning traffic (comparable to impact 4)
- Impact 9: Vibration from decommissioning works (comparable to impact 5).

193. The magnitudes of impacts would be comparable to or less than those identified for the construction phase. Accordingly, given the construction phase assessments concluded effects are no worse than minor for NVSRs, it is anticipated that the same would be valid for the decommissioning phase regardless of the final decommissioning methodologies.

194. The only addition to the above is that decommissioning of the proposed Onshore Substation could cause noise and vibration impacts at R32 to R34 (Yelland Quay). Proposed Onshore Substation construction noise and vibration impacts were excluded from the assessment scope, as discussed in **Table 18.20**; however, R32 to R34 are anticipated to be occupied during decommissioning.

195. No decision has been made regarding the final decommissioning policy for the Onshore Substation, as it is recognised that industry best practice, rules and legislation change over time. The decommissioning methodology would need to be finalised nearer to the end of the lifetime of the Project in line with current guidance, policy and legalisation at that point. Any such methodology would be agreed with the relevant authorities and statutory consultees. The decommissioning could be subject to a separate consenting approach.

196. The Onshore Substation site may be kept operational and upgraded accordingly for other potential electrical use or fully decommissioned (performed in the reverse of the construction works utilising similar types of equipment). To decommission the Onshore Substation, all electric plant is removed from their foundations and transported to a facility for processing for reuse, recycling, or disposal. The foundations may be pulled out and disposed of and any holes refilled with earth, if required. The control building can be demolished, and all materials disposed of.

197. The plant used for the decommissioning works (if required) are highly likely to emit lower levels of noise and vibration than the equivalent plant at the time of writing, due to the anticipated progression in technology over the Project lifetime, such as equipment electrification. Due to the uncertainties in the decommissioning policy for the Onshore Substation, decommissioning plant requirements and associated noise emissions, it has not been possible to predict the noise impacts from Onshore Substation decommissioning works.

198. R32, R33, and R34 are located approximately 187m, 98m, and 155m, respectively, from the proposed Onshore Substation. At these distances, assuming incorporation of Best Practicable Means to minimise noise and vibration emissions

from the works, effects of noise and vibration from the decommissioning works are not anticipated to be significant.

199. It should be noted that current legislation (CoPA) provides local authorities with powers to regulate construction works (including decommissioning works) noise and vibration impacts (as outlined in **Section 18.2.2.2**) which are in addition to those under the Town and Country Planning Act 1990. These powers can be used to ensure that significant adverse effects do not occur, if required.

18.8 Potential cumulative effects

200. The approach to CEA is set out in **Chapter 6: EIA Methodology**. Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment have been included in the CEA. Projects which are sufficiently implemented during the site characterisation for the Onshore Project have been considered as part of the baseline for the EIA. Where possible the Applicant has sought to agree with stakeholders the use of as-built project parameter information (if available) as opposed to consented parameters to reduce over-precaution in the cumulative assessment. The scope of the CEA was therefore established on a topic-by-topic basis with the relevant consultees.

201. The cumulative effect assessment for noise and vibration was undertaken in two stages. The first stage was to consider the potential for the effects assessed as part of the project to lead to cumulative effects in conjunction with other projects. The first stage of the assessment is detailed in **Table 18.34**.

202. Only potential impacts assessed in **Section 18.5, Section 18.6** and **Section 18.7** as negligible or above are included in the CEA (i.e. those assessed as 'no impact' are not taken forward as there is no potential for them to contribute to a cumulative impact).

Table 18.34 Potential cumulative impacts considered for noise and vibration

Impact	Potential for cumulative effect	Rationale
Construction Phase		
Impact 1: Noise of construction works at the landfall	Yes	Construction works associated with other projects in similar locations to the Onshore Project construction activities have the potential to result in cumulative effects, where there is a temporal overlap.
Impact 2: Noise of cable corridor construction works	Yes	

Impact	Potential for cumulative effect	Rationale
Impact 3: Noise of Onshore Substation construction works	Yes	In addition, other projects may introduce NVSRs which could be affected by construction noise from the Onshore Project.
Impact 4: Noise from off-site construction traffic	Yes	There is the potential for road traffic introduced by the construction of the Onshore Project and traffic introduced by other nearby projects to result in cumulative road traffic noise impacts, where there is a temporal overlap.
Impact 5: Construction vibration	Yes	There is the potential for cumulative construction vibration impacts with projects that are introducing nearby sources of vibration to the onshore cable corridor, where there is a temporal overlap. In addition, other projects may introduce NVSRs which could be affected by construction vibration from the Onshore Project.
Operation and Maintenance Phase		
Impact 6: Operational noise	Yes	There is the potential for cumulative operational noise impacts with projects that are introducing industrial / commercial noise sources nearby to the Onshore Substation. In addition, other projects may introduce NVSRs which could be affected by operational noise from the Onshore Project.

203. The second stage of the CEA is to evaluate the projects considered for the CEA to determine whether a cumulative effect is likely to arise. The considered projects (identified in **Chapter 6: EIA Methodology**) and their anticipated potential for cumulative effects are summarised in **Table 18.35**.

204. **Table 18.35** does not consider the potential for indirect cumulative effects due to construction road traffic noise. The projects identified for inclusion in the CEA in relation to traffic are identified in **Chapter 19: Traffic and Transport**. Traffic flows for the cumulative projects have been identified and the associated cumulative noise effects have been assessed on this basis in **Section 18.8.1**.

Table 18.35 Projects considered in the cumulative effect assessment of direct noise and vibration effects

Project	Status	Distance from Onshore Development Area (km)	Included in the CEA?	Rationale
White Cross Offshore Project	Consent application submitted	0	No	The only aspect of the White Cross Offshore Project with the potential to result in cumulative direct noise and vibration effects with the Onshore Project is the offshore construction works. **Table 18.20** explains that offshore construction works will be further than 300m from the NVSRs; hence, noise and vibration from offshore works does not require assessment and will not result in cumulative effects with the Onshore Project.
Land off North Land, Bickington, Barnstaple, Devon, EX312JN	Approved	4.6	No	The project is greater than 500m from the Onshore Project, therefore there would be no potential for cumulative noise and vibration impacts.
Yelland Quay development (Transfer Station Yelland Barnstaple)	Appeal - Allowed	0.2	No	The project construction could overlap temporally with the Onshore Project construction phase. However, there are no NVSRs with the potential to be affected by construction noise from the Onshore Project; hence, no cumulative construction noise effects are anticipated. The project introduces NVSRs which could be affected by the Onshore Project. However, the construction phasing plan for this project indicates that around 34 months of construction works are required before construction of residential properties starts. The Onshore Project construction schedule indicates that construction works will be completed by October 2025. Hence, the residential properties introduced by the project will not be occupied during the construction of the Onshore Project.

Project	Status	Distance from Onshore Development Area (km)	Included in the CEA?	Rationale
				The assessment of operational noise from the Onshore Project described in **Section 18.6.1** includes the NVSRs which will be introduced by this project. Hence, no further cumulative operational noise effects are anticipated.
Land at Chivenor Cross, Chivenor, Devon	Approved	1.7	No	The project is greater than 500m from the Onshore Project, therefore there would be no potential for cumulative noise and vibration impacts.
Larkbear, Tawstock, Barnstaple, Devon	Pending	6.4	No	
Land at Chivenor Cross, Chivenor, Braunton, EX31 4BN	Appeal allowed	2.4	No	
Lower Yelland Farm Yelland Barnstaple	Approved	0.76	No	
St Johns Garden Centre, Roundswell, Barnstaple, Devon, EX31 3FA	Approved	5.7	No	
Land West of Mead Park Bickington Barnstaple	Approved	3.8	No	
Land at Yelland Road	Approved	0.6	No	
20 West Yelland Yelland Barnstaple	Pending	0.16	No	The project introduces a new NVSR in the vicinity of the substation; however, this would be further away than existing identified NVSRs. Hence, effects will be no worse than already assessed.
Land at Braunton Burrows Braunton Devon	Approved	1.3		The project is greater than 500m from the Onshore Project, therefore there would be no potential for cumulative noise and vibration impacts.
Land at Woolmers Farm, North Lane, Bickington, Barnstaple, Devon, EX31	Approved	4.6	No	

Project	Status	Distance from Onshore Development Area (km)	Included in the CEA?	Rationale
2JN				
A T T U R M Instow Bideford Devon	Approved	0.12	No	This project involves demolition of a training shed in proximity to a proposed access road for the Onshore Project onshore construction works. There are no shared NVSRs with the potential to be impacted by noise from this project and the Onshore Project.
Chilpark Fremington Devon	Pending	2	No	The project is greater than 500m from the Onshore Project, therefore there would be no potential for cumulative noise and vibration impacts.
Land at Barton Cross Instow Bideford Devon EX39 4JQ	Pending decision	0.24	No	This project introduces additional NVSRs to the south of the proposed Onshore Project site access road; however, this would be further away than the existing identified NVSRs. Hence, effects will be no worse than already assessed.
Land At Pitt Hill Appledore	Pending	1.7	No	The project is greater than 500m from the Onshore Project, therefore there would be no potential for cumulative noise and vibration impacts.

205. It is noted that the first project listed is the Section 36 consent application for the offshore components of the White Cross Offshore Wind Farm (OWF) which are a separate component to the onshore Town and Country Planning Application for which this ES is prepared. The specific combined project components are assessed cumulatively first and then cumulatively with all other projects.

206. No projects have been identified for inclusion in the CEA for direct noise and vibration effects. Hence, the only cumulative effects assessment required is in relation to the indirect effects of off-site construction traffic noise.

18.8.1 Cumulative Impact 4: Noise from off-site construction traffic

207. The traffic consultants have provided cumulative road traffic flows on those links anticipated to be used by the Onshore Project construction traffic and the cumulative projects identified in **Chapter 19: Traffic and Transport**. The impact of the cumulative traffic noise has been assessed by comparison of the calculated BNLs for the baseline scenario and the cumulative flows scenario. In addition, to separate out the impact of the Onshore Project construction traffic and the other cumulative traffic flows, an additional comparison has been undertaken of the calculated BNLs for the "baseline + the Onshore Project" scenario and the total cumulative flows. These calculations are provided in **Appendix 18.C: Construction Traffic Noise Predictions**.

18.8.1.1 Magnitude of impact

208. Six links were identified for which cumulative traffic flow data were provided. Based on the comparison of the baseline and cumulative traffic flows, the identified cumulative road traffic noise impacts are **negligible** on four links, **low** on one link and **moderate** on one link (unnamed road to Yelland Substation). Based on the comparison of the "baseline + the Onshore Project" scenario and the total cumulative flows, the identified impacts are negligible on five links and minor on the unnamed road to Yelland Substation.

18.8.1.2 Significance of effect

209. All NVSRs along the identified road links are considered to be of **medium sensitivity**. Hence, the predicted impacts result in effects of **minor adverse significance** (not significant in EIA terms) on all links except the unnamed road to Yelland Substation, at which there is potentially a **moderate adverse** effect.

210. The anticipated cumulative road traffic flows on the unnamed road to Yelland Substation are 2,054 vehicles (AAWT), of which 163 are HGVs. The only NVSRs

within 50m of this road are those at its southern end (R26 to R28). At these NVSRs, the noise of the traffic on the B8233 (forecast traffic flows are 8,515 vehicles, of which 72 are HGVs) is highly likely to be dominant. In addition, to facilitate access to the proposed Yelland Quay Regeneration project, a new access road will be constructed from the B3233. Hence, cumulative road traffic noise effects at the NVSRs near this link are considered to be no worse than **minor adverse** significance, i.e. not significant in EIA terms.

18.9 Potential Transboundary Impacts

211. The Scoping Report identified that there was no potential for significant transboundary effects regarding noise and vibration from the Onshore Project upon the interests of other European Economic Area (EEA) States and this is not discussed further.

18.10 Inter-relationships

212. Inter-relationship impacts are covered as part of the assessment and consider impacts from the construction, operation or decommissioning of the Onshore Project on the same receptor (or group). A description of the process to identify and assess these effects is presented in **Chapter 6: EIA Methodology**. The potential inter-relationship effects that could arise in relation to noise and vibration include both:

- **Project lifetime effects:** Effects arising throughout more than one phase of the Onshore Project (construction, operation, and decommissioning) to interact to potentially create a more significant effect on a receptor than if just one phase were assessed in isolation
- **Receptor led effects:** Assessment of the scope for all relevant effects to interact, spatially and temporally, to create inter-related effects on a receptor (or group). Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

213. **Table 18.36** serves as a sign-posting for inter-relationships.

Table 18.36: noise and vibration Inter-relationships

Topic and description Construction	Related chapter	Where addressed in this Chapter	Rationale
Impact 1: Noise of construction works at the	**Chapter 15: Land Use**	N/a	Potential impacts at PRoW receptors addressed separately

Topic and description	Related chapter	Where addressed in this Chapter	Rationale
landfall			in **Chapter 15: Land Use**.
Impact 2: Noise of cable corridor construction works **Impact 3: Noise of Onshore Substation construction works** **Impact 5: Construction vibration**	**Chapter 16: Onshore Ecology and Ornithology**	N/a	Potential noise impacts at ecological receptors addressed separately in **Chapter 16: Onshore Ecology and Ornithology**.
	Chapter 20: Onshore Landscape and Visual Amenity	N/a	Potential impacts on landscape receptors addressed separately in **Chapter 20: Onshore Landscape and Visual Amenity**.
	Chapter 21: Socio-economics (including Tourism and Recreation)	N/a	Potential noise impacts addressed separately in **Chapter 21: Socio-economics (including Tourism and Recreation)**.
	Chapter 22: Human Health	**Section 18.3.2**	Increase in noise or vibration levels at NVSRs associated with the Onshore Project have the potential to result in human health effects.
Impact 4: Noise from off-site construction traffic	**Chapter 19: Traffic and Transport**	**Section 18.5.4**	Noise emissions from traffic movements associated with construction of the Onshore Project have the potential to impact on local amenity.
	Chapter 22: Human Health	**Section 18.3.2**	Increase in noise or vibration levels at NVSRs associated with the Onshore Project have the potential to result in human health effects.
Operation and Maintenance			
Impact 5: Operational Noise	**Chapter 16: Onshore Ecology and Ornithology**	N/A	Potential noise impacts at ecological receptors addressed separately in **Chapter 16:**

Topic and description	Related chapter	Where addressed in this Chapter	Rationale
			Onshore Ecology and Ornithology.
	Chapter 21: Socio-economics (including Tourism and Recreation)	N/A	Potential noise impacts addressed separately in **Chapter 21: Socio-economics (including Tourism and Recreation)**.
	Chapter 22: Human Health	**Section 18.3.2**	Increase in noise or vibration levels at NVSRs associated with the Onshore Project have the potential to result in human health effects.
Decommissioning			
Inter-relationships and the identified impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.			

18.11 Interactions

214. The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. As only one impact is identified for the operational phase, synergistic impacts will not occur. Potential synergistic impacts during the decommissioning phase are likely to be no worse than those during construction; hence, these are also excluded from this assessment. The areas of interaction between construction phase impacts are presented in **Table 18.37**, along with an indication as to whether the interaction may give rise to synergistic impacts. This provides a screening tool for which impacts have the potential to interact.

215. **Table 18.38** then provides an assessment for each receptor (or receptor group) related to these impacts in two ways. Firstly, the impacts are considered within a development phase (i.e. construction, operation, maintenance or decommissioning) to see if, for example, multiple construction impacts could combine. Secondly, a lifetime assessment is undertaken which considers the potential for impacts to affect receptors across development phases. The significance of each individual impact is determined by the sensitivity of the receptor and the magnitude of effect; the sensitivity is constant whereas the magnitude may differ. Therefore, when considering the potential for impacts to be additive it is the magnitude of effect which is important – the magnitudes of the

different effects are combined upon the same sensitivity receptor. If minor impact and minor impact were added this would effectively double count the sensitivity.

Table 18.37: Interaction between impacts during construction

Potential impact Construction	Impact 1: Noise of construction works at the landfall	Impact 2: Noise of cable corridor construction works	Impact 3: Noise of Onshore Substation construction works	Impact 4: Noise from off-site construction traffic	Impact 5: Construction vibration
Impact 1: Noise of construction works at the landfall		Yes	No	Yes	Yes
Impact 2: Noise of cable corridor construction works	Yes		Yes	Yes	Yes
Impact 3: Noise of Onshore Substation construction works	No	Yes		Yes	Yes
Impact 4: Noise from off-site construction traffic	Yes	Yes	Yes		Yes
Impact 5: Construction vibration	Yes	Yes	Yes	Yes	

Table 18.38: Potential interactions between impacts on noise and vibration

Highest level significance					
Receptor	Construction	Operation and Maintenance	Decommissioning	Phase Assessment	Lifetime Assessment
Residential	Minor adverse	Minor adverse	Minor adverse	No greater than individually assessed impacts The impacts are considered to range from negligible to minor adverse impact significance at residential receptors. Given the predicted impact significance and that each impact will be managed with standard and best practice methodologies it is considered that there would be no interactions or that these would not result in greater impact than when assessed individually. There are unlikely to be interactions between the landfall and onshore cable corridor construction, due to the length of the major trenchless technique drill under the golf course, which separates these impacts by around 1200m. As there are no NVSRs which could be adversely affected by noise from construction of the Onshore Substation, no interactions with this impact are anticipated.	No greater than individually assessed impacts It should be noted that worst-case assumptions have been used for each impact; therefore the effect level is unlikely to increase the significance of effect over the lifetime of the project. The Onshore Substation assessment indicates minor adverse effects throughout the project lifetime which are considered not significant in EIA terms; therefore, it is considered that these impacts would not combine to increase the significance level of any impacts identified in this assessment.

18.12 Summary

216. This chapter has investigated the potential effects on NVSRs arising from the Onshore Project. The range of potential impacts and associated effects considered has been informed by the Scoping Opinion, consultation, and agreed through ETG Meetings, as well as reference to existing policy and guidance. The impacts considered include those brought about directly as well as indirectly.

217. The baseline environment has been characterised through identification and classification of the NVSRs with the potential to be impacted by the Onshore Project, and a baseline noise level survey at representative locations.

218. **Table 18.39** presents a summary of the impacts assessed within this ES chapter, any commitments made, and mitigation required and the residual effects.

219. Temporary noise and vibration effects during construction have been assessed. With appropriate mitigation in place, which includes some proposed temporary screening, adverse noise effects can be minimised and significant effects are not anticipated.

220. The change in noise levels due to construction traffic relating to the Onshore Project has been assessed and effects are found to be of no worse than **minor** significance.

221. Predictions of operational noise emissions identified that residual effects are likely to be of no worse than **minor** significance.

222. The assessment of cumulative impacts from the Onshore Project and other developments and activities concluded that significant cumulative effects are not anticipated.

223. The screening of transboundary impacts identified no potential for significant transboundary effects regarding noise and vibration from the Onshore Project upon the interests of other EEA States.

Table 18.39: Summary of potential impacts for noise and vibration during construction, operation, maintenance and decommissioning of the Onshore Project

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Potential mitigation measure	Residual impact
Construction						
Impact 1: Noise of construction works at the landfall	Residential	Medium	Negligible / low	Minor adverse (exceedances of LOAEL)	BPM and temporary screening between the landfall compound and the nearby NVSRs	Minor adverse (mitigated exceedances of LOAEL)
	Non-residential	Low	Negligible to medium	Negligible / minor adverse		
Impact 2: Noise of cable corridor construction works	Residential	Medium	Negligible to medium	Minor adverse (exceedances of LOAEL)	BPM and temporary screening between the haul road and R14 and R16	Minor adverse (mitigated exceedances of LOAEL)
	Non-residential	Low	Negligible / low	Negligible / minor adverse	None	
Impact 3: Noise of Onshore Substation construction works	Non-residential	Low	Negligible / low	Negligible / minor adverse	None	Negligible / minor adverse
Impact 4: Noise of off-site construction traffic	Residential	Medium	Negligible / low	Negligible / minor adverse	Traffic management measures specified in CTMP	Negligible / minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Potential mitigation measure	Residual impact
Impact 5: Construction vibration	Residential	Medium	Negligible / low	Minor adverse (exceedances of LOAEL)	BPM	Minor adverse (mitigated exceedances of LOAEL)
Operation and Maintenance						
Impact 6: Operational noise	Residential	Medium	Negligible to high	Minor to major adverse	Reduction in ventilation system sound emissions towards R31 to R33. Final mitigation package will be based on substation detailed design and will be controlled by condition.	Minor adverse (no exceedances of LOAEL)
	Non-residential	Low				
Decommissioning						
It is anticipated that the decommissioning impacts would be similar in nature to those of construction.						
Cumulative						
Impact 3: Noise of off-site construction traffic	Residential	Medium	Negligible to moderate	Minor adverse	None required	Minor adverse

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Appendix 18.A: Baseline Noise Survey

WHITE CROSS

White Cross Offshore Windfarm Environmental Statement

Chapter 18: Noise and Vibration

Appendix 18.A: Onshore Noise and Vibration Baseline

Document Code:	FLO-WHI-REP-0016-22	
Contractor Document Number:	PC2978-RHD-ZZ-XX-RP-Z-0413	
Version Number:	00	
Date:	*14/08/2023*	
Prepared by:	*DE*	*Electronic Signature*
Checked by:	*TB*	*Electronic Signature*
Owned by:	*CB*	*Electronic Signature*
Approved by Client :	*OG*	*Electronic Signature*

Version Number	**Reason for Issue / Major Changes**	**Date of Change**
00	For issue	14/08/2023

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Glossary of Acronyms

Acronym	Definition
BS	British Standard
BSI	British Standards Institute
dB	Decibel
ES	Environmental Statement
HGV	Heavy Goods Vehicle
m	Meter
NVSR	Noise and Vibration Sensitive Receptors
SLM	Sound Level Meter

Glossary of Terminology

Defined Term	Description
Applicant	Offshore Wind Limited
Landfall	Where the offshore export cables come ashore
National Grid Onshore Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of the electrical transformers.
Onshore Transmission Assets	The aspects of the project related to the transmission of electricity from MLWS at the Landfall to the NG grid connection point at East Yelland including the Onshore Export Cable, the White Cross Onshore Substation and onward connection to the NG grid connection point at East Yelland.
The Project	the Project is a proposed floating offshore windfarm called White Cross located in the Celtic Sea with a capacity of up to 100MW. It encompasses the project as a whole, i.e. all onshore and offshore infrastructure and activities associated with the Project.
White Cross Offshore Windfarm	Up to 100MW capacity offshore windfarm including associated onshore and offshore infrastructure.
White Cross Onshore Substation	A new substation built specifically for the White Cross project. It is required to ensure electrical power produced by the offshore windfarm is compliant with NG electrical requirements at the grid connection point at East Yelland.

1 Baseline Noise Survey

1.1 Introduction

1. This Appendix to the White Cross Offshore Windfarm Environmental Statement (ES) **Chapter 18: Noise and Vibration** details the baseline sound survey undertaken to characterise the existing soundscape within the onshore noise and vibration study area.

2. The baseline sound survey comprised of attended measurements at one location and unattended measurements at a further 5 locations, representative of identified noise and vibration sensitive receptors (NVSRs) around the locations of the proposed landfall and onshore substation. Measurements were conducted in accordance with current best practice guidance as specified in British Standard (BS) 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' and BS 7445-2:1991 'Description and measurement of environmental noise'.

3. Notes were made on the sources observed to be contributing to the soundscape at each monitoring location.

4. The survey was undertaken between 22nd March 2023 and 4th April 2023.

1.2 Existing Environment

5. Aerial imagery was used to determine NVSR locations at the landfall search area and at the onshore substation zone.

6. Measurement locations (representative of individual or groups of NVSRs) are as shown in **Table 1.1.**

7. Monitoring locations are illustrated in **Figure 18.1** of **Chapter 18: Noise and Vibration**. Photos of each measurement location are provided in Annex A1.

Table 1.1: Baseline Sound Survey Measurement Locations

Measurement location identifier	Coordinates X	Coordinates Y	Representative Receptors
Landfall locations			
LAM1	244833	137634	R5 and R6
LUM1	244630	137722	R2
LUM2	244562	137779	R1
Onshore substation locations			
SUM1	248364	131610	R29
SUM2	248600	131843	R26

Measurement location identifier	Coordinates X	Y	Representative Receptors
SUM3	248028	132014	*No receptors.

*This position was used to measure the ambient noise levels originating from both the existing substation and solar panel farm.

1.3 Instrumentation

8. The instrumentation used to conduct the surveys is detailed in **Table 1.2.**

Table 1.2: Instrumentation details

Measurement location	Equipment type	Model number	Serial number	Last calibration date
LAM1	Sound Level Meter	Rion NL52	00821105	06-Jan-2023
LUM1	Sound Level Meter	Rion NL52	00610205	06-Feb-2023
LUM2	Sound Level Meter	Rion NL52	00864982	11-Oct-2022
SUM1	Sound Level Meter	Rion NL52	00898320	17-Oct-20222
SUM2	Sound Level Meter	Rion NL52	00821105	06-Jan-2023
SUM3	Sound Level Meter	Rion NL52	00220558	16-Jun-2022
All locations	Portable calibrator	Rion NC74	01020506	17-Oct-2022

9. All the above instrumentation has in-date laboratory calibration certificates which can be provided on request. Each sound level meter (SLM) was calibrated immediately before and after each survey period and no changes greater than +/- 0.2 dB were noted.

10. Various sound level indicators were logged every 15-minutes, including the equivalent noise level ($L_{Aeq,T}$), maximum noise level (L_{Amax}) and statistical indices such as background sound levels ($L_{A90,T}$) as well as 1/3 octave band data. The sound measurements were taken at a height which was between 1.2 and 1.5m above ground level and located at least 3.5m from any vertical reflecting surfaces.

1.4 Weather Conditions

11. A portable weather station was deployed to log at 15-minute intervals, alongside noise monitoring equipment throughout the survey periods. Measurement location

SUM2 was considered representative of the geographic spread of all other locations in the vicinity of the onshore substation zone.

12. Good practice detailed in BS 4142 recommends that representative environmental noise measurements should be undertaken during favourable weather conditions, i.e. with windspeed <5 m/s and no precipitation. Therefore data recorded during periods with precipitation or wind speeds in exceedance of 5 m/s were excluded from the analysis.

13. Weather conditions at the landfall locations were observed during the short period attended measurements, setup, and collection of the untended instrumentation.

1.5 Results

14. The following subsections provide summaries of the data obtained at each survey location.

1.5.1 Landfall Measurement Location LAM1

15. During the daytime period, the noise sources observed to be contributing to the baseline sound climate at this location were vehicles in Saunton Sands car park, the crashing of sea waves, ongoing construction activities in the Saunton Sands car park, pedestrians accompanied by pets, and the call of sea birds. During the night-time period, the noise sources observed to be contributing to the baseline sound climate at this location were the crashing waves.

16. The results of the attended baseline noise survey at LAM1 during the BS 5228-1 night-time (23:00 to 07:00) reference period are summarised in **Table 1.3**.

17. All samples measured during non-compliant weather conditions have been removed from the data presented in this section.

18. To determine the relevant sound level parameter over the specified time periods, the measured 15-minute data has been processed as follows:

- $L_{Aeq,15min}$ data has been logarithmically averaged
- $L_{A10,15min}$ and $L_{A90,15min}$ data have been arithmetically averaged
- Maximum of the recorded $L_{AMax,15min}$ data.

Table 1.3: Baseline Noise Summary – Measurement Location LAM1 (Attended)

Measurement Start Date/Time	Measurement End Date/Time	$L_{Aeq,15min}$ (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)	$L_{Amax,15min}$ (dB)
04/04/2023 - 00:33	04/04/2023 – 01:03	37	38	34	43

1.5.2 Measurement Location LUM1

19. During the daytime period, the noise sources observed to be contributing to the baseline sound climate at this location were vehicles in Saunton Sands car park, the crashing sea waves, ongoing construction activities in Saunton Sands car park, pedestrians accompanied by pets, and the call of sea birds. No surveyor was present during the night time period at this location, and so no information about sources is available.

20. **Table 1.4** summarises the BS 4142 weather compliant unattended baseline survey sound data measured at location LUM1. This measurement was undertaken from 14:00hrs on 22nd March to 11:30hrs on 2nd April.

Table 1.4: Baseline Noise Summary – Measurement Location LUM1 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
22/03/23	22/03/23	Daytime	65	72	65	63
		Evenings & weekend	62	82	63	60
	23/03/23	Night-time	63	77	62	60
23/03/23		Daytime	64	75	64	62
		Evenings & weekend	65	71	65	63
	24/03/23	Night-time	61	78	61	59
24/03/23		Daytime	66	82	67	64
		Evenings & weekend	**	**	**	**
	25/03/23	Night-time	**	**	**	**
25/03/23		Daytime	61	74	62	60
		Evenings & weekend	63	89	63	61
	26/03/23	Night-time	53	57	54	52

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
26/03/23		Daytime	*	*	*	*
		Evenings & weekend	60	89	58	54
	27/03/23	Night-time	55	72	55	52
27/03/23		Daytime	57	97	56	53
		Evenings & weekend	60	69	61	58
	28/03/23	Night-time	54	66	54	52
28/03/23		Daytime	62	77	63	60
		Evenings & weekend	63	84	64	61
	29/03/23	Night-time	58	63	58	56
29/03/23		Daytime	61	76	62	60
		Evenings & weekend	65	84	66	63
	30/03/23	Night-time	63	83	64	62
30/03/23		Daytime	62	80	62	60
		Evenings & weekend	**	**	**	**
	31/03/23	Night-time	**	**	**	**
31/03/23		Daytime	**	**	**	**
		Evenings & weekend	**	**	**	**
	01/04/23	Night-time	**	**	**	**
01/04/23		Daytime	57	73	58	56
		Evenings & weekend	59	98	58	56
	02/04/23	Night-time	58	65	59	56
02/04/23		Daytime	*	*	*	*
		Evenings & weekend	53	68	55	51

Note BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Night-time period 23:00 – 07:00 Monday to Sunday.

* BS5228 classes all day on Sunday as part of the weekend period.

** No data due to weather conditions.

1.5.3 Measurement Location LUM2

21. During the daytime period, the noise sources observed to be contributing to the baseline sound climate at this location were vehicles in Saunton Sands car park, the crashing waves of the sea, ongoing construction activities in Saunton Sands car park, hotel guest engaging in recreational activities, and the call of sea birds. No surveyor was present during the night time period at this location, and so no information about sources is available.

22. **Table 1.5** summarises the BS 4142 weather compliant unattended baseline survey sound data measured at location LUM2. This measurement was undertaken from 14:00hrs on 22nd March to 10:00hrs on 4th April.

Table 1.5: Baseline Noise Summary – Measurement Location LUM2 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
22/03/23	22/03/23	Daytime	60	78	61	58
		Evenings & weekend	58	71	59	57
	23/03/23	Night-time	59	76	59	57
23/03/23		Daytime	60	78	60	58
		Evenings & weekend	61	80	62	60
	24/03/23	Night-time	58	76	58	56
24/03/23		Daytime	61	84	62	59
		Evenings & weekend	**	**	**	**
	25/03/23	Night-time	**	**	**	**
25/03/23		Daytime	56	70	57	55
		Evenings & weekend	58	88	58	56
	26/03/23	Night-time	55	58	55	54
26/03/23		Daytime	*	*	*	*
		Evenings & weekend	56	90	56	52
	27/03/23	Night-time	53	73	54	51
27/03/23		Daytime	56	99	55	52
		Evenings & weekend	57	65	59	55

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
	28/03/23	Night-time	53	68	54	51
28/03/23		Daytime	57	78	58	56
		Evenings & weekend	60	82	61	58
	29/03/23	Night-time	56	63	57	54
29/03/23		Daytime	57	76	58	55
		Evenings & weekend	60	82	61	58
	30/03/23	Night-time	59	79	60	58
30/03/23		Daytime	57	77	58	56
		Evenings & weekend	**	**	**	**
	31/03/23	Night-time	**	**	**	**
31/03/23		Daytime	**	**	**	**
		Evenings & weekend	**	**	**	**
	01/04/23	Night-time	**	**	**	**
01/04/23		Daytime	55	74	56	54
		Evenings & weekend	56	85	56	54
	02/04/23	Night-time	57	67	58	55
02/04/23		Daytime	*	*	*	*
		Evenings & weekend	54	93	53	50
	03/04/23	Night-time	54	75	55	52
03/04/23		Daytime	52	79	52	48
		Evenings & weekend	50	81	50	47
	04/04/23	Night-time	56	70	56	53
04/04/23		Daytime	55	86	54	51

Note BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Night-time period 23:00 – 07:00 Monday to Sunday.

* BS5228 classes all day on Sunday as part of the weekend period.

** No data due to weather conditions.

1.5.4 Onshore Substation Measurement Locations

23. The results of the unattended baseline noise survey are summarised in this section for the BS 4142 daytime (07:00 to 23:00) reference period, the BS 5228-1 daytime (weekdays 07:00 to 19:00 and Saturday 07:00 to 13:00) and evening and weekend (weekdays 19:00 to 23:00, Saturdays 13:00 to 23:00, Sundays 07:00 to 23:00) periods and the night-time period (23:00 to 07:00 Monday to Sunday in both BS 4142 and BS 5228-1).

24. All samples measured during non-compliant weather conditions have been removed from the data presented in this section.

25. To determine the relevant sound level parameter over the specified time periods, the measured 15-minute data has been processed as follows:

- $L_{Aeq,15min}$ data has been logarithmically averaged
- $L_{A10,15min}$ and $L_{A90,15min}$ data have been arithmetically averaged
- Maximum of the recorded $L_{AMax,15min}$ data.

1.5.5 Measurement Location SUM1

26. During the daytime period, the noise sources observed to be contributing to the baseline sound climate at this location were road traffic on West Yelland B3233, rustling vegetation and birdcall. No surveyor was present during the night time period at this location, and so no information about sources is available.

27. **Table 1.6** summarises the BS 4142 weather compliant unattended baseline survey sound data measured at location SUM1. This measurement was undertaken from 14:00hrs on 22nd March to 16:00hrs on 3rd April.

Table 1.6 Baseline Noise Summary – Measurement Location SUM1 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
22/03/23	22/03/23	Daytime (BS 4142)	54	77	55	46
		Daytime (BS 5228)	52	77	54	45
		Evenings & weekend (BS 5228)	56	74	56	47
	23/03/23	Night-time	46	70	45	41
23/03/23		Daytime (BS 4142)	53	79	53	44
		Daytime (BS 5228)	54	79	55	45

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	47	66	49	42
	24/03/23	Night-time	49	78	46	42
24/03/23		Daytime (BS 4142)	56	84	58	49
		Daytime (BS 5228)	57	84	59	50
		Evenings & weekend (BS 5228)	53	70	55	48
	25/03/23	Night-time	55	80	58	50
25/03/23		Daytime (BS 4142)	53	83	54	45
		Daytime (BS 5228)	54	83	54	47
		Evenings & weekend (BS 5228)	53	82	53	42
	26/03/23	Night-time	49	82	45	39
26/03/23		Daytime (BS 4142)	50	82	50	40
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	50	82	50	40
	27/03/23	Night-time	48	76	40	34
27/03/23		Daytime (BS 4142)	53	86	52	40
		Daytime (BS 5228)	53	86	54	42
		Evenings & weekend (BS 5228)	52	81	47	32
	28/03/23	Night-time	47	73	41	33
28/03/23		Daytime (BS 4142)	53	81	53	42
		Daytime (BS 5228)	54	81	56	45
		Evenings & weekend (BS 5228)	43	68	44	35
	29/03/23	Night-time	49	76	42	36
29/03/23		Daytime (BS 4142)	54	81	54	44
		Daytime (BS 5228)	54	81	55	44
		Evenings & weekend (BS 5228)	54	81	53	42
	30/03/23	Night-time	52	74	53	44
30/03/23		Daytime (BS 4142)	53	81	55	46

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Daytime (BS 5228)	54	81	55	47
		Evenings & weekend (BS 5228)	51	65	53	42
	31/03/23	Night-time	56	75	55	45
31/03/23		Daytime (BS 4142)	54	77	54	49
		Daytime (BS 5228)	57	77	58	53
		Evenings & weekend (BS 5228)	47	63	49	46
	01/04/23	Night-time	48	74	48	44
01/04/23		Daytime (BS 4142)	50	82	50	40
		Daytime (BS 5228)	51	82	53	43
		Evenings & weekend (BS 5228)	48	82	48	38
	02/04/23	Night-time	48	72	42	35
02/04/23		Daytime (BS 4142)	49	78	50	39
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	49	78	50	39
	03/04/23	Night-time	46	71	42	33
03/04/23		Daytime (BS 4142)	51	78	53	43
		Daytime (BS 5228)	51	78	53	43

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.

* BS5228 classes all day on Sunday as part of the weekend period.

28. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SUM1 is presented in **Table 1.7**.

Table 1.7 Baseline LA90 Noise Data Analysis – SUM1 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90,15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	708	44	43	44	5
Night-time	349	41	39	41	8

1.5.6 Measurement Location SUM2

29. During the daytime period, the noise sources observed to be contributing to the baseline sound climate at this location were road traffic on West Yelland B3233, rustling vegetation, birdcall and vehicles on the access road to Certas Energy and Flogas Britain Ltd – Barnstaple, predominantly consisting of heavy goods vehicles (HGVs). During the night-time period, the baseline sound climate at this location is typically rural with absence of dominant contributing sources.

30. **Table 1.8** summarises the BS 4142 weather compliant unattended baseline survey sound data measured at location SUM2. This measurement was undertaken from 14:15hrs on 22nd March to 16:15hrs on 3rd April.

Table 1.8: Baseline Noise Summary – Measurement Location SUM2 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
22/03/23	22/03/23	Daytime (BS 4142)	54	86	55	46
		Daytime (BS 5228)	54	86	55	46
		Evenings & weekend (BS 5228)	54	73	55	46
	23/03/23	Night-time	47	76	47	42
23/03/23		Daytime (BS 4142)	53	84	54	45
		Daytime (BS 5228)	54	84	55	46
		Evenings & weekend (BS 5228)	48	81	50	42
	24/03/23	Night-time	47	77	47	43
24/03/23		Daytime (BS 4142)	55	81	57	48
		Daytime (BS 5228)	56	81	58	49
		Evenings & weekend (BS 5228)	52	77	55	47
	25/03/23	Night-time	55	74	58	49
25/03/23		Daytime (BS 4142)	51	79	53	44
		Daytime (BS 5228)	52	79	54	47
		Evenings & weekend (BS 5228)	50	77	52	42
	26/03/23	Night-time	46	65	46	40
26/03/23		Daytime (BS 4142)	49	87	49	36
		Daytime (BS 5228)	*	*	*	*

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	49	87	49	36
	27/03/23	Night-time	48	82	40	34
27/03/23		Daytime (BS 4142)	51	84	51	37
		Daytime (BS 5228)	51	84	52	39
		Evenings & weekend (BS 5228)	52	79	47	31
	28/03/23	Night-time	48	80	40	32
28/03/23		Daytime (BS 4142)	53	85	52	43
		Daytime (BS 5228)	54	85	55	45
		Evenings & weekend (BS 5228)	43	71	45	37
	29/03/23	Night-time	49	80	44	38
29/03/23		Daytime (BS 4142)	54	82	55	44
		Daytime (BS 5228)	54	82	56	45
		Evenings & weekend (BS 5228)	52	82	53	42
	30/03/23	Night-time	50	76	51	43
30/03/23		Daytime (BS 4142)	53	85	54	45
		Daytime (BS 5228)	54	85	55	46
		Evenings & weekend (BS 5228)	49	75	51	41
	31/03/23	Night-time	54	77	52	44
31/03/23		Daytime (BS 4142)	54	78	55	48
		Daytime (BS 5228)	56	78	58	52
		Evenings & weekend (BS 5228)	49	61	51	45
	01/04/23	Night-time	49	78	50	43
01/04/23		Daytime (BS 4142)	48	77	49	38
		Daytime (BS 5228)	51	73	53	43
		Evenings & weekend (BS 5228)	46	77	46	35
	02/04/23	Night-time	47	72	41	33
02/04/23		Daytime (BS 4142)	49	79	51	35

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	49	79	51	35
	03/04/23	Night-time	49	80	40	29
03/04/23		Daytime (BS 4142)	53	87	54	41
		Daytime (BS 5228)	53	87	54	41

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.
* BS5228 classes all day on Sunday as part of the weekend period.

31. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SUM2 is presented in **Table 1.9**.

Table 1.9: Baseline LA90 Noise Data Analysis – SUM2 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90,15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	708	46	42	43	6
Night-time	349	43	39	40	8

1.5.7 Measurement Location SUM3

32. During period daytime, the noise sources observed to be contributing to the baseline sound climate at this location were occasional vehicles on West Yelland B3233, rustling vegetation and birdcall. During the night-time period, it wasn't safe to visit this monitoring location. The measured third-octave band sound levels have been analysed and show a tonal component at 100Hz, which suggests a contribution from the Yelland substation. To remove the contribution from Yelland substation, the 15-minute L_{A90} values have been calculated from the spectral data, with the 100Hz L_{90} level reduced by 10dB. Over the entire survey, this reduced the average L_{A90} by 0.8dB from the measured value.

33. **Table 1.10** summarises the BS 4142 weather compliant unattended baseline survey sound data measured at location SUM3, without the contribution from Yelland substation. This measurement was undertaken from 14:00hrs on 22nd March to 15:45hrs on 3rd April.

Table 1.10: Baseline Noise Summary – Measurement Location SUM3 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
22/03/23	22/03/23	Daytime (BS 4142)	53	81	51	44
		Daytime (BS 5228)	45	73	46	41
		Evenings & weekend (BS 5228)	56	81	57	48
	23/03/23	Night-time	45	81	45	42
23/03/23		Daytime (BS 4142)	47	68	49	42
		Daytime (BS 5228)	47	68	49	42
		Evenings & weekend (BS 5228)	47	61	49	42
	24/03/23	Night-time	45	68	46	43
24/03/23		Daytime (BS 4142)	55	85	57	48
		Daytime (BS 5228)	56	85	57	48
		Evenings & weekend (BS 5228)	54	81	56	49
	25/03/23	Night-time	55	83	57	50
25/03/23		Daytime (BS 4142)	47	79	47	40
		Daytime (BS 5228)	48	79	48	43
		Evenings & weekend (BS 5228)	46	75	46	38
	26/03/23	Night-time	43	63	43	39
26/03/23		Daytime (BS 4142)	44	73	43	34
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	44	73	43	34
	27/03/23	Night-time	42	75	40	36
27/03/23		Daytime (BS 4142)	48	78	43	35
		Daytime (BS 5228)	43	69	44	36
		Evenings & weekend (BS 5228)	53	78	42	32
	28/03/23	Night-time	39	62	38	33
28/03/23		Daytime (BS 4142)	44	86	44	39
		Daytime (BS 5228)	45	86	45	39

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	40	65	40	36
	29/03/23	Night-time	42	61	41	37
29/03/23		Daytime (BS 4142)	49	78	47	41
		Daytime (BS 5228)	44	65	46	40
		Evenings & weekend (BS 5228)	54	78	51	43
	30/03/23	Night-time	52	80	53	45
30/03/23		Daytime (BS 4142)	47	72	48	41
		Daytime (BS 5228)	47	72	49	41
		Evenings & weekend (BS 5228)	43	60	45	39
	31/03/23	Night-time	55	81	51	45
31/03/23		Daytime (BS 4142)	50	81	50	46
		Daytime (BS 5228)	52	81	53	49
		Evenings & weekend (BS 5228)	46	81	46	44
	01/04/23	Night-time	46	80	46	43
01/04/23		Daytime (BS 4142)	43	91	42	38
		Daytime (BS 5228)	44	72	45	41
		Evenings & weekend (BS 5228)	43	91	41	36
	02/04/23	Night-time	40	63	40	36
02/04/23		Daytime (BS 4142)	40	70	42	33
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	40	70	42	33
	03/04/23	Night-time	46	78	39	34
03/04/23		Daytime (BS 4142)	44	73	43	37
		Daytime (BS 5228)	44	73	43	37

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.

* BS5228 classes all day on Sunday as part of the weekend period.

34. A statistical analysis of the background sound levels (L_{A90},15min) measured during the baseline survey at location SUM3 is presented in **Table 1.11**.

Table 1.11: Baseline LA90 Noise Data Analysis – SUM3 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90,15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	707	35	40	39	5
Night-time	349	44	40	40	6

1.5.8 BS 4142 Background Sound Levels (LA90,15min)

35. Statistical analysis of the baseline background sound level (LA90) was undertaken following guidance detailed in BS 4142:2014+A1:2019. As suggested by BS 4142, histograms of the measured $L_{A90,15min}$ levels during the day and night-time at each onshore substation measurement location are provided in Annex A2. These histograms have been used to identify the representative background sound levels, as detailed in **Chapter 18: Noise and Vibration**.

1.6 References

British Standards Institute (BSI) (1991) BS 7445-2:1991 - Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use. London.

BSI (2003) BS EN 61672-1:2003 - Electroacoustics. Sound level meters. Specifications. London.

BSI (2014). BS 5228-1:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites – Part 1: Noise".

BSI (2019) BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound. London.

Annex 1: Measurement Location Photos

Figure 1 LAM1 Measurement Location

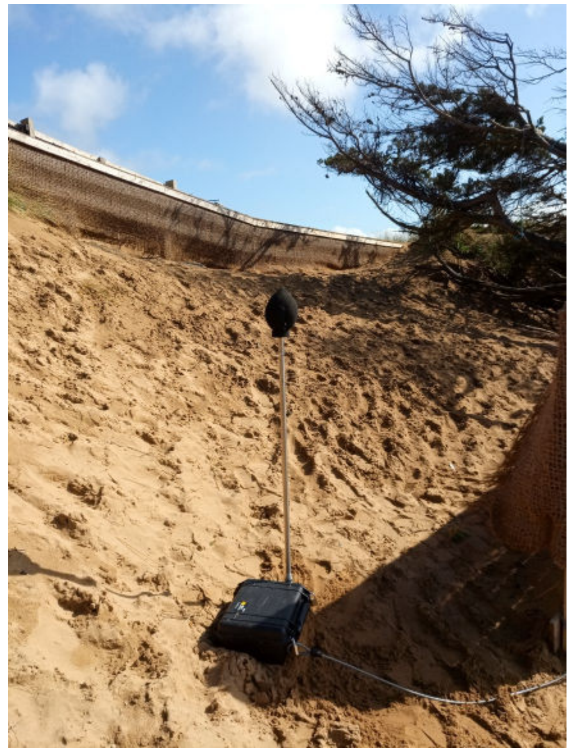


Figure 2 LUM1 Measurement Location

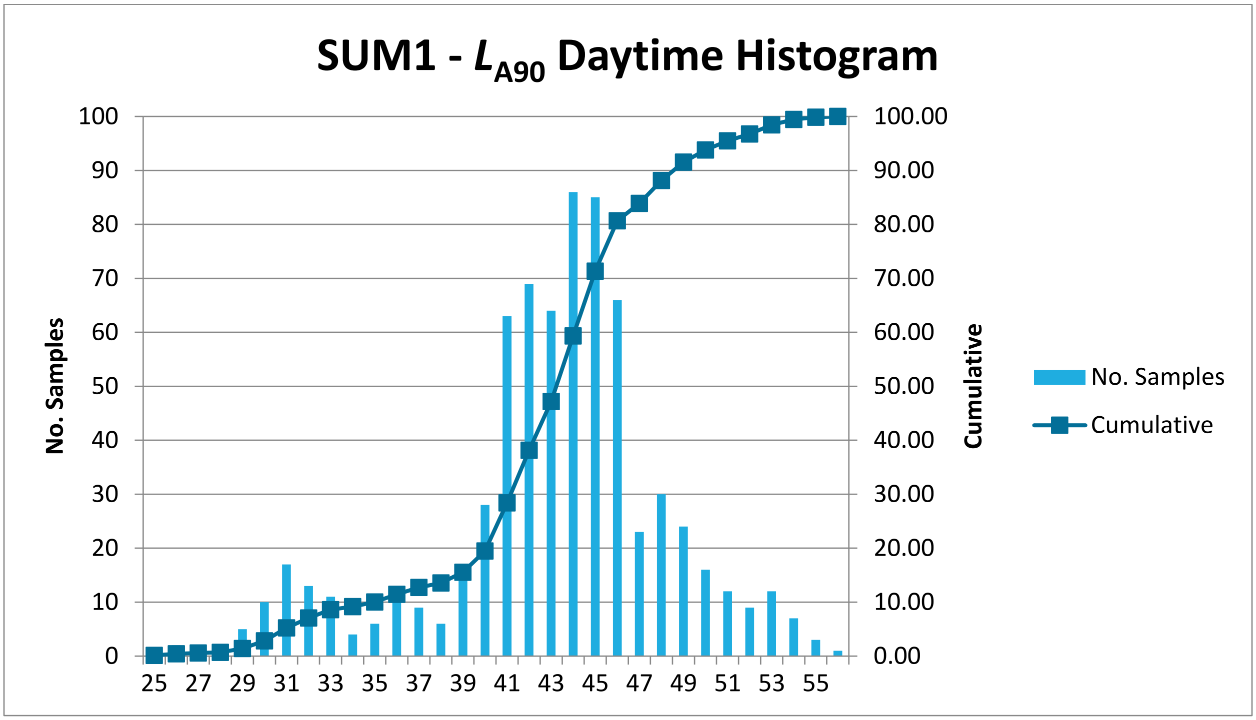
Figure 3 LUM2 Measurement Location

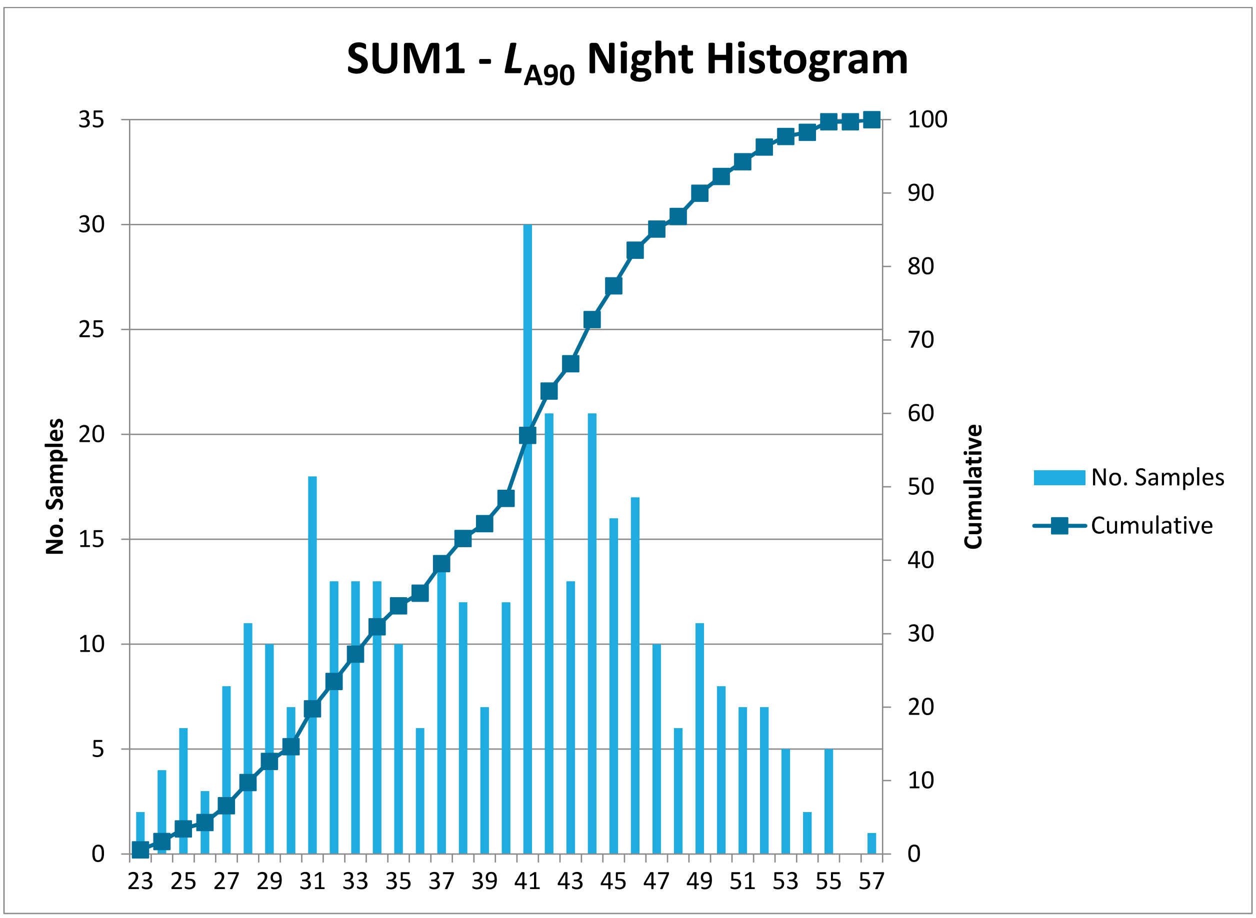
Figure 4 SUM1 Measurement Location

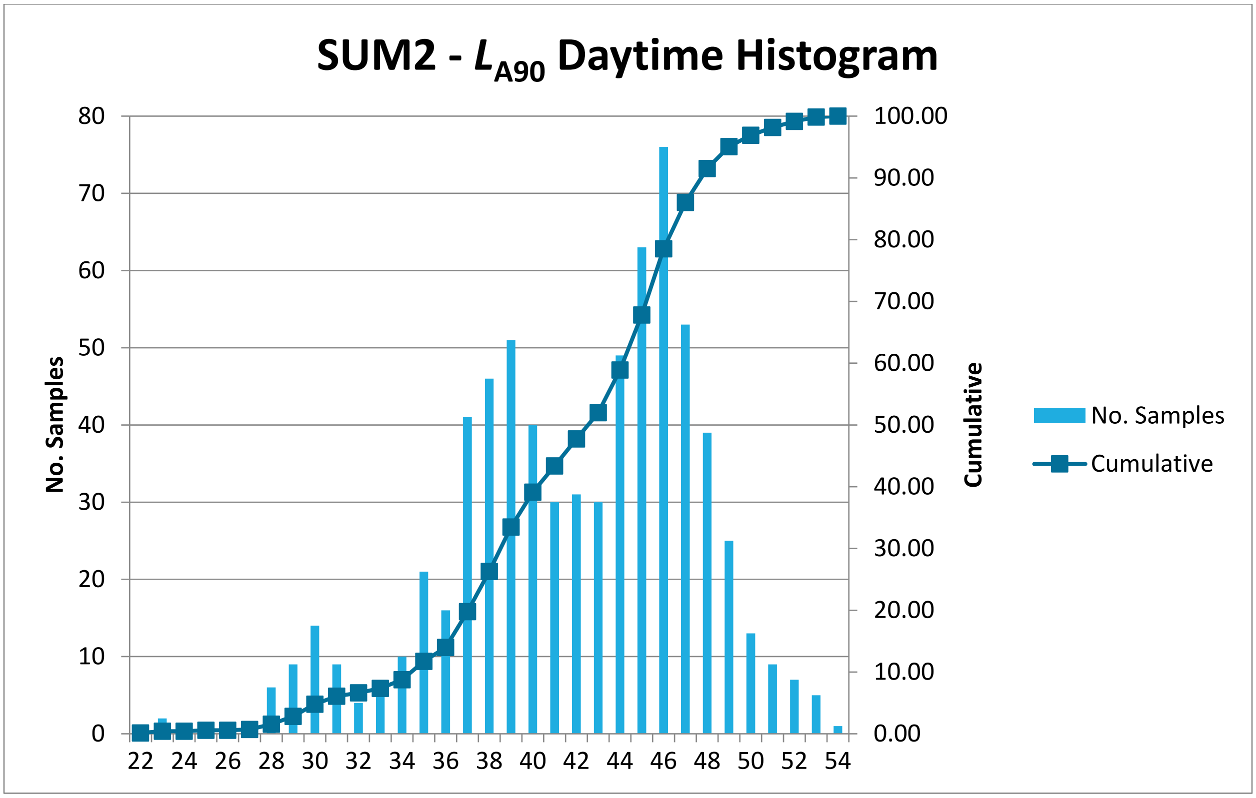
Figure 5 SUM2 Measurement Location

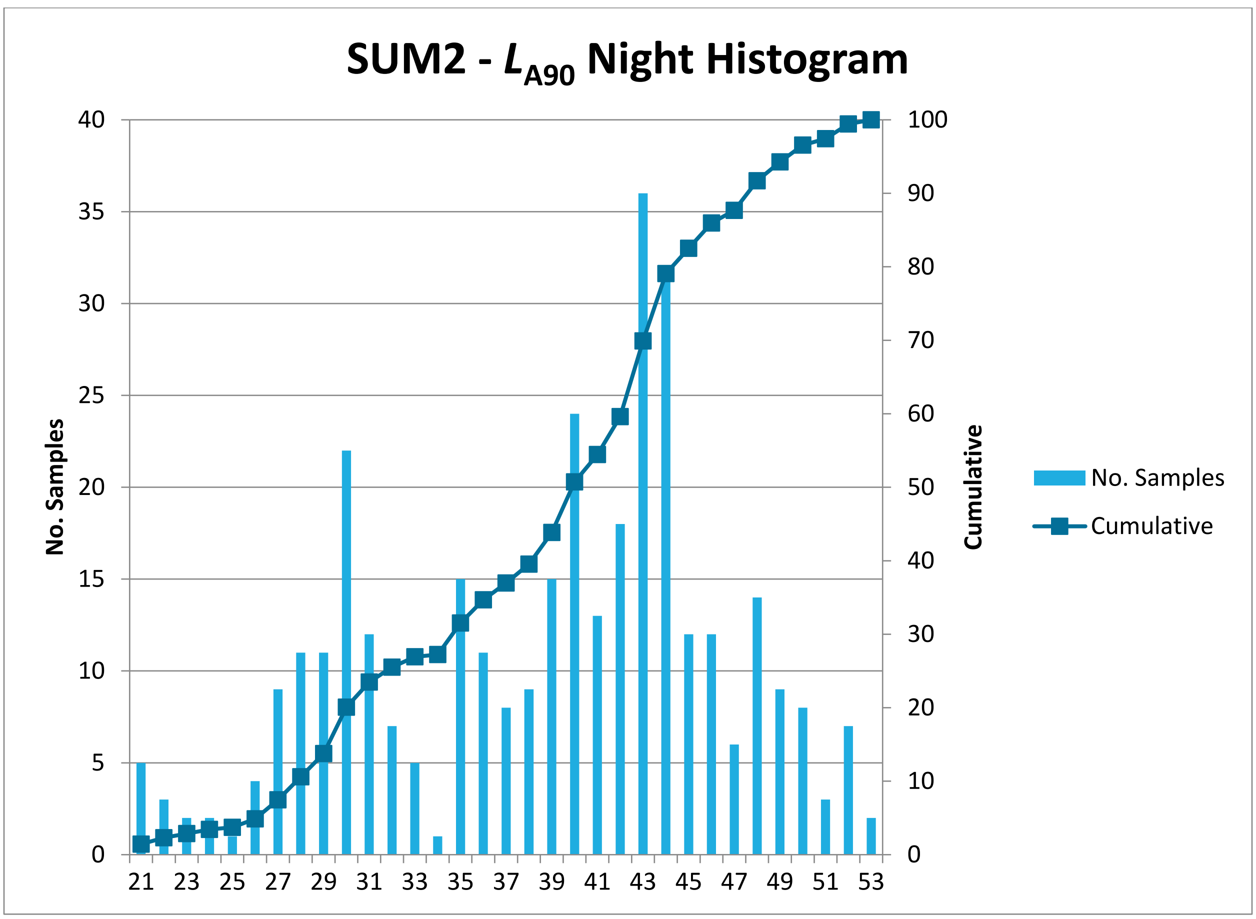
Figure 6 SUM3 Measurement Location

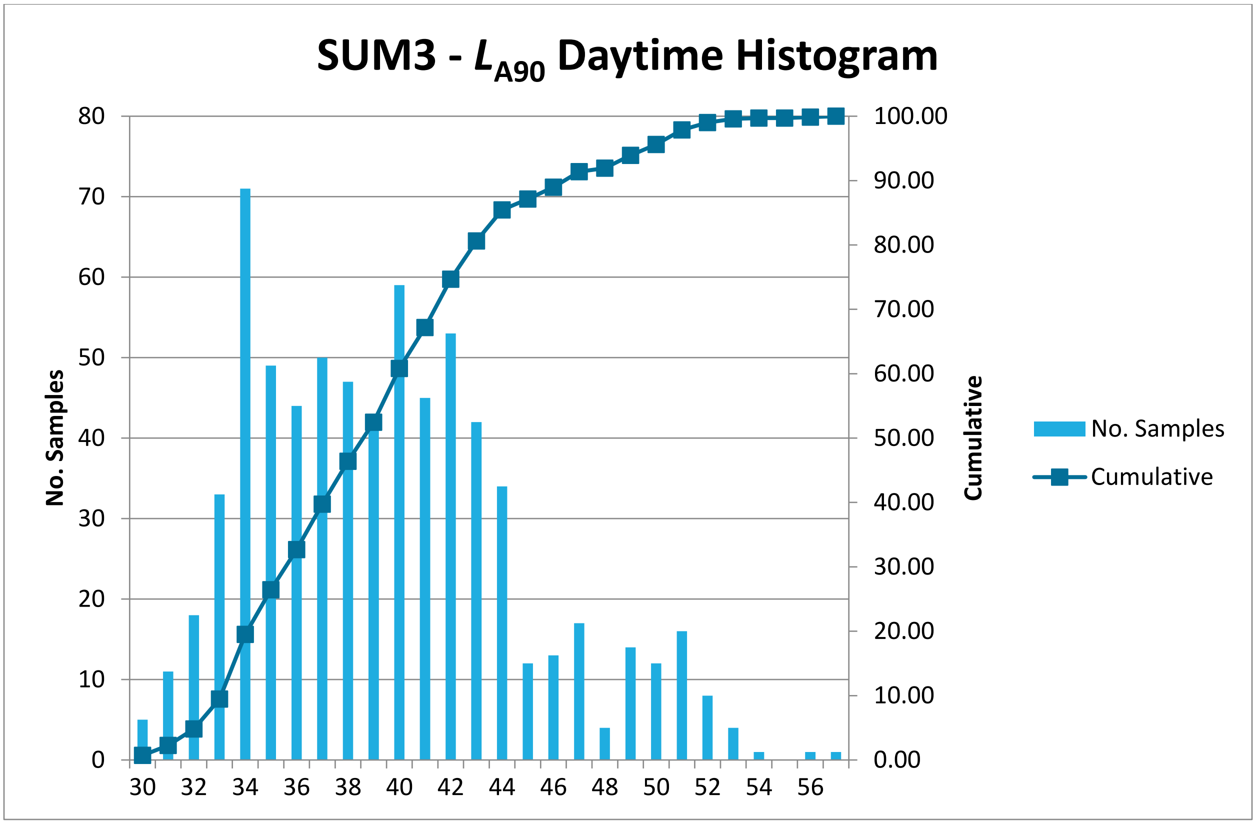
Annex 2: Background Noise Survey Histograms

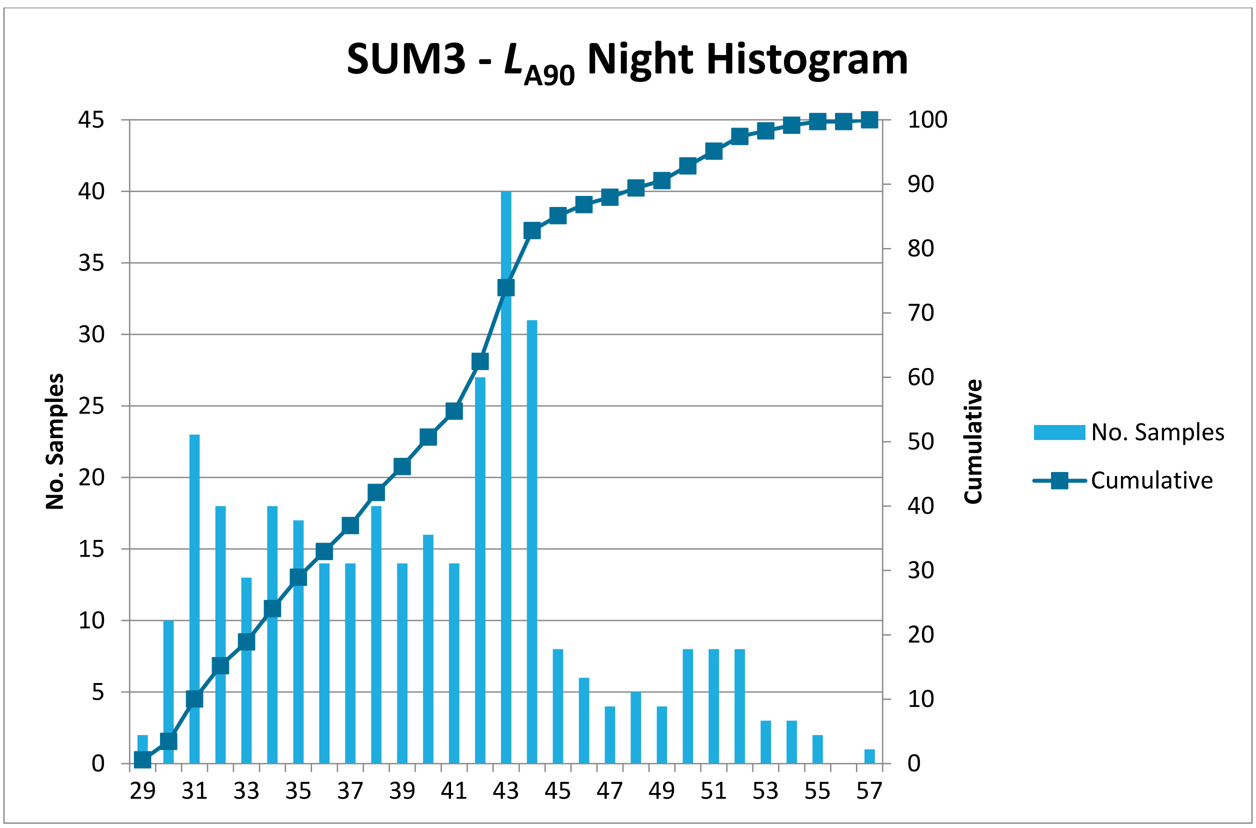





SUM2 - L_{A90} Daytime Histogram
No. Samples
Cumulative
0
10
20
30
40
50
60
70
80
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54
No. Samples
Cumulative


SUM2 - L_{A90} Night Histogram
No. Samples
Cumulative
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
60
70
80
90
100
21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53
No. Samples
Cumulative


SUM3 - L_{A90} Daytime Histogram
No. Samples
Cumulative
0
10
20
30
40
50
60
70
80
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
30
32
34
36
38
40
42
44
46
48
50
52
54
56
No. Samples
Cumulative


SUM3 - L_{A90} Night Histogram
No. Samples
Cumulative
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70
80
90
100
29
31
33
35
37
39
41
43
45
47
49
51
53
55
57
No. Samples
Cumulative

Appendix 18.B: Construction Noise and Vibration Predictions

White Cross Offshore Windfarm Environmental Statement

Chapter 18: Noise and Vibration

Appendix 18.B: Construction Noise and Vibration Predictions

Document Code:	FLO-WHI-REP-0016-22	
Contractor Document Number:	PC2978-RHD-ZZ-XX-RP-Z-0413	
Version Number:	00	
Date:	*Issue Date 14/08/2023*	
Prepared by:	NH	*Electronic Signature*
Checked by:	TB	*Electronic Signature*
Owned by:	CB	*Electronic Signature*
Approved by Client :	OG	*Electronic Signature*

Version Number	**Reason for Issue / Major Changes**	**Date of Change**
00	For issue	14/08/2023

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Table of Tables

Glossary of Acronyms

Acronym	Definition
dB	Decibel
ES	Environmental Statement
kJ	Kilojoules
NSR	Noise Sensitive Receptor
NVSR	Noise and Vibration Sensitive Receptor

Glossary of Terminology

Defined Term	Description
Jointing bay	Underground structures constructed at regular intervals along the Onshore Export Cable Corridor to join sections of cable and facilitate installation of the cables into the buried ducts
Landfall	Where the offshore export cables come ashore
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing electrical earthing links
Mitigation	A term used interchangeably with Commitment(s). Mitigation measures (Commitments) are embedded within the assessment at the relevant point in the EIA (e.g., at Scoping).
Onshore Transmission Assets	The aspects of the project related to the transmission of electricity from MLWS at the Landfall to the WPD grid connection at East Yelland including the Onshore Export Cable, the White Cross Onshore Substation and onward connection to the WPD grid connection at East Yelland
Project	The Project for the offshore Section 36 and Marine Licence application includes all elements offshore of MHWS. This includes the infrastructure within the windfarm site (e.g., wind turbine generators, substructures, mooring lines, seabed anchors, inter-array cables and Offshore Substation Platform (as applicable)) and all infrastructure associated with the export cable route and landfall (up to MHWS) including the cables and associated cable protection (if required).
White Cross Offshore Windfarm	100MW capacity offshore windfarm including associated onshore and offshore infrastructure
White Cross Onshore Substation	A new substation built specifically for the White Cross project. It is required to ensure electrical power produced by the offshore windfarm is compliant with WPD electrical requirements at the grid connection at East Yelland.

1 Construction Noise and Vibration Predictions

1.1 Introduction

1. This appendix of the Environmental Statement (ES) **Chapter 18: Noise and Vibration** for the proposed White Cross Offshore Wind Farm details the approach the undertaken for the onshore construction noise and vibration assessment including assessment approach and criteria, construction assumptions, construction noise predictions and their associated magnitude of impact.

2. This indicative assessment has been undertaken based on a preliminary understanding of the likely construction schedule, activities and plant to be used. This information may change once a construction contractor is appointed.

1.2 Assumptions and Indicative Plant List

3. Construction impacts will be temporary in nature and include noise and vibration generating activities associated with:

   - Construction works at landfall location including:
     - One active trenchless technique rig for all scenarios.
   - Construction works along the onshore cable corridor including:
     - Installation of temporary access tracks
     - Establishing temporary work areas
     - Installation, ducting and pulling of cables along the onshore cable corridor and landfall location
     - Trenchless crossing works along onshore cable corridor
     - Onshore Main Compound.

4. It is assumed that all construction works will be undertaken during the BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' daytime reference period only (07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturdays), with the exception of trenchless technique works along the onshore cable corridor and landfall location, and power generation plant, which are proposed to have the option to be undertaken 24 hours a day.

5. Eight scenarios have been identified from the construction schedule which are anticipated to result in the worst-case noise impacts at the identified NVSRs. This is due to the potential for activities to be undertaken simultaneously and at similar locations, thereby resulting in elevated cumulative construction noise levels.

Separate noise models were created to predict the impact of each identified scenario.

6. The closest existing identified NVSR to the proposed Onshore Substation is more than 350m away. This is outside the construction noise study area; hence, substation construction noise impacts are not assessed further.

7. **Table 1** outlines the assumed construction phase noise sources that informed the noise predictions. Noise source levels were taken using those available in the plant and construction equipment list provided by Stockton Drilling Limited. On-time corrections, as specified in BS 5228-1, were incorporated.

Table 1 Details of assumed construction plant

Plant	No.	L_w (dB)	On-time correction (%) – Daytime	On-time correction (%) – Night-time	Noise Modelling Scenario
Landfall and river Taw compounds - Duct weld and test					
30T excavator	4	103	90	N/A	1; 3; 4; 6; 7
T500 Tracstar	1	88	90	N/A	1; 3; 4; 6; 7
Landfall and river Taw compounds - Trenchless technique Drive					
Power pack	1	86	100	100	1; 3; 4; 5; 7
Fluid separation unit	1	86	100	100	1; 3; 4; 5; 7
70kva generator	1	88	100	100	1; 3; 4; 5; 7
Landfall, golf course, river Taw compounds - Mobilisation/ De-mobilisation					
40T Tracked telescopic crawler crane (LTR 1040)	1	103	90	N/A	2; 6; 8
20T Excavator	2	103	90	N/A	2; 6; 8
Landfall, golf course, river Taw compounds - Top Soil Re-instate					
D6 Bulldozer	2	102	90	N/A	2; 8
25T excavator	1	103	90	N/A	2; 8
20T Excavator	1	103	90	N/A	2; 8
5T Excavator	1	96	90	N/A	2; 8
Onshore cable corridor - Installation of welfare areas					
20T Excavator	2	103	90	N/A	3
Onshore cable corridor - Welfare areas operation					
70kva generator	1	88	100	100	4; 5; 6; 7; 8
Onshore cable corridor – Joint bays					
20T Excavator	2	103	90	N/A	5; 6
14m Telehandler	2	108	90	N/A	5; 6

Plant	No.	L_w (dB)	On-time correction (%) – Daytime	On-time correction (%) – Night-time	Noise Modelling Scenario
Hydrema 12T back tipping dumper	2	102	90	N/A	5; 6
Concrete Lorry	1	103	90	N/A	5; 6
M24 Mobile Concrete pump	1	98	90	N/A	5; 6
Vibratory poker	2	103	90	N/A	5; 6
Ramax Vibratory Roller	2	108	90	N/A	5; 6
10T Forward tipping dumper	3	108	90	N/A	5; 6
River Taw Compound - Trenchless technique exit					
20T Excavator	2	103	90	N/A	7

8. Acoustic modelling has been undertaken using the following model settings:

- Maximum search radius of 5000m
- Maximum number of reflections: 3
- Noise predictions carried out at 1.5m above ground
- ISO17534-3 compliant - no side diffraction if terrain blocks line of sight
- Building heights were set to 6.5m and 9.5m for Saunton Sands Hotel (R1)
- Ground has been assumed to be acoustically absorptive (i.e. soft) for grassland, sand, and vegetation areas. Ground has been assumed to be acoustically reflective (i.e. hard) for water, rock, coastal slopes and man-made surfaces.

9. The data sources used in the modelling are shown in **Table 2**.

Table 2 Modelling Data Sources

Data	Source	Origin
Nearby building locations	SoundPLAN OSM connection and Google Earth Software	OpenStreetMap and Google Earth Pro v7.3.6.9345
Site topography	Topographical & detail survey Maindata Nigeria Limited along Ogombo Road, Ogombo, AJAH Lagos	Benyeogor & Co.
Wider area topography	Topographical & detail survey Maindata Nigeria Limited along Ogombo Road, Ogombo, AJAH Lagos and Google Maps	Benyeogor & Co. Google Earth Pro v7.3.6.9345

Data	Source	Origin
Site layout	Drawing LG04-M3-G-901-ZZ-ZZ-ZZZZ-RHK	Royal HaskoningDHV (Pty) Ltd
Ground Absorption	SoundPLAN OSM connection	OpenStreetMap

1.3 Predicted Construction Noise Levels

10. Temporary increases in noise levels at nearby receptors are expected during the construction of the Project. Calculations of these temporary noise increases were undertaken using the construction equipment assumptions displayed in **Table 2** in accordance with procedure provided in BS 5228-1.

11. Only trenchless technique construction activities associated with landfall location and river Taw compounds were calculated for night-time and evenings and weekends reference periods as all other activities are assumed to be limited to daytime working hours.

1.3.1 Landfall Location

12. Noise predictions at the landfall location were undertaken assuming all plant is simultaneously operating at the proposed onshore trenchless technique location.

13. The noisiest onshore works at the landfall will comprise site preparation, excavation of transition bays and the trenchless technique works.

14. Predicted construction noise levels at the landfall location are displayed in **Table 3**.

Table 3 Predicted construction noise levels - landfall locations

NVSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime working only	24-hour working	Daytime	Evenings and weekends	Night-time
Scenario 1					
R1	53	36	Negligible	Negligible	Negligible
R2	54	36	Negligible	Negligible	Negligible
R3	55	37	Negligible	Negligible	Negligible
R4	66	48	Low	Negligible	Low
R5	72	55	Low	Negligible	Low
R6	65	47	Negligible	Negligible	Low
R7	55	38	Negligible	Negligible	Negligible
R8	57	39	Negligible	Negligible	Negligible
R9	27	10	Negligible	Negligible	Negligible
R10	31	13	Negligible	Negligible	Negligible
R11	35	18	Negligible	Negligible	Negligible

NVSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime working only	24-hour working	Daytime	Evenings and weekends	Night-time
R12	38	20	Negligible	Negligible	Negligible
R13	27	10	Negligible	Negligible	Negligible
Scenario 2					
R1	55	-	Negligible	Negligible	Negligible
R2	56	-	Negligible	Negligible	Negligible
R3	57	-	Negligible	Negligible	Negligible
R4	68	-	Low	Negligible	Negligible
R5	74	-	Low	Negligible	Negligible
R6	67	-	Low	Negligible	Negligible
R7	57	-	Negligible	Negligible	Negligible
R8	59	-	Negligible	Negligible	Negligible
R9	42	-	Negligible	Negligible	Negligible
R10	42	-	Negligible	Negligible	Negligible
R11	38	-	Negligible	Negligible	Negligible
R12	40	-	Negligible	Negligible	Negligible
R13	41	-	Negligible	Negligible	Negligible
Scenario 3					
R1	53	36	Negligible	Negligible	Negligible
R2	54	36	Negligible	Negligible	Negligible
R3	55	37	Negligible	Negligible	Negligible
R4	66	48	Low	Negligible	Low
R5	72	55	Low	Negligible	Low
R6	65	47	Negligible	Negligible	Low
R7	55	38	Negligible	Negligible	Negligible
R8	57	39	Negligible	Negligible	Negligible
R9	40	10	Negligible	Negligible	Negligible
R10	41	13	Negligible	Negligible	Negligible
R11	37	18	Negligible	Negligible	Negligible
R12	39	20	Negligible	Negligible	Negligible
R13	38	10	Negligible	Negligible	Negligible
Scenario 4					
R1	53	36	Negligible	Negligible	Negligible
R2	54	36	Negligible	Negligible	Negligible
R3	55	37	Negligible	Negligible	Negligible
R4	66	48	Low	Negligible	Low
R5	72	55	Low	Negligible	Low
R6	65	47	Negligible	Negligible	Low
R7	55	38	Negligible	Negligible	Negligible
R8	57	39	Negligible	Negligible	Negligible
R9	28	19	Negligible	Negligible	Negligible
R10	31	19	Negligible	Negligible	Negligible
R11	35	18	Negligible	Negligible	Negligible

NVSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime working only	24-hour working	Daytime	Evenings and weekends	Night-time
R12	38	21	Negligible	Negligible	Negligible
R13	28	17	Negligible	Negligible	Negligible
Scenario 5					
R1	55	36	Negligible	Negligible	Negligible
R2	57	36	Negligible	Negligible	Negligible
R3	58	37	Negligible	Negligible	Negligible
R4	64	48	Negligible	Negligible	Low
R5	68	55	Low	Negligible	Low
R6	68	47	Low	Negligible	Low
R7	56	38	Negligible	Negligible	Negligible
R8	56	39	Negligible	Negligible	Negligible
R9	57	19	Negligible	Negligible	Negligible
R10	55	19	Negligible	Negligible	Negligible
R11	50	18	Negligible	Negligible	Negligible
R12	52	21	Negligible	Negligible	Negligible
R13	58	17	Negligible	Negligible	Negligible
Scenario 6					
R1	55	15	Negligible	Negligible	Negligible
R2	57	10	Negligible	Negligible	Negligible
R3	58	10	Negligible	Negligible	Negligible
R4	64	10	Negligible	Negligible	Negligible
R5	68	11	Low	Negligible	Negligible
R6	68	11	Low	Negligible	Negligible
R7	56	16	Negligible	Negligible	Negligible
R8	56	14	Negligible	Negligible	Negligible
R9	57	18	Negligible	Negligible	Negligible
R10	55	18	Negligible	Negligible	Negligible
R11	50	11	Negligible	Negligible	Negligible
R12	52	11	Negligible	Negligible	Negligible
R13	58	16	Negligible	Negligible	Negligible
Scenario 7					
R1	53	15	Negligible	Negligible	Negligible
R2	57	10	Negligible	Negligible	Negligible
R3	58	10	Negligible	Negligible	Negligible
R4	64	10	Negligible	Negligible	Negligible
R5	68	11	Low	Negligible	Negligible
R6	68	11	Low	Negligible	Negligible
R7	55	16	Negligible	Negligible	Negligible
R8	55	14	Negligible	Negligible	Negligible
R9	52	18	Negligible	Negligible	Negligible
R10	49	18	Negligible	Negligible	Negligible
R11	48	11	Negligible	Negligible	Negligible

NVSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime working only	24-hour working	Daytime	Evenings and weekends	Night-time
R12	50	11	Negligible	Negligible	Negligible
R13	56	16	Negligible	Negligible	Negligible
Scenario 8					
R1	53	15	Negligible	Negligible	Negligible
R2	57	10	Negligible	Negligible	Negligible
R3	58	10	Negligible	Negligible	Negligible
R4	64	10	Negligible	Negligible	Negligible
R5	68	11	Low	Negligible	Negligible
R6	68	11	Low	Negligible	Negligible
R7	55	16	Negligible	Negligible	Negligible
R8	55	14	Negligible	Negligible	Negligible
R9	52	18	Negligible	Negligible	Negligible
R10	49	18	Negligible	Negligible	Negligible
R11	48	11	Negligible	Negligible	Negligible
R12	50	11	Negligible	Negligible	Negligible
R13	56	16	Negligible	Negligible	Negligible

1.3.2 Onshore Cable Corridor

15. The onshore cable construction works includes the establishment and use of temporary compounds, trenchless crossings, open-cut trench works (excavation, duct and cable installation and backfill), jointing bay construction and construction and use of temporary haul roads.

16. Upon refinement of the work areas for each construction activity, the separation distance between construction works and Noise Sensitive Receptors (NSRs) may be increased; and therefore, a lower noise level will be predicted.

17. Predicted construction noise levels at NSRs are displayed in **Table 4**.

Table 4 Predicted construction noise levels - Onshore Cable Corridor locations

NVSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime working only	24-hour working	Daytime	Evenings and weekends	Night-time
Scenario 1					
R14	28	17	Negligible	Negligible	Negligible
R15	27	18	Negligible	Negligible	Negligible
R16	27	19	Negligible	Negligible	Negligible
R17	22	19	Negligible	Negligible	Negligible
R18	27	19	Negligible	Negligible	Negligible

NVSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime working only	24-hour working	Daytime	Evenings and weekends	Night-time
R19	28	28	Negligible	Negligible	Negligible
R20	33	33	Negligible	Negligible	Negligible
R22	24	24	Negligible	Negligible	Negligible
R23	30	30	Negligible	Negligible	Negligible
R24	27	20	Negligible	Negligible	Negligible
Scenario 2					
R14	38	16	Negligible	Negligible	Negligible
R15	34	17	Negligible	Negligible	Negligible
R16	34	19	Negligible	Negligible	Negligible
R17	27	19	Negligible	Negligible	Negligible
R18	33	19	Negligible	Negligible	Negligible
R19	29	28	Negligible	Negligible	Negligible
R20	33	33	Negligible	Negligible	Negligible
R22	24	24	Negligible	Negligible	Negligible
R23	30	30	Negligible	Negligible	Negligible
R24	32	19	Negligible	Negligible	Negligible
Scenario 3					
R14	45	17	Negligible	Negligible	Negligible
R15	47	18	Negligible	Negligible	Negligible
R16	55	19	Negligible	Negligible	Negligible
R17	71	19	Low	Negligible	Negligible
R18	63	19	Negligible	Negligible	Negligible
R19	42	28	Negligible	Negligible	Negligible
R20	56	33	Negligible	Negligible	Negligible
R22	29	24	Negligible	Negligible	Negligible
R23	39	30	Negligible	Negligible	Negligible
R24	49	20	Negligible	Negligible	Negligible
Scenario 4					
R14	30	26	Negligible	Negligible	Negligible
R15	28	21	Negligible	Negligible	Negligible
R16	28	21	Negligible	Negligible	Negligible
R17	23	21	Negligible	Negligible	Negligible
R18	28	22	Negligible	Negligible	Negligible
R19	29	29	Negligible	Negligible	Negligible
R20	36	36	Negligible	Negligible	Negligible
R22	24	24	Negligible	Negligible	Negligible
R23	30	30	Negligible	Negligible	Negligible
R24	28	23	Negligible	Negligible	Negligible
Scenario 5					
R14	69	26	Low	Negligible	Negligible
R15	74	21	Low	Negligible	Negligible
R16	70	21	Low	Negligible	Negligible
R17	62	21	Negligible	Negligible	Negligible

NVSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime working only	24-hour working	Daytime	Evenings and weekends	Night-time
R18	63	22	Negligible	Negligible	Negligible
R19	65	29	Negligible	Negligible	Negligible
R20	73	36	Low	Negligible	Negligible
R22	39	24	Negligible	Negligible	Negligible
R23	50	30	Negligible	Negligible	Negligible
R24	67	23	Low	Negligible	Negligible
Scenario 6					
R14	69	26	Low	Negligible	Negligible
R15	74	21	Low	Negligible	Negligible
R16	70	21	Low	Negligible	Negligible
R17	62	21	Negligible	Negligible	Negligible
R18	63	22	Negligible	Negligible	Negligible
R19	65	29	Negligible	Negligible	Negligible
R20	73	36	Low	Negligible	Negligible
R22	39	24	Negligible	Negligible	Negligible
R23	50	30	Negligible	Negligible	Negligible
R24	67	23	Low	Negligible	Negligible
Scenario 7					
R14	65	26	Negligible	Negligible	Negligible
R15	61	21	Negligible	Negligible	Negligible
R16	70	21	Low	Negligible	Negligible
R17	60	21	Negligible	Negligible	Negligible
R18	59	22	Negligible	Negligible	Negligible
R19	64	29	Negligible	Negligible	Negligible
R20	64	36	Negligible	Negligible	Negligible
R22	31	24	Negligible	Negligible	Negligible
R23	41	30	Negligible	Negligible	Negligible
R24	59	23	Negligible	Negligible	Negligible
Scenario 8					
R14	65	26	Negligible	Negligible	Negligible
R15	61	21	Negligible	Negligible	Negligible
R16	70	21	Low	Negligible	Negligible
R17	60	21	Negligible	Negligible	Negligible
R18	59	22	Negligible	Negligible	Negligible
R19	64	29	Negligible	Negligible	Negligible
R20	58	36	Negligible	Negligible	Negligible
R22	31	24	Negligible	Negligible	Negligible
R23	41	30	Negligible	Negligible	Negligible
R24	59	23	Negligible	Negligible	Negligible

1.4 Construction Vibration Calculations

18. The operation of trenchless technique rigs and ancillary equipment would produce the greatest vibration impact along the onshore export cable corridor and is therefore taken forward as the worst case for the vibration assessment.

19. The vibration predictions for trenchless technique identified the driving energy of the drill to produce a PPV of 0.5mm.s^{-1} at 5m (measured vibration levels in row 106, Table D.6, BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'). This driving energy (11 kJ) was used to calculate the distances at which the vibration criteria would be predicted.

1.5 Summary

20. **Table 5** provides a summary of the number of NSRs defined by each level of magnitude of impact for the predicted daytime construction noise levels for landfall and onshore cable corridor locations.

Table 5 Number of NSR Locations per Magnitude of Impact Criteria – Daytime (in Isolation)

Magnitude of impact (Daytime)			
Negligible	**Low**	**Medium**	**High**
Landfall - Scenario 1			
11	2	0	0
Landfall - Scenario 2			
10	3	0	0
Landfall - Scenario 3			
11	2	0	0
Landfall - Scenario 4			
11	2	0	0
Landfall - Scenario 5			
11	2	0	0
Landfall - Scenario 6			
11	2	0	0
Landfall - Scenario 7			
11	2	0	0
Landfall - Scenario 8			
11	2	0	0
Onshore Cable Corridor - Scenario 1			
10	0	0	0
Onshore Cable Corridor - Scenario 2			
10	0	0	0
Onshore Cable Corridor - Scenario 3			
9	1	0	0

Magnitude of impact (Daytime)			
Onshore Cable Corridor - Scenario 4			
10	0	0	0
Onshore Cable Corridor - Scenario 5			
5	5	0	0
Onshore Cable Corridor - Scenario 6			
5	5	0	0
Onshore Cable Corridor - Scenario 7			
9	1	0	0
Onshore Cable Corridor - Scenario 8			
9	1	0	0

21. **Table 6** provides a summary of the number of NSRs defined by each level of magnitude of impact for the predicted evenings and weekends construction noise levels.

Table 6 Number of NSR Locations per Magnitude of Impact Criteria – Evenings and Weekends (in Isolation)

Magnitude of impact (Evenings and Weekends)			
Negligible	**Low**	**Medium**	**High**
Landfall - Scenario 1			
13	0	0	0
Landfall - Scenario 2			
13	0	0	0
Landfall - Scenario 3			
13	0	0	0
Landfall - Scenario 4			
13	0	0	0
Landfall - Scenario 5			
13	0	0	0
Landfall - Scenario 6			
13	0	0	0
Landfall - Scenario 7			
13	0	0	0
Landfall - Scenario 8			
13	0	0	0
Onshore Cable Corridor - Scenario 1			
10	0	0	0
Onshore Cable Corridor - Scenario 2			
10	0	0	0
Onshore Cable Corridor - Scenario 3			
10	0	0	0
Onshore Cable Corridor - Scenario 4			
10	0	0	0

Magnitude of impact (Evenings and Weekends)			
Onshore Cable Corridor - Scenario 5			
10	0	0	0
Onshore Cable Corridor - Scenario 6			
10	0	0	0
Onshore Cable Corridor - Scenario 7			
10	0	0	0
Onshore Cable Corridor - Scenario 8			
10	0	0	0

22. **Table 7** provides a summary of the number of NSRs defined by each level of magnitude of impact for the predicted night-time construction noise levels.

Table 7 Number of NSR Locations per Magnitude of Impact Criteria – Night-Time (in isolation)

Magnitude of impact (Night-Time)			
Negligible	**Low**	**Medium**	**High**
Landfall - Scenario 1			
10	3	0	0
Landfall - Scenario 2			
13	0	0	0
Landfall - Scenario 3			
10	3	0	0
Landfall - Scenario 4			
10	3	0	0
Landfall - Scenario 5			
10	3	0	0
Landfall - Scenario 6			
13	0	0	0
Landfall - Scenario 7			
13	0	0	0
Landfall - Scenario 8			
13	0	0	0
Onshore Cable Corridor - Scenario 1			
10	0	0	0
Onshore Cable Corridor - Scenario 2			
10	0	0	0
Onshore Cable Corridor - Scenario 3			
10	0	0	0
Onshore Cable Corridor - Scenario 4			
10	0	0	0
Onshore Cable Corridor - Scenario 5			
10	0	0	0

Magnitude of impact (Night-Time)			
Onshore Cable Corridor - Scenario 6			
10	0	0	0
Onshore Cable Corridor - Scenario 7			
10	0	0	0
Onshore Cable Corridor - Scenario 8			
10	0	0	0

References

BSI (2014). British Standards Institution [BS] 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'.

BSI (2014). British Standards Institution [BS] 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'.

Appendix 18.C: Construction Traffic Noise Predictions

White Cross Offshore Windfarm Environmental Statement

Chapter 18: Noise and Vibration

Appendix 18.C: Construction Traffic Noise Predictions

Document Code:	FLO-WHI-REP-0016-22	
Contractor Document Number:	PC2978-RHD-ZZ-XX-RP-Z-0413	
Version Number:	00	
Date:	*Issue Date 14/08/2023*	
Prepared by:	NH	*Electronic Signature*
Checked by:	TB	*Electronic Signature*
Owned by:	CB	*Electronic Signature*
Approved by Client :	OG	*Electronic Signature*

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Glossary of Acronyms

Acronym	Definition
BNL	Basic Noise Level
CRTN	Construction of Road Traffic Noise
dB	Decibel
ES	Environmental Statement
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle
Mph	Miles Per Hour
NAC	Noise Advisory Council
UK	United Kingdom

Glossary of Terminology

Defined Term	Description
Cumulative effects	The effect of the Project taken together with similar effects from a number of different projects, on the same single receptor/resource. Cumulative Effects are those that result from changes caused by other past, present or reasonably foreseeable actions together with the Project.
Environmental Impact Assessment (EIA)	Assessment of the potential impact of the proposed Project on the physical, biological and human environment during construction, operation and decommissioning.
the Project	the Project is a proposed floating offshore windfarm called White Cross located in the Celtic Sea with a capacity of up to 100MW. It encompasses the project as a whole, i.e. all onshore and offshore infrastructure and activities associated with the Project.
White Cross Offshore Windfarm	Up to 100MW capacity offshore windfarm including associated onshore and offshore infrastructure

1 Construction Traffic Noise Predictions

1.1 Introduction

1. This appendix of the Environmental Statement (ES) for the proposed White Cross Offshore Wind Farm details the approach undertaken for the Onshore Development Area construction road traffic noise assessment including traffic data, assessment criteria and the associated magnitude of impact per road link.

1.2 Off-Site Construction Traffic Data

2. This section outlines the traffic data provided by the Transport Consultants, displayed in **Table 1.1**.

Table 1.1 Traffic flow data

Link ID	Description	Speed (mph)	2025 Factored Base		2025 Factored Base + Peak Construction Traffic		Overall Change 2025 Factored Base + Peak Construction Traffic (%)		Additional traffic due to cumulative projects	
			Total vehicles	Total HGV	Total vehicles	Total HGV	Total vehicles	Total HGV	Total vehicles	Total HGV
1	B3231 west of the CCS	40	5888	47	5,959	85	1.2	80.6	0	0
2	B3231 east of the CCS	40	5888	47	6,059	139	2.9	195.4	0	0
3	Blind Acres Lane to Moor Lane	60	162	1	230	1	42.1	0.0	0	0
4	Moor Lane	60	304	3	372	3	22.4	0.0	0	0
5	Sandy Lane south of Moor Lane	60	370	6	438	6	18.4	0.0	0	0
6	A361 south of B3231 to link 11	30	14451	219	14,623	311	1.2	41.8	0	0
7	Unnamed road to Yelland Substation	40	579	72	735	163	27.1	126.2	1319	1141
8	B3233 east of link 7	40	6996	72	7,062	72	0.9	0.0	1453	1423
9	B3233 west of link 7	60	5445	51	5,601	141	2.9	179.6	870	843
10	A3125 south of B3233	30	16377	121	16,443	121	0.4	0.0	847	841
11	Vellator Way to Sandy Lane	60	390	8	458	8	17.5	0.0	9	11

Link ID	Description	Speed (mph)	2025 Factored Base		2025 Factored Base + Peak Construction Traffic		Overall Change 2025 Factored Base + Peak Construction Traffic (%)		Additional traffic due to cumulative projects	
			Total vehicles	Total HGV	Total vehicles	Total HGV	Total vehicles	Total HGV	Total vehicles	Total HGV
12	A361 south of link 11	50	14451	219	14,609	311	1.1	41.8	568	564

1.3 Noise From Off-Site Construction Traffic Assessment

3. Construction off-site traffic noise impacts along existing roads have been estimated based on the Calculation of Road Traffic Noise (CRTN) methodology for the calculation of the Basic Noise Level (BNL) at a reference distance of 10m from the nearside carriageway. Calculations have been undertaken for both the "*f*orecast 2025 baseline" and "forecast 2025 baseline + peak construction traffic" traffic scenarios, for each road link on which construction traffic data have been supplied. The magnitude of impact depends on the change in BNL between these scenarios.

4. For those links on which the predicted traffic flows are below the validated CRTN range (<1000 vehicles per 18hrs), the alternative calculation method detailed in '*A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq}, Report by a Working Party for the Technical Sub-committee of the Noise Advisory Council*' (NAC) has been used. This alternative methodology predicts the noise level at 10m from the nearside carriageway edge, similar to CRTN methodology. The NAC alternative methodology was applied for both 'with development construction phase flows' and 'without development construction phase flows' noise level predictions. Following this approach ensures that the resulting noise level change is determined based on following the same calculation approach i.e., CRTN without development and CRTN with development, NAC without development and NAC with development.

5. The results of these calculations are provided in **Table 1.2**. The magnitude of impact has also been reported in accordance with the criteria presented in **Table 18.6** of **Chapter 18: Noise and Vibration**.

1.4 Noise From Cumulative Off-Site Construction Traffic Assessment

6. The same calculation methodology for noise from off-site construction traffic has been used for the assessment of cumulative off-site traffic noise effects. The only change is that the following traffic scenarios have been compared to identify the change in BNL:

- "Forecast 2025 baseline" vs "Forecast 2025 baseline + peak construction traffic + cumulative traffic"
- "Forecast 2025 baseline + peak construction traffic" vs "Forecast 2025 baseline + peak construction traffic + cumulative traffic".

7. The results of these calculations and associated magnitudes of impact are provided in **Table 1.3**.

Table 1.2 Calculated Construction Off-Site Traffic Noise Impacts

Link ID	Description	2025 Factored Base BNL (CRTN dB $L_{A10,18hr}$) (NAC dB $L_{Aeq,18hr}$)*	2025 Factored Base + Peak Construction Traffic BNL (CRTN dB $L_{A10,18hr}$) (NAC dB $L_{Aeq,18hr}$)*	Overall Change (dB)	Magnitude of Impact
1	B3231 west of the CCS	65.9	66.1	0.2	Negligible
2	B3231 east of the CCS	65.9	66.5	0.6	Negligible
3	Blind Acres Lane to Moor Lane	51.5*	53.0*	1.5	Minor
4	Moor Lane	54.4*	55.3*	0.9	Negligible
5	Sandy Lane south of Moor Lane	55.4*	56.1*	0.7	Negligible
6	A361 south of B3231 to link 11	68.3	68.6	0.3	Negligible
7	Unnamed road to Yelland Substation	55.5*	57.6*	2.1	Minor
8	B3233 east of link 7	66.7	66.8	0.1	Negligible
9	B3233 west of link 7	68.9	69.3	0.4	Negligible
10	A3125 south of B3233	68.6	68.6	0.0	Negligible
11	Vellator Way to Sandy Lane	55.7*	56.3*	0.6	Negligible
12	A361 south of link 11	71.7	71.9	0.2	Negligible
* NAC calculation methodology has been used and the calculated level is an $L_{Aeq,18hr}$					

Table 1.3 Calculated Cumulative Construction Off-Site Traffic Noise Impacts

Link ID	2025 Factored Base BNL (CRTN dB $L_{A10,18hr}$) (NAC dB $L_{Aeq,18hr}$)*	2025 Factored Base + Peak Construction Traffic BNL (CRTN dB $L_{A10,18hr}$) (NAC dB $L_{Aeq,18hr}$)*	2025 Factored Base + Peak Construction Traffic + Cumulative Traffic BNL (CRTN dB $L_{A10,18hr}$) (NAC dB $L_{Aeq,18hr}$)*	"2025 Factored Base + Peak Construction Traffic + Cumulative" BNL – "2025 Factored Base" BNL (CRTN dB $L_{A10,18hr}$) (NAC dB $L_{Aeq,18hr}$)*	Magnitude of Impact	"2025 Factored Base + Peak Construction Traffic + Cumulative" BNL – "2025 Factored Base + Peak Construction Traffic" BNL (CRTN dB $L_{A10,18hr}$) (NAC dB $L_{Aeq,18hr}$)*	Magnitude of Impact
1	N/a as cumulative schemes will not use these links						
2							
3							
4							
5							
6							
7	55.5*	57.6*	60.4*	4.9	Moderate	2.8	Minor
8	66.7	66.8	67.5	0.8	Negligible	0.7	Negligible
9	68.9	69.3	69.9	1.0	Minor	0.6	Negligible
10	68.6	68.6	68.8	0.2	Negligible	0.2	Negligible
11	55.7*	56.3*	56.4*	0.7	Negligible	0.1	Negligible
12	71.7	71.9	72.0	0.3	Negligible	0.1	Negligible
* NAC calculation methodology has been used and the calculated level is an $L_{Aeq,18hr}$							

1.5 References

Department of Transport, Welsh Office (1988) Calculation of Road Traffic Noise (CRTN). London, HMSO.

Highways England (2020). Design Manual for Roads and Bridges, Sustainability & Environment Appraisal LA111 Noise and Vibration (formerly HD213/11, IAN 185/15) Revision 2. Highways England.

Working Party for the Technical Sub-committee of the Noise Advisory Council (1978), A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq}. London: HMSO

Appendix 18.D: Operational Noise Predictions

WHITE CROSS

White Cross Offshore Windfarm Environmental Statement

Chapter 18: Noise and Vibration

Appendix 18.D: Operational Noise Predictions

Document Code:	FLO-WHI-REP-0016-22	
Contractor Document Number:	PC2978-RHD-ZZ-XX-RP-Z-0413	
Version Number:	00	
Date:	*Issue Date 14/08/2023*	
Prepared by:	NH	*Electronic Signature*
Checked by:	TB	*Electronic Signature*
Owned by:	CB	*Electronic Signature*
Approved by Client :	OG	*Electronic Signature*

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00	For issue	14/08/2023

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Glossary of Acronyms

Acronym	Definition
dB	Decibel
ES	Environmental Statement
HVAC	High Voltage Alternate Current
m	meter
NSR	Noise Sensitive Receptor
OS	Ordinance Survey
WCOWL	White Cross Offshore Windfarm Ltd
PRoW	Public Rights of Way

Glossary of Terminology

Defined Term	Description
Applicant	White Cross Offshore Windfarm Ltd
Development Area	The area comprising the Onshore Development Area and the Offshore Development Area
High Voltage Alternating Current	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
Project	The Project for the offshore Section 36 and Marine Licence application includes all elements offshore of MHWS. This includes the infrastructure within the windfarm site (e.g., wind turbine generators, substructures, mooring lines, seabed anchors, inter-array cables and Offshore Substation Platform (as applicable)) and all infrastructure associated with the export cable route and landfall (up to MHWS) including the cables and associated cable protection (if required).
Transition bay	Underground structures at the Landfall that house the joints between the offshore export cables and the onshore export cables
White Cross Onshore Substation	A new substation built specifically for the White Cross project. It is required to ensure electrical power produced by the offshore windfarm is compliant with WPD electrical requirements at the grid connection at East Yelland.
Works completion date	Date at which construction works are deemed to be complete and the windfarm is handed to the operations team. In reality, this may take place over a period of time.

1. Operational Noise Predictions

1.1 Introduction

1. This appendix of the Environmental Statement (ES) of the proposed White Cross Offshore Wind Farm, provides operational noise modelling details and results at the identified Noise Sensitive Receptor (NSR) locations surrounding the onshore substation site.

1.2 Operational Noise Assessment Assumptions

1.2.1 Noise Modelling Assumptions and Methodology

2. Noise levels associated with the onshore substation were predicted at the identified NSR locations using SoundPLAN 3D modelling software. The software implements accepted national and international acoustic calculation standards.

3. Operational noise modelling predictions were undertaken in accordance with the methodology provide in ISO 9613-2; energy loss due to geometrical spreading, air absorption, ground absorption, acoustic screening, and reflections due to intervening buildings and structures between the NSR locations and noise sources at the onshore substation site options.

4. A three-dimensional model was created using geo-referenced OS mapping data, topographical data of the local area incorporating buildings, plans and elevations of the site.

5. Daytime predictions were undertaken at the ground floor level and night-time predictions were undertaken at first floor level, 1.5m and 4.0m respectively.

6. Ground surfaces within the study area are generally considered 'soft' such as the agricultural and grassland areas in the intervening area between the onshore substation sites and the NSRs. Ground has been assumed to be acoustically reflective (i.e. hard) for water, rock, coastal slopes and man-made surfaces.

1.2.2 Operational Noise Sources

7. Operational noise sources that were included in the 3D noise model are identified in **Table 1.1** and their respective frequency spectra are presented in **Table 1.2**.

Table 1.1 Operational Noise Source

Plant ID	Component	Component quantity	Sound power level (dBA)	Equipment height (m)	Associated spectra
1	66kV Shunt Reactor, 10MVA	1	85	10	SNS1
2	CT, VT, Surge Arrestors (132kV)	2	88	10	SNS2
3	HVAC ventilation - Centrifugal fan, straight radial blades	15	80	7.5	SNS3

Table 1.2 Operational Noise Source Spectra

Sound levels (dBA) in octave band (Hz)							
63Hz	**125Hz**	**250Hz**	**500Hz**	**1000Hz**	**2000Hz**	**4000Hz**	**8000Hz**
SNS1							
48	82	49	79	77	24	20	20
SNS2							
55	86	80	80	78	68	60	57
SNS3							
54	63	68	73	76	74	69	65

8. Plant ID 1 to 3 are inside the proposed substation building. The frequency spectra of the assumed sound reduction indices of the building envelope are presented in Table 1.3 Assumed Sound Reduction Indices of the Building Envelope**Table 1.3**.

Table 1.3 Assumed Sound Reduction Indices of the Building Envelope

Sound levels (dBA) in octave band (Hz)							
63Hz	**125Hz**	**250Hz**	**500Hz**	**1000Hz**	**2000Hz**	**4000Hz**	**8000Hz**
Assumed Sound Reduction Indices of the Building Envelope							
4	8	9	8	11	12	7	2

1.3 Predicted Unmitigated Operational Noise Levels

9. This section outlines the predicted noise levels and the respective magnitude of effect at each NSR for each scenario.

10. The predicted noise level at each NSR for the unmitigated noise levels are presented in **Table 1.4** The rating level has been calculated by adding a 2dB character correction for tonality to the predicted specific sound level.

Table 1.4 Operational Noise Assessment - Unmitigated

NVSR	Predicted specific sound level (dB $L_{Aeq,T}$)	Background sound level (dB L_{A90})	Rating level (dB $L_{Ar,T}$)	Difference between $L_{Ar,T}$ and LA90 (dB)
Daytime (07:00 – 23:00)				
R25	37	N/a		
R26	22	37	24	-13
R27	22	37	24	-13
R28	22	37	24	-13
R29	22	41	24	-17
R31	40	35	42	7
R32	34	35	36	1
R33	35	35	37	2
PRoW	33	N/a		
Night-time (23:00 – 07:00)				
R25	37	N/a		
R26	22	30	24	-6
R27	23	30	25	-5
R28	23	30	25	-5
R29	23	31	25	-6
R31	40	32	42	10
R32	36	32	38	6
R33	36	32	38	6
PRoW	33	N/a		

1.4 Predicted Mitigated Operational Noise Levels

11. To reduce the magnitude of effect, noise attenuation would be introduced at six HVAC ventilation units located at the northern part of the onshore electrical substation. To reduce the source noise levels of five units from 80 dB L_{WA} to 75 dB L_{WA}, and for one unit, from 80 dB L_{WA} to 73 dB L_{WA}, as presented on **Figure 1.1**.

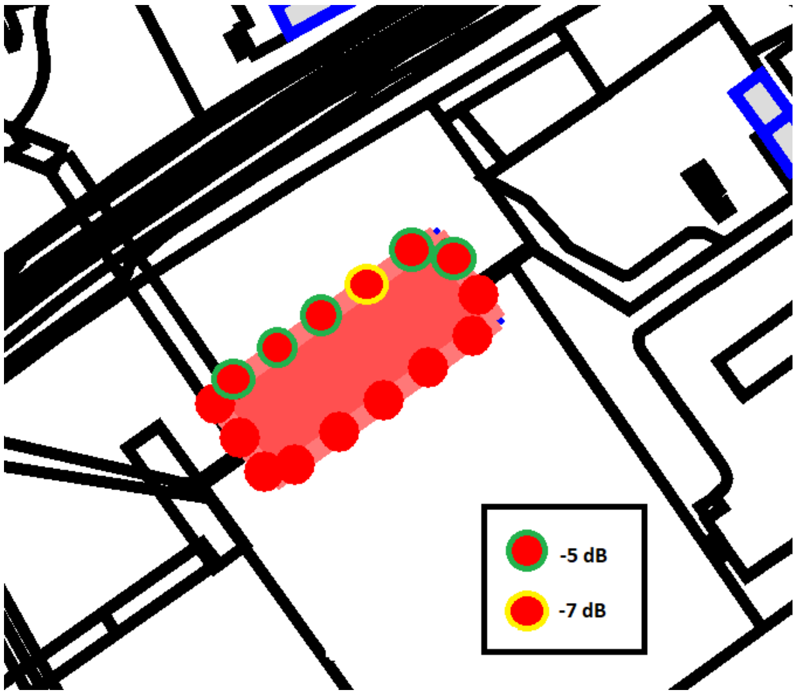

Figure 1.1 Mitigated HVAC Ventilation Units

12. The predicted noise level at each NSR for the mitigated night-time noise levels are presented in **Table 1.5**. The rating level has been calculated by adding a 2dB character correction for tonality to the predicted specific sound level.

Table 1.5 Operational Noise Assessment - Mitigated

NVSR	Predicted specific sound level (dB $L_{Aeq,T}$)	Background sound level (dB L_{A90})	Rating level (dB $L_{Ar,T}$)	Difference between $L_{Ar,T}$ and LA90 (dB)
Daytime (07:00 – 23:00)				
R25	37	N/a		
R26	21	37	23	-14
R27	22	37	24	-13
R28	21	37	23	-14
R29	22	41	24	-17
R31	35	35	37	2

NVSR	Predicted specific sound level (dB $L_{Aeq,T}$)	Background sound level (dB L_{A90})	Rating level (dB $L_{Ar,T}$)	Difference between $L_{Ar,T}$ and LA90 (dB)
R32	32	35	34	-1
R33	31	35	33	-2
PRoW	30	N/a		
Night-time (23:00 – 07:00)				
R25	37	N/a		
R26	21	30	23	-7
R27	23	30	25	-5
R28	23	30	25	-5
R29	23	31	25	-6
R31	35	32	37	5
R32	34	32	36	4
R33	33	32	35	3
PRoW	30	N/a		

References

British Standards Institute (BSI) (1991) BS 7445-2:1991 - Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use. London.

BSI (2003) BS EN 61672-1:2003 - Electroacoustics. Sound level meters. Specifications. London.

BSI (2014). BS 5228-1:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites – Part 1: Noise".

BSI (2019) BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound. London.

Appendix 18.E: Acoustic Terminology Appendix

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Chapter 18: Noise and Vibration

Appendix 18.E: Acoustic Terminology Appendix

Document Code:	FLO-WHI-REP-0016-22	
Contractor Document Number:	PC2978-RHD-ZZ-XX-RP-Z-0413	
Version Number:	00	
Date:	*Issue Date 14/08/2023*	
Prepared by:	NH	*Electronic Signature*
Checked by:	TB	*Electronic Signature*
Owned by:	CB	*Electronic Signature*
Approved by Client :	OG	*Electronic Signature*

Version Number	Reason for Issue / Major Changes	Date of Change
00	For issue	14/08/2023

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Acronym	Definition
ES	Environmental Statement

Glossary of Terminology

Defined Term	Description
White Cross Offshore Wind Farm	Up to 100MW capacity offshore windfarm including associated onshore and offshore infrastructure

1 Acoustic Terminology

1. This appendix of the Environmental Statement (ES) for the proposed White Cross Offshore Wind Farm provides a layperson's explanation of the acoustics terms that commonly appear in **Chapter 18: Noise and Vibration** and associated appendices. It is not intended to give full scientific definitions or explain why these terms are as they are. Some obsolete terms and abbreviations have been included as they still appear in documents from time to time.

Table 1.1 Common acoustic terms

Defined Term	Description
Sound	The physical phenomenon of the transmission of energy through gaseous or liquid media via rapid fluctuations in pressure.
Level	Values measured in decibels
Loudness	The human perception of the level of sound
Noise	No strict definition and is often used interchangeably with sound however it is usually taken to mean unwanted sound
Index	A value based on the mathematical processing of raw data
Indicator	A value used to indicate the likelihood of a particular response of effect e.g. $L_{10,18hr}$ is an index based on statistical processing of sound pressure data that is used as an indicator for road traffic noise response.
Weighted	Spectral values have been modified to reflect a frequency sensitivity.
Directivity	The amount by which a source radiates more sound in one direction than another.
Decibels **dB**	A logarithmic ratio of two values of a variable. The decibel is not a true measurement unit nor is it exclusive to acoustics. Decibels are used because they can represent very wide ranges of ratios (from trillionths and billionths to billions and trillions) with a small range of decibel values. Decibels can be used to represent measured values by using a known reference value in the ratio. When using decibels to measure something it is therefore important to specify what variable is being measured and what reference level has been used. This is done by adding a reference value statement in the form "dB re x units", where the units indicate the variable being measured and x is the reference value. Decibels are used in acoustics because the human ear responds to sound pressure in a logarithmic way and the quantities measured in acoustics vary over wide ranges. As the decibel is used in acoustics to represent a range of sound level parameters, there is a standardised notation system. This takes the form of an italic capital letter '*L*' (referring to 'level') and subscript characters which give specific details of what is being represented.

Defined Term	Description
	Because decibels are logarithmic, they must be added, subtracted, multiplied, divided and averaged using different techniques from normal numbers.
Sound Pressure Level L_p **obsolete – SPL**	The basic measure of how much sound there is at a given location. It is a measure of the size of the pressure fluctuations in the air that we perceive as sound. Sound Pressure Level is expressed in decibels with a reference level of 20×10^{-6} Pa (L_p in dB re 20 µPa)
Sound Power Level L_W **obsolete – SWL**	The total amount of sound produced by a source. It cannot be measured directly but it can be calculated from Sound Pressure Level measurements in known conditions. It can be used to predict the Sound Pressure Level at any point. Sound Power Level is expressed in decibels with a reference level of 1×10^{-12} W (L_W in dB re 1 pW).
A-weighting L_A **or** L_{pA}, L_{WA}, **similar – C-weighting** L_C **or** L_{pC}, L_{WC}	Is an electronic filter which is equal to the frequency sensitivity of the human ear. Our sensitivity is at a maximum at around 2 kHz and steadily decreases above and below. Below 20 Hz and above about 20 kHz we can't hear at all. Within its operating limits a precision measurement microphone measures all frequencies the same so the output it produces does not reflect what we would hear. When considering impacts on humans, it is therefore often necessary to apply an A-weighting to the measured sound frequency spectrum. When A-weighted, the Sound Pressure Level L_p becomes L_{pA} (or L_A) and the Sound Power Level L_W becomes L_{WA}. The response of the human ear varies depending on how loud the sound is. A-weighting matches the response of a sound level meter to human hearing at low levels (~ 40-90 dB). For higher levels there are other weightings, the most common of which is the C-weighting.
Near and far-fields	Are the regions of the radiation field of a sound source. In the near field, the sound pressure and acoustic particle velocity are not in phase and there is no simple relationship between sound pressure level and distance from the source. The near field is limited to a distance from the source of around a wavelength of sound or three times the largest dimension of the sound source (whichever is the larger). The far field is the region of the sound field in which sound pressure level decreases predictably with distance. For a point source, the sound pressure level decreases by 6 dB for each doubling of distance. It extends from the near field to infinity.

Table 1.2 Common acoustic terms

Defined Term	Description
L_p **L_{pA} (or L_A)** **L_{AF}, L_{AS}**	The instantaneous sound pressure level (L_p) The A-weighted instantaneous sound pressure level (L_{pA} or L_A) This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125 s (FAST time constant) or the previous 1 s (SLOW time constant). The letters F or S are added to the subscripts in the notation to indicate when the FAST or SLOW time constant has been used. These are often omitted but it is good practice to include them.
L_{max} **L_{Amax}** **L_{AFmax}** **L_{min} , L_{Fmin}**	The maximum instantaneous sound pressure level (L_{max}), The A-weighted maximum instantaneous sound pressure level (L_{Amax}) The A-weighted maximum instantaneous sound pressure level with a FAST time constant (L_{AFmax}). This is the highest instantaneous sound pressure level reached during a measurement period. The opposite of the L_{max} is the minimum instantaneous sound pressure level or L_{min} etc. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{N,T}$ **$L_{AN,T}$ $L_{AFN,T}$** **N = %age value, 0-100** **T = measurement time** **e.g. L_{A90}, L_{A10}, $L_{AF90, 5 min}$**	The percentage exceedance sound pressure level ($L_{N,T}$), The A-weighted percentage exceedance sound pressure level ($L_{AN,T}$), the A-weighted percentage exceedance sound pressure level with a FAST time constant ($L_{AFN,T}$). This is the sound pressure level exceeded for N% of the time T. e.g. If an A-weighted level of x dB is exceeded for a total of 6 minutes within one hour, the level will have been above x dB for 10% of the measurement period. This is written as $L_{A10,1hr}$ = x dB. L_{A0} (the level exceeded for 0 % of the time) is equivalent to the L_{Amax} and L_{A100} (the level exceeded for 100 % of the time) is equivalent to the L_{Amin}. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{eq,T}$ **$L_{Aeq,T}$** **T = measurement time** **eg. $L_{Aeq,5min}$**	The equivalent continuous sound pressure level over period T ($L_{eq,T}$), The A-weighted equivalent continuous sound pressure level over period T ($L_{Aeq,T}$). This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value.

Defined Term	Description
	The L_{eq} is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation