LLŶR FLOATING OFFSHORE WIND PROJECT

Llŷr 1 Floating Offshore Wind Farm

Environmental Statement

Volume 2: Chapter 15 - Noise and Vibration

August 2024

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FLOVENTIS ENERGY

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Acronyms and abbreviations

Acronym or Abbreviation	Definition	Acronym or Abbreviation	Definition
ANC	Acoustics & Noise Consultants	ISO	International Standards Organization
BNL	Basic Noise Level	LA	Local Authority
BPM	Best Practicable Means	LDP	Local Development Plan
BS	British Standard	LPA	Local Planning Authority
BSI	British Standards Institute	m	Metres
CEA	Cumulative Effects Assessment	MLT	Marine Licensing Team
CEMP	Construction Environmental Management Plan	mm	Millimetres
CoPA	Control of Pollution Acts	mm/s	Millimetres per Second
CRTN	Calculation of Road Traffic Noise	NRW	Natural Resources Wales
dB	Decibels	PINS	Planning Inspectorate
DMRB	Design Manual for Road and Bridges	PPV	Peak Particle Velocity
EEA	European Economic Area	PPW	Planning Policy Wales
EPA	Environmental Protection Act	SDP	Strategic Development Plan
ES	Environmental Statement	TAN11	Technical Advice Note 11
GN	Guidance Note	TRL	Transport Research Laboratory
HDD	Horizontal Directional Drilling	WTG	Wind Turbine Generators
HGV	Heavy Good Vehicle	ZoI	Zone of Influence
IAM	Impact Assessment Matrix		

Glossary of project terms

Term	Definition
The Applicant	The developer of the Project, Llŷr Floating Wind Ltd.
Array	All wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the Array Area, as defined, when considered collectively, excluding the offshore export cable(s).
Array Area	The area within which the wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure will be located.
Floventis Energy	A joint venture company between Cierco Ltd and SBM Offshore Ltd of which Llŷr Floating Wind Limited is a wholly owned subsidiary.
Landfall	The location where the offshore export cable(s) from the Array Area, as defined, are brought onshore and connected to the onshore export cables (as defined) via the transition joint bays.
Llŷr 1	The proposed Project, for which the Applicant is applying for Section 36 and Marine Licence consents. Including all offshore and onshore infrastructure and activities, and all project phases.
Marine Licence	A licence required under the Marine and Coastal Access Act 2009 for marine works which is administered by Natural Resources Wales (NRW) Marine Licensing Team on behalf of the Welsh Ministers.

Term	Definition
Offshore Development Area	The footprint of the offshore infrastructure and associated temporary works, comprised of the Array Area and the Offshore Export Cable Corridor, as defined, that forms the offshore boundary for the S36 Consent and Marine Licence application.
Offshore Export Cable	The cable(s) that transmit electricity produced by the WTGs to landfall.
Offshore Export Cable Corridor (OfECC)	The area within which the offshore export cable circuit(s) will be located, from the Array Area to the Landfall.
Onshore Development Area	The footprint of the onshore infrastructure and associated temporary works, comprised of the Onshore Export Cable Corridor and the Onshore Substation, as defined, and including new access routes and visibility splays, that forms the onshore boundary for the planning application.
Onshore Export Cable(s)	The cable(s) that transmit electricity from the landfall to the onshore substation.
Onshore Export Cable Corridor (OnECC)	The area within which the onshore export cable circuit(s) will be located.
proposed Project	All aspects of the Llŷr 1 development (i.e. the onshore and offshore components).
Onshore Substation	Located within the Onshore Development Area, converts high voltage generated electricity into low voltage electricity that can be used for the grid and domestic consumption.
Section 36 consent	Consent to construct and operate an offshore generating station, under Section 36 (S.36) of the Electricity Act 1989. This includes deemed planning permission for onshore works.

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15. NOISE AND VIBRATION

15.1 Introduction

1. Llŷr Floating Wind Ltd (hereafter the Applicant) is proposing to develop the Llŷr 1 Floating Offshore Wind Farm (hereafter referred to as the proposed Project), located approximately 31 km off the coast of Pembrokeshire in the Celtic Sea.

2. The proposed Project is a test and demonstration wind farm development, comprising up to 10 wind turbine generators (WTGs). The proposed Project will make landfall at Freshwater West before connecting into Pembroke Dock power station and the national grid network.

3. The Applicant is seeking a Section 36 consent and Marine Licence for Llŷr 1, and this chapter forms part of the Environmental Statement (ES) which is submitted in support of those consent applications. This chapter describes the potential impacts and effects of the proposed Project on noise and vibration during the construction, operation and maintenance and decommissioning phases, and includes mitigation and good practice measures to reduce the impacts of the proposed Project on noise and vibration.

4. **Section 15.8** of this ES chapter provides a summary of the impact assessment undertaken and any residual significant effects on noise and vibration following consideration of any mitigation measures.

5. The assessment presented in this chapter should be read in conjunction with the following linked and supporting chapters:

   - **Chapter 02: Regulatory and Planning Policy Context** – provides details on regulations and planning policies relevant to the project;
   - **Chapter 05: EIA Approach and Methodology** - provides further details of the general framework and approach to the EIA;
   - **Chapter 04: Description of the Project** - provides further details of the project design parameters; and
   - **Chapter 13: Traffic and Transport** – provides details on the scope of the transport assessment and traffic flow data.

6. Additional information to support the assessment includes:

   - **Appendix 15A: Acoustic Terminology**; and
   - **Appendix 15B: Noise Modelling**.

7. The assessment has been undertaken by AECOM. Further details of the proposed Project Team's competency are provided in **Appendix 1A: Statement of Competence**.

15.2 Legislation, Policy and Guidance

8. The following sections identify specific legislation, policy and guidance that is applicable to the assessment of noise and vibration. Further detail on the wider legislation, policy and guidance relevant to this ES is provided in **Chapter 02: Regulatory and Planning Policy Context**.

15.2.1. Legislation

9. The legislation that is applicable to the assessment of noise and vibration is summarised below.

   - Control of Pollution Act 1974 (HSMO, 1974); and

- Environmental Protection Act 1990 (HSMO, 1990).

15.2.2. National Planning Policy

10. **Table 15-1** sets out national planning policies relevant to noise and vibration, along with how and where they have been addressed within this chapter. Details on overarching or general policy from NPS EN-1 and EN-3 are included in **Chapter 02: Regulatory and Planning Policy Context**. Although the project does not reach the threshold to qualify as a Nationally Significant Infrastructure Project, guidance in NPS EN-1 and EN-3 are still considered relevant. Planning Inspectorate (PINS) advice is also considered where relevant.

Table 15-1. A summary of national planning policy relevant to noise and vibration

Summary of policy	How and where it is considered in the chapter
Planning Policy Wales (PPW) – Edition 12 (Welsh Government, 2024): Section 6.7 states: *'In proposing new development, planning authorities and developers must, therefore:* • *Address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors* • *Not create areas of poor air quality or inappropriate soundscape; and* • *Seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.'* *'Planning authorities must consider the potential for temporary environmental risks, including airborne pollution and surface and subsurface risks, arising during the construction phases of development. Where appropriate planning authorities should require a construction management plan, covering pollution prevention, noisy plant, hours of operation, dust mitigation and details for keeping residents informed about temporary risks.'*	• No noise action planning priority areas are identified within the noise and vibration Study Area (**defined in paragraph 46**). • An assessment of noise and vibration effects is provided within this ES chapter. A summary of residual effects is presented in **Table 15-26.** • Details of mitigation measures are provided in **Table 15-19.**
Future Wales – the National Plan 2040 (Welsh Government, 2021b): References PPW when considering noise from new developments and highlights the importance of reducing noise pollution and making improvements to soundscapes where practicable and feasible to do so.	An assessment of noise and vibration effects is provided within this ES chapter. A summary of residual effects is presented in **Table 15-26**. Details of mitigation measures are provided in **Table 15-19.**

15.2.3. Regional Planning Policy

11. **Table 15-2** sets out regional planning policies relevant to noise and vibration, along with how and where they have been addressed within this chapter. Details on overarching or general policy are included in **Chapter 02: Regulatory and Planning Policy Context**.

Table 15-2. A summary of regional planning policy relevant to noise and vibration

Summary of policy	How and where it is considered in the chapter
Pembrokeshire County Council Local Development Plan 2013 (PCC, 2013): Policy GN.1 General Development Policy: *'Development will be permitted where the following criteria are met: 2. It would not result in a significant detrimental impact on local amenity in terms of visual impact, loss of light or privacy, odours, smoke, fumes, dust, air quality or an increase in noise or vibration levels.'*	An assessment of noise and vibration effects is provided within this ES chapter. A summary of residual effects is presented in **Table 15-26.**
Pembrokeshire Coast National Park Local Development Plan 2020 (PCNP, 2020): Policy 30, Amenity: '*Development will not be permitted where it has an unacceptable adverse effect on amenity, particularly where: … c) the development leads to an increase in traffic or noise or odour or light which has a significant adverse effect*.'	An assessment of noise and vibration effects is provided within this ES chapter. A summary of residual effects is presented in **Table 15-26.**
Pembrokeshire Coast National Park Local Development Plan 2020 (PCNP, 2020): Policy 33 Renewable and Low Carbon Energy: 'Proposals for renewable and low carbon energy development…. will be permitted subject to the following criteria: All renewable and low carbon energy development proposals will be required to demonstrate that: *ii. There will be no unacceptable impacts on residential amenity.*	An assessment of noise and vibration effects is provided within this ES chapter. A summary of residual effects is presented in **Table 15-26.**

15.2.4. Guidance

12. **Table 15-3** sets out guidance relevant to noise and vibration, along with how and where they have been addressed within this chapter.

Table 15-3. A summary of guidance relevant to noise and vibration

Summary of Guidance	How and where it is considered in the chapter
Technical Advice Note 11 (TAN11), Noise (1997) TAN11 (Welsh Government, 1997) provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which LPAs should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources. TAN11 offers guidance to LPAs on the assessment of noise and its potential effect on noise-sensitive dwellings. TAN 11 also 'provides advice on how the planning system can be used to minimise the adverse effect of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.'	Referenced when applying assessment methodologies from BS 5228-1 for construction noise (**as detailed in paragraphs 23 to 26**), BS 5228-2 for construction vibration (**as detailed in paragraphs 27 to 29**), BS 4142 (**as detailed in paragraphs 32 to 37**).

Summary of Guidance	How and where it is considered in the chapter
Where the information within TAN11 references British Standards that have since been superseded, the current version of these standards will be used within this assessment. This includes BS 4142, BS 5228-1 and BS 5228-2. The likelihood of complaints about noise from industrial development can be assessed, where the Standard is appropriate, using guidance in BS 4142. Tonal or impulsive characteristics of the noise are likely to increase the scope for complaints and this is taken into account by the 'rating sound level' defined in BS 4142. Detailed guidance on assessing noise from construction sites can be found in BS 5228-1, which describes a method for predicting noise from construction sites as well as giving general advice.	
Noise and Soundscape Action Plan for Wales 2018-2023 (Welsh Government, 2018): Explains how different sources of noise are being managed across Wales and by whom, and provides summaries of evidence to support noise policy, it gives examples of positive initiatives that have taken place in Wales. Regarding industrial noise, Section 8.1 identifies BS 4142 as the common method for assessing impact from industrial noise. Methods are provided so that noise impacts from industrial sites can be minimised.	Referenced when applying assessment methodologies from BS 4142 **as detailed in paragraphs 32 to 37**.
British Standard 5228-1:2009+A1:2014 (BSI, 2014a): Provides a 'best practice' guide for noise control and includes sound power level (Lw) data for individual plant as well as a calculation method for noise from construction activities.	Referenced when defining construction and decommissioning noise assessment criteria in **Table 15-5.**
British Standard 5228-2:2009+A1:2014 (BSI, 2014a): Provides comparable 'best practice' for vibration control, including guidance on the human response to vibration	Referenced when defining construction and decommissioning vibration assessment criteria in **Table 15-7.**
British Standard 4142:2014+A1:2019 (BSI, 2019): Can be used for assessing the effect of noise of an industrial nature, including mechanical services plant noise. The method compares the difference between 'rating level' of the industrial sound, with the 'background sound level' at the receptor position.	Referenced when defining operational noise assessment criteria in **Table 15-9.**
BS 8233:2014 Sound Insulation and Noise Reduction for Buildings – Code of Practice (BSI, 2014b): Provides criteria for the assessment of internal noise levels for various uses including dwellings and commercial properties.	Referenced when defining operational noise assessment criteria in **Table 15-9.**
ISO 9613-2:1996 Attenuation of Sound during Propagation Outdoors (ISO, 1993; 1996): Specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.	Methodology applied when operational noise at noise sensitive receptors in **Table 15-25.**

Summary of Guidance	How and where it is considered in the chapter
Calculation of Road Traffic Noise (CRTN) (DfT, Welsh Office, 1998): Describes procedures for traffic noise calculation and measurement and is suitable for environmental assessments of schemes where road traffic noise may have an effect.	Methodology applied when calculating road traffic noise levels in **Table 15-23.**
Design Manual for Road and Bridges (DMRB) LA111 (DMRB, 2020): Provides guidance on the appropriate approach to be taken when assessing the noise and vibration effects arising from all road projects, including new construction, improvements and maintenance. The guidance is also useful for assessing changes in traffic noise levels as a result of non-road projects such as this.	Referenced when defining construction traffic noise assessment criteria in **Table 15-8.**

15.3 Stakeholder Engagement and Consultation

13. Consultation with statutory and non-statutory organisations is a key element of the EIA process. Consultation with regards to noise and vibration has been undertaken to inform the approach to, and scope of, the assessment.

14. An EIA Scoping Report was prepared by AECOM and submitted in March 2022; this is provided within **Appendix 5A: Scoping Report**. The EIA Scoping Report sets out the proposed approach to the EIA and is intended to facilitate discussions regarding the scope of the EIA. In response to the EIA Scoping Report, the Natural Resources Wales (NRW) prepared a Scoping Opinion; this is provided within **Appendix 5B: Scoping Opinion**.

15. In addition to the statutory consultation process, there has been ongoing engagement with statutory and non-statutory consultees to steer the development of the proposed Project and this is detailed in **Table 15-3.**

Table 15-4. Summary of the key issues raised by consultees and how each issue was addressed

Consultee	Consultation type and date	Comment raised	How issue has been addressed and location of response in chapter
Scoping			
Pembrokeshire County Council (PCC)	Email, 9th June 2023	Scope of Noise and Vibration Assessment to be undertaken.	No response received.
Pre-application			
Pembrokeshire County Council (PCC)	Email, 9th August 2023	Outlined scheme and provided an overview of the noise and vibration impact assessment.	Assessment method employed throughout the noise and vibration chapter.

15.4 Approach to Assessment

15.4.1. Assessment Methodology

16. **Chapter 05: EIA Approach and Methodology** provides a summary of the general impact assessment methodology applied in this ES. The following sections provide further detail on the specific methodology used to assess the potential impacts on noise and vibration.

17. The approach to the assessment of cumulative impacts and interrelated effects and transboundary impacts is provided in **Sections 15.10, 15.11 and 15.12.**

18. The significance of potential effects has been evaluated using a systematic approach together with the expert judgement of the specialist consultant. The systematic approach is based upon the identification of the importance / value of receptors and their sensitivity to the proposed Project together with the predicted magnitude of the potential impact.

19. The terms used to define receptor sensitivity and magnitude of impact are based on current industry best practice.

Overview of Construction Works

20. For the purposes of assessing noise and vibration, the construction programme has been summarised into three scenarios that represent the typical high noise and vibration generating activities. These activities are most likely to generate significant effects and are as follows:

- Open trench construction;
- Horizontal Directional Drilling (HDD) works; and
- Substation construction.

21. As the specific location of HDD works and substation locations are not identified at this stage of the proposed Project, the assessment of noise and vibration impacts accounts for a worst-case where plant could be located at the closest Onshore Project Boundary to sensitive receptors.

22. All construction activity would be undertaken during core daytime construction hours of 07:00 to 19:00 Monday to Saturday (excluding Bank Holidays), as set out in the **Outline Construction Noise Management Plan, Appendix 4A: Outline CEMP**. Continuous 24-hour activities may be required for HDD works.

Construction and Decommissioning Noise

23. TAN 11 provides guidance on assessing impacts from noise generating development and references guidance documents for assessing specific sources of noise. Reference has been made to the latest iterations of guidance documents in TAN 11 when defining assessment criteria.

24. Noise due to construction and decommissioning works will be calculated and assessed using the data and procedures given in BS 5228-1. The ABC method will be used as a basis to define criteria that constitutes a potential significant effect at residential receptors. The ABC method is reproduced in **Table 15-5.**

Table 15-5. BS5228-1 ABC method

Assessment category and threshold value period	Threshold values in dB $L_{Aeq,T}$		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23:00-07:00)	45	50	55
Evening and weekends [D)]	55	60	65

Assessment category and threshold value period	Threshold values in dB $L_{Aeq,T}$		
	Category A [A)]	Category B [B)]	Category C [C)]
Daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level. NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise. NOTE 3 Applied to residential receptors only.			
A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values. D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

25. For the appropriate period (day, evening, night, weekend etc.), the ambient noise level is determined and rounded to the nearest 5 dB and the appropriate Threshold Value is then derived. The predicted construction noise level is then compared with this Threshold Value. The criterion adopted in this assessment for the onset of potentially significant effects is the exceedance of the LAeq,T threshold level for the category appropriate to the ambient noise level at each receptor. Other project-specific factors are also considered by the assessor when determining if there is a potentially significant effect, such as the number of receptors affected and the duration and character of the impact.

26. With consideration of the above, **Table 15-6** presents the construction noise magnitude of impact criteria for residential receptors.

Table 15-6. Construction noise assessment criteria

Magnitude of Impact	Construction Noise Level $L_{Aeq,T}$ (dB)
Large	Exceedance of ABC Threshold Value by ≥5 dB
Medium	Exceedance of ABC Threshold Value by up to 5 dB
Small	Equal to or below the ABC Threshold Value by up to 5 dB
Negligible	Below the ABC Threshold Value by ≥5 dB

Construction and Decommissioning Vibration

27. Ground-borne vibration would be generated due to use of heavy plant during the construction and decommissioning phases. The main vibration generating works are as follows:

- Vibratory rollers used for ground reinstatement after pen trench construction;
- Horizontal Directional Drilling (HDD) works; and

- Piling used for substation construction.

28. BS 5228-2 provides further guidance on the perception of vibration within occupied buildings. This provides a simple method of determining annoyance alongside evaluation of cosmetic damage associated with construction and decommissioning induced vibration. **Table 15-7** details Peak Particle Velocity (PPV) levels (a standard measure of vibration effects), their potential effect on humans and the approximate distance where these effects may occur.

Table 15-7. BS5228-2 guidance on vibration effects

Magnitude of Impact	Vibration level	Effect	Approximate Distance
Large	10.0 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	< 5 m
Medium	1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	5 to <10 m
Small	0.3 mm/s	Vibration might just be perceptible in residential environments.	10 to <20 m
Negligible	0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	>20 m

29. In addition to human annoyance, building structures may be damaged by high levels of vibration. The levels of vibration that may cause building damage are far more than those that may cause annoyance. Consequently, if vibration levels are controlled to those specified by annoyance, then it is highly unlikely that buildings will be damaged by demolition and construction vibration.

Construction and Decommissioning Traffic Noise

30. Construction and decommissioning traffic noise impacts due to increases in traffic flows on existing roads have been estimated based on the CRTN methodology for the calculation of the Basic Noise Level (BNL) at a reference distance of 10 m from the nearside carriageway. Predictions have been undertaken for both the 'with' and 'without' construction traffic scenarios.

31. The criteria for the assessment of traffic noise level changes have been taken from Table 3.54a of DMRB LA111 and are provided in **Table 15-8.**

Table 15-8. Road traffic noise assessment criteria (temporary changes)

Magnitude of Impact	Change in Road Traffic Noise Level $L_{A10,18h}$ (dB)
Large	≥ 5
Medium	3 to <5
Small	1 to <3
Negligible	<1

Methodology or Determining Operational Effects

32. Operational noise from fixed plant has been assessed following BS 4142 guidance, whereby the rating level of noise emissions from activities are compared against the background level of the pre-development noise climate. The relevant parameters in this instance are as follows:

- Background sound level – LA90,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 and quoted to the nearest whole number of decibels;
- Specific sound level – LAeq,Tr – the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr; and
- Rating level – LAr,Tr – the specific sound level plus any adjustment made for the characteristic features of the noise.
- BS 4142 allows for, as an absolute worst case, a cumulative +15 dB correction to be applied to the specific sound level based upon the presence or expected presence of the following:
- Tonality - up to +6 dB penalty;
- Impulsivity - up to +9 dB penalty (this can be summed with tonality penalty); and
- Other sound characteristics (neither tonal nor impulsive but still distinctive) - +3 dB penalty.
- BS 4142 states the following regarding the assessment of impacts, comparing the rating level of the new noise source with the existing background level:
- 'Typically, the greater this difference, the greater the magnitude of the impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating level is 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.'

33. It should be noted that the context assessment can vary the overall significance of effects. BS 4142 advises that any consideration of the significance of effect should also consider other contextual factors including:

- The absolute level of the sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor.

34. BS 4142 advises that where rating levels and background levels are low, which is the case in rural areas surrounding the proposed Project, the assessment of operational noise should take into context the absolute noise level. The Acoustics & Noise Consultants (ANC) Guide to BS 4142 (ANC, 2020) provides context to this by stating:

'BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB LA90, and low rating levels as being less than about 35 dB LAr,Tr'.

35. The ANC Guide suggests that: '*…similar values would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate'.*

36. As such, a minimum external rating level of 35 dB $L_{Ar,Tr}$ is adopted for identifying adverse levels of noise during the daytime. As this is equivalent to good noise conditions for relaxation in a dwelling during the daytime in BS 8233, reference has been made to noise criterion for good sleeping conditions in a dwelling at night of 30 dB $L_{Aeq,T}$ when defining night-time assessment criteria.

37. The criteria for determining the magnitude of operational noise impacts at receptors, based on guidance within BS 4142, are presented in **Table 15-9.**

Table 15-9. Operational noise assessment criteria

Magnitude of Impact	Rating Level (External) at Receptor, $L_{Ar,Tr}$	
	Daytime (07:00-19:00) and Evening (19:00-23:00)	Night-time (23:00-07:00)
Large	Greater than 10 dB above the background noise level – minimum of 45 dB $L_{Ar,Tr}$	Greater than 10 dB above the background noise level – minimum of 45 dB $L_{Ar,Tr}$
Medium	Greater than 5 dB and up to 10 dB above the background noise level – minimum of 40-45 dB $L_{Ar,Tr}$	Greater than 5 dB and up to 10 dB above the background noise level – minimum of 40-45 dB $L_{Ar,Tr}$
Small	Greater than and up to 5 dB above the background noise level – minimum of 35-40 dB $L_{Ar,Tr}$	Greater than and up to 5 dB above the background noise level – minimum of 30-40 dB $L_{Ar,Tr}$
Negligible	Less than or equal to the typical background level ($L_{A90,T}$) – minimum of 35 dB $L_{Ar,Tr}$	Less than or equal to the typical background level ($L_{A90,T}$) – minimum of 30 dB $L_{Ar,Tr}$

15.4.2. Significance Criteria

Magnitude of Impact

38. The scale or magnitude of potential impacts (both beneficial and adverse) is determined by a combination of three criteria: scale of change, spatial extent of change and duration of change, as outlined in **Chapter 05: EIA Approach and Methodology, Section 5.4.9**.

39. The criteria for defining magnitude of impact for the purpose of the assessment on noise and vibration are provided in **Table 15-10.**

Table 15-10. A summary of the magnitude criteria that are associated to specific impacts

Magnitude Criteria	Definition
Large	**Adverse:** Severe impact on health and quality of life **Beneficial:** Major improvement to health and quality of life
Medium	**Adverse:** Significant impact on health and quality of life

Magnitude Criteria	Definition
	Beneficial: Significant improvement to health and quality of life
Small	**Adverse:** Minor impact on health and quality of life **Beneficial:** Minor improvement to health and quality of life
Negligible	**Adverse:** Very minor impact on health and quality of life. **Beneficial:** Very minor benefit improvement to health and quality of life

Sensitivity of Receptor

40. Receptor sensitivity is defined as the degree to which a receptor would be affected by an impact. The sensitivity of the receptor is characterised by three factors: vulnerability, recoverability and importance, as outlined in **Chapter 05: EIA Approach and Methodology**, **Section 5.4.10.**

41. The criteria for defining receptor sensitivity for the purpose of the assessment on noise and vibration are provided in **Table 15-11.**

Table 15-11. A summary of the criteria determining a receptor's sensitivity

Sensitivity	Description	Examples of receptor usage
Very High	Receptors where noise will significantly affect the function of a receptor.	• Auditoria/studios; • Specialist medical/teaching centres; and • Libraries.
High	Receptors where people or operations are particularly susceptible to noise.	• Residential and student accommodation; • Hotels; • Places of worship; • Conference facilities; • Schools; and • Hospitals/residential care homes.
Medium	Receptors of low sensitivity to noise, where it may cause some distraction or disturbance.	• Offices; • Restaurants; • Public houses; and • Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf).
Low	Receptors where distraction or disturbance from noise is minimal.	• Residences and other buildings not occupied during working hours; • Factories and working environments with existing high noise levels; and • Sports grounds when spectator or noise is a normal part of the event.

Significance of Effect

42. As set out in **Chapter 05: EIA Approach and Methodology**, an Impact Assessment Matrix (IAM) is used to determine the significance of effect which is a function of the sensitivity of the receptor and the magnitude of the impact, as shown in **Table 15-12**.

43. The matrix provides a framework for the consistent and transparent assessment of predicted effects across all receptor topics, however, it is important to note that the IAM acts as a guide and that assessments also allow for the application of expert judgement.

Table 15-12. Significance matrix

		Sensitivity			
		Very High	**High**	**Medium**	**Low**
Magnitude	**Large**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Negligible
	Small	Moderate	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

44. The IAM provides levels of effect significance ranging from major to negligible. Assignment of significance is carried out with consideration of embedded mitigation measures relevant to noise and vibration. Embedded mitigation measures (including project design measures and best practice) are presented within **Section 15.7**. Details on additional mitigation measures and associated definitions can be found in **Section 15.8**. For the purposes of this assessment, Moderate and Major levels of significance are defined as significant, and where relevant additional mitigation measures may be required, whilst Negligible or Minor impacts are defined as not significant.

Table 15-13. A summary of the definitions of each significant of effect criteria

Significance Category	Definitions	Significant / Not Significant Effect
Major	A large and detrimental effect on health and quality of life for occupiers of a receptor; Or A large and beneficial effect on health and quality of life. These effects may represent key factors in the decision-making process.	Significant
Moderate	A medium and detrimental effect on health and quality of life for occupiers of a receptor; Or A positive moderate effect on health and quality of life. These effects, if adverse, are likely to be important at a local scale and on their own could have a material influence on decision making.	Significant (unless otherwise specified)
Minor	A small effect on health and quality of life for occupiers of a receptor. Unlikely to breach planning policy. Or A small positive effect on health and quality of life, but not one that is likely to be a key factor in the overall balance of issues.	Not Significant

Significance Category	Definitions	Significant / Not Significant Effect
	These effects may be raised as local issues and may be of relevance in the detailed design of a project but are unlikely to be critical in the decision-making process.	
Negligible	A very small effect on health and quality of life for occupiers of a receptor and unimportant such that it is considered acceptable to disregard. Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. These effects are unlikely to influence decision making irrespective of other effects.	Not Significant

15.4.3. Study Area

45. The Study Area has been defined to include construction, decommissioning and operational noise and vibration features likely to be at risk from possible direct and indirect impacts that might arise from the proposed Project.

46. For construction and decommissioning noise effects, the area for which impacts are expected is 300 m from the Onshore Project Boundary, based on guidance in BS 5228-1, which states construction noise predictions are generally reliable up to 300 m. However, for the operational substation sites, the Study Area is based on the extent of operational noise effects, which is set at 1 km. This distance of 1 km is based on professional judgement and AECOM's previous experience of energy projects and ensures that all potential impacts are captured.

47. A Study Area of 50 m either side of construction traffic routes (see **Chapter 13: Traffic and Transport**) has been defined based on guidance in the DMRB LA111.

48. The combination of the Study Areas defined above is considered to represent the Zone of Influence. This is illustrated in **Volume 5: Figure 15-1.**

15.4.4. Data Sources

Desk Study

49. A comprehensive desk-based review was undertaken to inform the baseline for noise and vibration. Key data sources used to inform the assessment are set out in **Table 15-14.**

Table 15-14. Summary of key desktop sources

Title	Source	Year	Brief description	Author
Project Erebus Environmental Statement	Publicly available	2021	Offshore wind farm	Blue Gem Wind

15.5 Baseline

50. The following sections describe the baseline environment relating to noise and vibration.

15.5.1. Existing Baseline

51. Baseline noise data has been referenced from Chapter 22 of the Project Erebus ES, which provides noise data from the locations illustrated in **Volume 5: Figure 15-1**. The locations that

are relevant to Project Erebus are SSR1 to SSR4. These noise data were measured from 7 to 21 July 2021.

52. Noise data from the Project Erebus ES that is used in the assessment of noise are presented in **Table 15-15**. No development is known that would result in a material change in baseline noise conditions since 2021 and the data presented in **Table 15-15** is considered representative of current baseline conditions.

Table 15-15. Project Erebus Baseline Noise Data

Location	Daytime $L_{Aeq,T}$ dB	Night-time $L_{Aeq,T}$ dB	Representative Night-time $L_{A90,15min}$ dB
SSR1	55	50	32
SSR2	55	38	32
SSR3	47	42	32
SSR4	43	41	34

15.5.2. Sensitive Receptors

53. The impact of noise and vibration generated during the construction, decommissioning and operational phases of the proposed Project are considered at nearby sensitive receptors. Sensitive receptors have been identified through a desktop study of aerial imagery and mapping and are presented in **Volume 5: Figure 15-1** and are summarised in **Table 15-16.**

Table 15-16. Sensitive Receptors

Receptor ID	Location	Description	Sensitivity	Approximate Coordinates	Relevant Study Area
R1	Coreside, Angle	Residential	High	51.660544, -5.022784°	Construction / Decommissioning
R2	Harry Standup, Rhoscrowther	Residential	High	51.662981, -5.025245°	Construction / Decommissioning
R3	Newton Cottage, Rhoscrowther	Residential	High	51.663600, -5.028999°	Construction / Decommissioning
R4	Four Winds, Rhoscrowther	Residential	High	51.667191, -5.053153°	Construction / Decommissioning
R5	Burrows, Angle	Residential	High	51.667845, -5.060874°	Construction / Decommissioning
R6	Middle Age Farm, Angle	Residential	High	51.671454, -5.062836°	Construction / Decommissioning
R7	Broomhill, Angle	Residential	High	51.672125, -5.057121°	Construction / Decommissioning
R8	Neath Farm, Rhoscrowther	Residential	High	51.670022, -5.034875°	Construction / Decommissioning
R9	Wogaston, angle	Residential	High	51.665840, -5.012457°	Construction / Decommissioning and Operation
R10	Hoplass Farm, Rhoscrowther	Residential	High	51.669826, -5.012847°	Operation
R11	Green Hill Farm, Pwllcrochan	Residential	High	51.679398, -5.001890°	Operation

Receptor ID	Location	Description	Sensitivity	Approximate Coordinates	Relevant Study Area
R12	Wallaston green Receptors	Residential	High	51.666174, -5.004530°	Construction / Decommissioning and Operation
R13	Somerton Cottages, Hundleton	Residential	High	51.664869°, -4.992324°	Operation
R14	Moreston Cottage, Hundleton	Residential	High	51.669628°, -4.986050°	Construction / Decommissioning
R15	Lambeth Farm, Pwllcrochan	Residential	High	51.675668°, -4.983394°	Construction / Decommissioning
R16	Five Cross Receptors	Residential	High	51.671625°, -5.004585°	Construction / Decommissioning and Operation

15.5.3. Future Baseline

54. This section considers any changes to the baseline conditions described above that might occur over the lifespan of the proposed Project, but in their absence (i.e. if the Project is not consented).

55. The future baseline at the proposed Project may be influenced by new industrial development changes in road traffic noise, which may occur due to natural growth or new developments. New industrial development would be expected to achieve noise limits defined in accordance with BS 4142. This process is expected to control ambient noise levels at sensitive locations. As changes in road traffic flows are not expected to be sufficient to result in changes in road traffic noise (i.e. less than 20% decrease or 25% increase that is equivalent to a change in noise of 1 dB), the defined baseline conditions are suitably representative of future baseline conditions.

15.6 Scope of the Assessment

56. An EIA Scoping Report for the proposed Project was submitted to NRW Marine Licensing Team (MLT) in April 2022. The Scoping Report was also shared with relevant consultees, inviting comment on the proposed approach adopted by the Applicant. A Scoping Opinion was provided to the Applicant by NRW MLT in July 2022. Based on the Scoping Opinion received, and further consultation undertaken, potential impacts on noise and vibration scoped into the assessment are listed below in **Table 15-17**. Impacts scoped out of the assessment are listed in **Table 15-18.**

57. As set out in **Section 15.4.1**, this assessment considers the design parameters of the proposed Project which are predicted to result in the greatest environmental impact, known as the 'realistic worst-case scenario'. The realistic worst-case scenario represents, for any given receptor and potential impact on that receptor, various options in the Project Design Envelope (see **Chapter 04: Description of the Proposed Project** for a definition) that would result in the greatest potential for change to the receptor in question. Given that the realistic worst-case scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be held that the development of any alternative options

within the design parameters will give rise to effects no greater or worse than those included in this impact assessment.

58. Accordingly, the design scenarios identified in **Table 15-17** have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group within the noise and vibration Study Area. These scenarios have been selected from the details provided in **Chapter 04: Description of the Proposed Project**.

Table 15-17. Design scenario considered for the assessment

Potential impact	Design scenario	Justification
Construction		
Noise emission due to construction activities	Maximum extents of redline boundary used when assessing construction noise impact. Noise generating construction activities have been assessed that represent the typical high intensity construction works.	The reasonable worst case design scenario for noise impacts assumes construction activities can occur anywhere within the redline boundary to allow flexibility in the final cable route and HDD locations. The highest likely levels of construction noise are assessed to cover a reasonable worst-case scenario.
Ground-borne induced vibration from construction activities	Maximum extents of redline boundary used when assessing construction noise impact. Plant that generates the highest levels of vibration has been considered in the assessment	The reasonable worst case design scenario for vibration impacts assumes construction activities can occur anywhere within the redline boundary to allow flexibility in the final cable route and HDD locations. The highest likely levels of construction vibration are assessed to cover a reasonable worst-case scenario.
Increases in road traffic noise due to construction traffic	Peak construction traffic movements	Peak construction traffic movements are assessed to cover a reasonable worst-case scenario.
Operation and maintenance		
Operational noise emissions from substation infrastructure	Illustrative substation layout	Allows reasonable worst-case impacts to be identified and flexibility during the detailed design.
Decommissioning		
Noise emission due to substation decommissioning activities	Maximum extents of redline boundary used when assessing decommissioning noise impact. Noise generating construction activities have been assessed that	The reasonable worst case design scenario for noise impacts assumes decommissioning activities can occur anywhere within the redline boundary to

Potential impact	Design scenario	Justification
	represent the typical high intensity construction works.	allow flexibility in the final cable route. The highest likely levels of decommissioning noise are assessed to cover a reasonable worst-case scenario.
Ground-borne induced vibration from decommissioning activities	Maximum extents of redline boundary used when assessing decommissioning noise impact. Plant that generates the highest levels of vibration has been considered in the assessment	The reasonable worst case design scenario for vibration impacts assumes decommissioning activities can occur anywhere within the redline boundary to allow flexibility in the final cable route. The highest likely levels of decommissioning vibration are assessed to cover a reasonable worst-case scenario.
Increases in road traffic noise due to decommissioning traffic	Peak decommissioning traffic movements	Peak decommissioning traffic movements are assessed to cover a reasonable worst-case scenario.

15.6.1. Impacts scoped out of assessment

59. Several impacts have been scoped out of the assessment for noise during EIA scoping. These impacts are outlined, together with the justification for scoping them out, in **Table 15-18.**

Table 15-18. Potential impacts scoped out the assessment for noise and vibration

Potential impact	Justification
Operation and maintenance	
Operational traffic	No significant levels of operational traffic are expected so an assessment of operational road traffic noise impacts is scoped out.
Operational cable noise	Cables will be buried underground. Consequently, any noise that may be generated from underground cables will be attenuated by the ground and is unlikely to be perceptible at the surface. As such, an assessment of operational cable noise is scoped out.

15.6.2. Assessment Assumptions and Limitations

Baseline

60. 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 and a small degree of uncertainty will always remain in the values taken from such a measurement survey.

Construction noise

61. The assessment of construction noise (and vibration) has considered construction activities that have the potential to result in significant effects on identified receptors, based on information presented in **Chapter 04: Description of the Proposed Project** and previous experience of construction sites and professional judgement. These assessments are based on a reasonable worst-case scenario by considering periods of activity that are likely to generate high levels of noise.

62. Construction noise predictions have been undertaken using the computer modelling software CadnaA® (v2019) based on an example schedule of plant items that are typically used in such developments for the purposes of carrying out a quantitative assessment at this stage. Construction plant are summarised in **Appendix 15B: Noise Modelling**.

63. Predictions have been undertaken using BS 5228-1 methodologies and AECOM library data of sound sources associated with the proposed construction activities. These sound sources are taken to be representative of the plant and / or activities that will be used during the construction process of the proposed Project. Noise predictions were carried out to represent a conservative scenario where construction plant is operational nearest to the identified receptors and does not consider quieter periods when limited activities take place or at further distances. Consequently, noise predictions may overestimate construction noise levels and are therefore considered to be a reasonable likely worst case.

Operational noise

64. A series of assumptions were made for the generation of the construction and operation noise models as follows:

- Digital noise modelling of the operational proposed Project has been based on the parameters set out in the drawings, plans, and construction and operation details in **Chapter 04: Description of the Proposed Project**;
- Sound level data for construction plant (see **Appendix 15B: Noise Modelling**) have been sourced from BS 5228-1;
- Sound level data for operational noise-producing plant (i.e. inverters, transformers and BESS units) have been based on industry sound pressure level measurement data (**Appendix 15B: Noise Modelling**);
- Surrounding ground conditions have been modelled as soft (G=0.8);
- Air temperature was assumed to be 9 degrees and humidity 80%, which are typical annual average weather conditions for Milford Haven;
- One order of reflection was modelled;
- Land topography has been incorporated into the noise modelling; and
- All receptor points have been set at a standard height of 1.5 m above local ground levels for daytime and evening noise predictions and at a height of 4 m (representative of 1st floor level) for night-time predictions.

15.7 Embedded Mitigation, Management Plans and Best Practice

65. The design of the proposed Project includes embedded mitigation measures and reference to various management plans (see **Table 15-19**) that will be produced as conditions of consent, and which will further mitigate potential impacts. This approach has been employed to

demonstrate commitment to mitigation measures by including them in the design of the proposed Project and as such these measures have been considered within the assessment presented in **Section 15.8** below. Assessment of sensitivity, magnitude and therefore significance includes the implementation of these measures.

Table 15-19. Mitigation measures, management plans and best practice adopted as part of the proposed Project

Embedded Mitigation Measures, Management Plans and Best Practice	Justification
Management Plans	
Construction Environmental Management Plan	Secures mitigation measures covering best practicable means (defined in Section 72 of the Control of Pollution Act) and represent all reasonable measures that can be adopted to control noise during the construction phase.
Decommissioning Environmental Management Plan	Secures mitigation measures covering best practicable means (defined in Section 72 of the Control of Pollution Act) and represent all reasonable measures that can be adopted to control noise during the decommissioning phase.
Construction Noise Management Plan	Sets out noise threshold limits, mitigation measures to control noise and nighttime working requirements relating to noise. Further details have been provided the Outline CEMP, **Volume 6, Appendix 4A, Section 4.3.4**.
Pollution Prevention Management Plan (including Emergency Incident Response Plan)	Sets out measures to avoid and control pollution. Outlines the recording and response measures to be used in the event of an incident. Further details have been provided the Outline CEMP, **Volume 6, Appendix 4A, Section 4.3.4**.

15.8 Assessment of Environmental Effects

66. The impacts and effects (both beneficial and adverse) associated with the construction, operation and maintenance and decommissioning of the proposed Project are outlined in the sections below. The assessments consider the embedded mitigation measures described in **Section 15.7**.

15.8.1. Construction Effects

Construction Noise Effects

- This section includes coves an assessment of construction noise effects due to:
- Cable trenching works;
- Horizontal directional drilling; and
- Substation construction.

Magnitude of impact

67. Measured ambient noise levels are less than ABC method Category A threshold values in **Table 15-5**. Consequently, Category A noise thresholds presented in **Table 15-20** are applied along with magnitude of impact criteria in **Table 15-6** when assessing construction noise impacts using criteria in **Table 15-5.**

Table 15-20. Construction noise assessment thresholds

Assessment category and threshold value period	Threshold values in dB $L_{Aeq,T}$
Night-time (23:00-07:00)	45
Evening and weekends (19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays)	55
Daytime (07:00-19:00) and Saturdays (07:00-13:00)	65

68. Noise predictions have been undertaken of construction activities along the Cable Route Corridor, at HDD sites and at substation sites. The results of construction and decommissioning noise predictions at sensitive receptors (illustrated in **Volume 5: Figure 15-1**) are summarised in **Table 15-21.**

Table 15-21. Construction activity noise predictions

Receptor ID	Sensitivity of Receptor	Predicted $L_{Aeq,T}$ dB Façade Noise Level and Impact		
		Cable trenching works	HDD works (assumed at night for worst-case)	Substation construction
R1	High	51 (Negligible)	37 (Negligible)	37 (Negligible)
R2	High	60 (Small)	38 (Negligible)	38 (Negligible)
R3	High	59 (Negligible)	40 (Small)	37 (Negligible)
R4	High	59 (Negligible)	55 (Large)	29 (Negligible)
R5	High	55 (Negligible)	60 (Large)	27 (Negligible)
R6	High	53 (Negligible)	51 (Large)	26 (Negligible)
R7	High	59 (Negligible)	52 (Large)	28 (Negligible)
R8	High	59 (Negligible)	46 (Medium)	35 (Negligible)
R9	High	57 (Negligible)	34 (Negligible)	46 (Negligible)
R12	High	60 (Small)	29 (Negligible)	51 (Negligible)
R14	High	55 (Negligible)	26 (Negligible)	42 (Negligible)
R15	High	62 (Small)	25 (Negligible)	40 (Negligible)
R16	High	67 (Medium)	31 (Negligible)	69 (Medium)

69. Predicted unmitigated construction noise levels are below the daytime noise threshold at all sensitive receptors except for R16. At R16, a **Medium** impact is identified during cable trenching work and substation work.

70. As HDD activities would occur continuously over 24-hour periods, noise impacts have been assessed during the most sensitive night-time period. There is potential **Medium** impacts are predicted at R8 and **Large** impacts predicted at R4, R5, R6 and R7.

Significance of the effect

71. Receptor R16 is identified as a **High** sensitivity residential receptor. During cable laying and substation construction works, and the magnitude of the impact is assessed as **Medium**. Therefore, the effect will, be of **Moderate Adverse** significance, which is significant in EIA terms.

72. At all other **High** sensitivity residential receptors (R1-R9, R12, R14, R15), cable laying and substation construction activities are predicted to result in a **Negligible** or **Small** impact.

Therefore, the effect will, be of either **Negligible** or **Minor Adverse** significance, which is **not significant** in EIA terms.

73. Receptor R4 to R8 are identified as **High** sensitivity receptors. During night-time HDD works, the magnitude of the impact is assessed as **Large** at R4 to R8. Therefore, the effect will, be of **Moderate Adverse** significance at R4 and **Major Adverse** significance at R5 to R8, which is significant in EIA terms.

74. At all other **High** sensitivity residential receptors (R1-R3, R5-R7, R8, R9, R12, R14-R16) HDD activities are predicted to result in a **Negligible** impact. Therefore, the effect will, be of either **Negligible** significance, which is **not significant** in EIA terms.

75. The assessment of HDD noise at night assumes a worst-case in terms of HDD location so, once a detailed methodology is produced it is expected that the majority of significant effects can be reduced by measures discussed in paragraphs 81 and 82. As such, the identification of significant effects at this stage of the project is considered precautionary.

76. Occupants of nearby receptors are likely to be more tolerable of high noise events if they are regularly communicated to and kept informed of timings and duration of high noise generating events. Paragraph 6.3 of BS 5228-1 states that:

77. ‘Local residents might be willing to accept higher levels of noise if they know that such levels will only last for a short time.’

78. Consequently, the communication strategy secured through the **Construction Noise Management Plan, Appendix 4A: Outline CEMP**, will ensure that occupants of affected properties will be notified of the timings and duration of works.

Further mitigation and residual effect

Cable Laying and Substation Construction Activities

79. A buffer of 40 m will be maintained between sensitive receptors and areas where high-intensity construction activities are required. Where high intensity construction activities are required within the 40 m buffer, a temporary portable barrier will be employed to screen noise of any static plant that generates high levels of noise. Partial screening of noisy plant could reduce noise by 5 dB, which would be sufficient to reduce significant effects.

80. Taking the above mitigation into consideration, the residual effect of cable laying and substation construction activities at R16 will be, at worst, reduced to **Minor Adverse** significance and **not significant** in EIA terms.

HDD Night-time Activities

81. As requirements and locations for HDD activities will not be finalised until a principal contractor is appointed, a hierarchy of mitigation measures is proposed to ensure that significant noise effects do not occur due to potential night-time works:

- Where practicable, maximise the distance between HDD pits and sensitive receptors;
- The potential for the use of quieter equipment than listed in **Appendix 15B: Noise Modelling** will be explored by the principal contractor; and
- Depending on the location, plant and timing of works, acoustic fencing will be installed around the HDD site boundary to screen receptors from noise emission. This mitigation could provide up to 10 dB of attenuation when the noise screen completely hides the sources from the receiver.

82. Where works are required outside of core daytime work periods, the applicant will apply for prior consent to carry out noisy work under Section 61 of the CoPA to demonstrate that noise and vibration has been minimised as far as reasonably practicable. The Section 61 application will set out the specific method of working, calculations of noise levels at nearby receptors, the actual working hours required, noise monitoring locations, details of communication measures and the mitigation measures implemented to minimise noise impacts.

83. Taking the above mitigation into consideration assuming a reduction in noise of 10 dB is achievable, the residual effect of HDD activities will be **Moderate Adverse** significance at R4 to R8 and **significant** in EIA terms. At all other receptors, HDD activity noise at night would be, at worst, **Minor Adverse** significance and **not significant** in EIA terms.

Construction Vibration

84. This section assesses the effect of ground-borne vibration because of construction activities.

Magnitude of impact

85. BS 5228-2 refers to the Transport Research Laboratory (TRL) report 429 'Groundborne Vibration Caused by Mechanised Construction Works' (2000) (Hiller and Crabb, 2000). Figure 50 of the TRL report indicates that ground vibration from miscellaneous vehicle operations on construction sites (including scrapers, vibratory rollers, dumpers, breakers, dozers and HGVs) are in the region of 1mm/s PPV at approximately 10 m, decreasing to the region of 0.1 mm/s PPV at approximately 50 m.

86. Actual vibration levels from works are dependent on several factors including ground conditions, plant or vehicle size, the nature of the works (in particular piling methods), the speed of HGV movements, and the quality of surface of haul or other temporary roads. Based on the assumed HGV speeds on access routes and regular maintenance of access route road surfaces, vibration generated by vehicles on the access roads will be reduced as far as reasonably practicable.

87. Measured piling data in BS 5228-2 indicates that piling activities generally only generate vibration impacts when they are located less than 20 m from sensitive locations. The impact depends on the type of piling, ground conditions, and receptor distance. Vibration from auger piling techniques, which is a typically applied piling method, are generally limited to 1 mm/s for distances up to 10 m. This level of vibration is considered representative of HDD activities and vibratory rollers used for reinstatement after cable trenching works.

88. Details on the approximate distance from construction work sites to sensitive receptors (illustrated in **Volume 5: Figure 15-1**) are presented in **Table 15-22** and magnitude of impacts are based in information in **Table 15-7**.

Table 15-22. Distance from potential construction works sites to sensitive receptors

Receptor ID	Sensitivity of Receptor	Approximate Distance to Sensitive Receptor and Magnitude of Impact		
		Cable Trenching Works	HDD Works	Substation Works
R1	High	300 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)
R2	High	50 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)
R3	High	110 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)

Receptor ID	Sensitivity of Receptor	Approximate Distance to Sensitive Receptor and Magnitude of Impact		
		Cable Trenching Works	HDD Works	Substation Works
R4	High	170 m (Negligible)	240 m (Negligible)	> 300 m (Negligible)
R5	High	210 m (Negligible)	70 m (Negligible)	> 300 m (Negligible)
R6	High	> 300 m (Negligible)	230 m (Negligible)	> 300 m (Negligible)
R7	High	140 m (Negligible)	180 m (Negligible)	> 300 m (Negligible)
R8	High	120 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)
R9	High	180 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)
R12	High	60 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)
R14	High	290 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)
R15	High	30 m (Negligible)	> 300 m (Negligible)	> 300 m (Negligible)
R16	High	20 m (Small)	> 300 m (Negligible)	20 m (Small)

Significance of the effect

89. Receptor R16 is identified as a **High** sensitivity residential receptor. During cable laying and substation construction works, and the magnitude of the impact is assessed as **Small**. Therefore, the effect will, be of **Minor Adverse** significance, which is **not significant** in EIA terms.

90. At all other **High** sensitivity residential receptors (R1-R9, R12, R14, R15), cable laying, HDD and substation construction activities are predicted to result in a **Negligible** impact. Therefore, the effect will, be of either **Negligible** significance, which is **not significant** in EIA terms.

Construction Traffic Noise

91. This section assesses the effect of changes in road traffic noise as a result of construction traffic.

Magnitude of impact

92. The potential changes in road traffic noise from these roads as a result of the construction traffic have been considered by calculating the CRTN Basic Noise Level (BNL) and comparing the change. It is forecast that there will be peak daily average of 18 heavy vehicle movements associated the substation site and five heavy vehicle movements associated with the landfall site.

93. Changes in road traffic noise have been calculated as BNLs at roads that would be used by construction traffic. **Table 15-23** presents the results of the assessment. Road traffic flow data are presented in **Appendix 15B: Noise Modelling**. Roads are illustrated in **Volume 5: Figure 13-2.**

Table 15-23. Construction traffic noise assessment

Road	Baseline $L_{A10,18h}$ dB	Baseline + Construction Traffic $L_{A10,18h}$ dB	Difference dB	Magnitude of Impact
B4319	73.6	73.6	0.0	Very Low
Clay Lane	71.2	71.3	+0.1	Very Low

Road	Baseline $L_{A10,18h}$ dB	Baseline + Construction Traffic $L_{A10,18h}$ dB	Difference dB	Magnitude of Impact
B4320	69.9	70.0	+0.1	Very Low
C3101	68.7	68.8	+0.1	Very Low
Well Hill	75.7	75.7	0.0	Very Low
A4075	71.2	71.3	+0.1	Very Low

Significance of the effect

94. Due to the high level of baseline traffic on construction traffic routes, the calculated change in noise due to construction traffic is less than 1 dB. This is equivalent to a **Very Low** impact and a **Negligible** effect (not significant) at **High** sensitivity receptors. This is **not significant** in EIA terms.

95. It is noted that substation construction traffic will also Goldborough Road as an access route; however, as baseline flows are very low (approximately 20 vehicles per day), CRTN calculations are not valid. However, the peak average heavy vehicles movements of 18 per day is not considered sufficient to constitute an adverse effect so a **Negligible** effect (**not significant**) is identified.

15.8.2. Operation and Maintenance Effects

Operational Substation Noise

96. This section assesses the effect of operational substation noise.

Magnitude of impact

97. Noise impacts have been assessed assuming the worst-case impact will occur at night when noise conditions are quietest. Background noise measurements presented in Table 15-15 indicate that the lowest measured night-time background noise level is 32 dB LA90,T. As a conservative approach, this background noise level has been applied to all receptor locations. Consequently, with reference to **Table 15-9,** operational noise assessment criteria are presented in **Table 15-24.**

Table 15-24. Operational noise assessment criteria based on measured background noise level

Magnitude of Impact	Rating Level (External) at Receptor, $L_{Ar,Tr}$
Large	Greater than 45 dB $L_{Ar,Tr}$
Medium	Greater than 40 dB $L_{Ar,Tr}$ and less than or equal to 45 dB $L_{Ar,Tr}$
Small	Greater than 32 dB $L_{Ar,Tr}$ and less than or equal to 40 dB $L_{Ar,Tr}$
Negligible	Less than or equal 32 dB $L_{Ar,Tr}$

98. The impacts of the predicted noise levels from the Onshore Project Boundary at surrounding residential receptors (illustrated in **Volume 5: Figure 15-1**) are presented in **Table 15-25**. The magnitude of effects has been assessed in accordance with BS 4142. A tonality penalty of +6 dB(A) (for highly perceptible tonality) has been added to the predicted substation noise levels.

Table 15-25. Operational Substation Noise Predictions

Receptor ID	Sensitivity	Predicted Rating Noise Level $L_{Ar,Tr}$ dB	Magnitude of impact
R9	High	36	Small
R10	High	37	Small
R11	High	31	Negligible
R12	High	40	Medium
R13	High	35	Small
R14	High	32	Small
R15	High	29	Negligible
R16	High	51	Large

Significance of the effect

99. Receptor R16 is identified as a **High** sensitivity receptor. The magnitude of impact at R16 from operational substation noise is assessed as **Large**. Therefore, the effect will, be of **Major Adverse** significance, which is significant in EIA terms. The magnitude of impact at R12 from operational substation noise is assessed as **Medium**. Therefore, the effect will, be of **Moderate Adverse** significance, which is significant in EIA terms. At all other **High** sensitivity receptors operational substation noise is assessed as **Negligible** or **Small** impact. Therefore, the effect will, be of either **Negligible** or **Minor Adverse** significance, which is **not significant** in EIA terms.

Further mitigation and residual risk

100. Fixed plant shall be designed, constructed, operated and maintained with the objective that the rating level LAr,Tr of fixed plant under normal operation at the worst affected residential receptor is not more than 35 dB.

101. In cases where it is not reasonably practicable to achieve the above objective, the Applicant will adopt measures so that noise from all fixed plant is reduced as far as is reasonably practicable, including the consideration of:

- Engineering feasibility;
- Cost; and
- Other design considerations such as the visual appearance of plant, equipment and any screening or structures which house the equipment.

102. In these cases, the Applicant shall design, construct, and maintain the fixed plant such that, under all reasonably foreseeable circumstances, the rating level LAr,Tr of fixed plant under normal operation at the worst affected residential receptor is not more than 40 dB.

103. Low frequency noise can be very difficult to predict with a high level of certainty and similarly hard to identify and resolve if present. This is because it can be generated by the unexpected interactions between system components and can be amplified by the geometry of the site and receptor buildings. Additionally, mitigation can be difficult to implement successfully as low frequency noise is difficult to attenuate.

104. The proposed substation was assessed as a highly tonal noise source by applying a +6 dB rating penalty in accordance with guidance in BS 4142. However, in order to minimise any potential adverse effects due to low frequency noise, it will be considered throughout the Front-End

Engineering Design for the substation and eliminated through design, or appropriately mitigated (isolation and attenuation measures) where appropriate.

15.8.3. Decommissioning Effects

105. Decommissioning works would be like those during the installation phase except for no requirement for HDD works. Consequently, noise, vibration and decommissioning traffic noise impacts are equivalent to those identified during the installation phase.

Decommissioning Noise

106. Given that the same mitigation measures as the construction phase were adopted and secured in the Decommissioning Environmental Management Plan (DEMP), decommissioning noise effects are identified as no worse than **Minor Adverse** and **not significant**.

Decommissioning Vibration

107. Given that the same mitigation measures as the construction phase were adopted and secured in the DEMP, decommissioning vibration effects are identified as no worse than **Minor Adverse** and **not significant**.

Decommissioning Traffic Noise

108. Decommissioning traffic noise effects are identified as no worse than **Negligible** and **not significant**.

15.9 Summary of Effects and Conclusions

109. This section summarises the residual significant effects of the proposed Project on noise and vibration following the implementation of mitigation. A summary of residual noise and vibration effects is presented in **Table 15-26.**

Table 15-26. Assessment summary

Potential Impact	Receptor	Receptor Sensitivity	Magnitude of impact	Significance of effect	Additional Mitigation	Residual Significance of Effect
Construction						
Noise generated from daytime cable trenching works	R16	High	Medium	Moderate Adverse	Maintain 40 m buffer to sensitive receptors where practicable Barriers when works are required within 40 m.	Minor Adverse (not significant)
Noise generated from daytime cable trenching works	R2, R12, R16	High	Small	Minor Adverse		Minor Adverse (not significant)
Noise generated from daytime cable trenching works	R1, R3, R4, R5, R6, R7, R8, R9, R14	High	Negligible	Negligible		Negligible (not significant)
Noise generated from daytime cable trenching works	R1, R5, R6, R7, R10, R15	High	Negligible	Negligible		Negligible (not significant)
HDD noise at night	R5,	High	High	Major Adverse	Maximise distance to sensitive receptor Quieter equipment Use of barriers.	Moderate Adverse (significant)
HDD noise at night	R4, R6, R7	High	High	Major Adverse		Minor Adverse (not significant)
HDD noise at night	R8	High	Medium	Moderate Adverse		Minor Adverse (not significant)
HDD noise at night	R3	High	Small	Minor Adverse		Negligible (not significant)

Potential Impact	Receptor	Receptor Sensitivity	Magnitude of impact	Significance of effect	Additional Mitigation	Residual Significance of Effect
HDD noise at night	R1, R2, R9, R12, R14, R15, R16	High	Negligible	Negligible		Negligible (not significant)
Noise generated from daytime substation construction activities	R16	High	Medium	Moderate Adverse	Maintain 40 m buffer to sensitive receptors where practicable Barriers when works are required within 40 m.	Minor Adverse (not significant)
Noise generated from daytime substation construction activities	R1, R2, R3, R4, R5, R6, R7, R8, R9, R12, R14, R15	High	Negligible	Negligible		Negligible (not significant)
Vibration generated from daytime cable trenching works	R16	High	Negligible	Minor Adverse	None.	Minor Adverse (not significant)
Vibration generated from daytime cable trenching works	R1, R2, R3, R4, R5, R6, R7, R8, R9, R12, R14, R15	High	Negligible	Negligible	None.	Negligible (not significant)
Vibration generated from HDD works	All construction receptors	High	Negligible	Negligible	None.	Negligible (not significant)
Vibration generated from daytime substation construction works	R1, R2, R3, R4, R5, R6, R7, R8, R9, R12, R14, R15	High	Negligible	Negligible	None.	Negligible (not significant)
Vibration generated from daytime	R16	High	Negligible	Minor Adverse	None.	Minor Adverse (not significant)

Potential Impact	Receptor	Receptor Sensitivity	Magnitude of impact	Significance of effect	Additional Mitigation	Residual Significance of Effect
substation construction works						
Noise generated by construction traffic	All construction receptors	High	Negligible	Negligible	None.	Negligible (not significant)
Operation and Maintenance						
Operational substation noise emissions	R16	High	High	Major Adverse	Commitment to design to 35 dB LAr,Tr or 40 dB LAr,Tr if all reasonably practicable mitigation measures are applied.	Minor Adverse (not significant)
Operational substation noise emissions	R12	High	Medium	Moderate Adverse		Minor Adverse (not significant)
Operational substation noise emissions	R14, R15, R16, R17	High	Small	Minor Adverse		Minor Adverse (not significant)
Operational substation noise emissions	R17, R18	High	Negligible	Negligible		Negligible (not significant)
Decommissioning						
Noise generated from daytime decommissioning activities	All receptors	High	Small	Minor Adverse	Maintain 40 m buffer to sensitive receptors where practicable Barriers when works are required within 40 m.	Minor Adverse (not significant)

Potential Impact	Receptor	Receptor Sensitivity	Magnitude of impact	Significance of effect	Additional Mitigation	Residual Significance of Effect
Vibration generated from decommissioning activities	Noise generated from daytime decommissioning activities	High	Small	Minor Adverse	None.	Minor Adverse (not significant)
Noise generated by decommissioning traffic	Noise generated from daytime decommissioning activities	High	Negligible	Negligible	None.	Negligible (not significant)

15.10 Cumulative Effects of the Project

15.10.1. Introduction

110. Cumulative effects are those effects upon receptors arising from the proposed Project alongside all existing, and/ or reasonably foreseeable projects, plans and activities that result in cumulative effects with any element of the proposed Project. Existing projects are generally considered as part of the baseline and as such are considered within the impact assessment presented in **Section 15.8** above.

111. This section assesses potential cumulative effects on noise and vibration from identified projects, plans and activities that have the potential to act cumulatively with the proposed Project.

112. PINS Advice 17: Cumulative Effects Assessment (2019) suggests that CEA follows a four-stage process. The aim of this approach is to accurately determine relevant projects and associated relationships with scoped in receptors identified in the ES, to be included within the interproject CEA.

113. The approach to the assessment of cumulative effects is detailed in **Appendix 5B: Approach to Cumulative Effects Assessment** and is also summarised in **Table-15-27**.

Table-15-27 PINS Advice 17 Stages of the CEA process

CEA Stage	Activity
Stage 1	Determine a zone of influence (ZoI) via desk study for each topic receptor scoped into the ES. This will establish a *long list* of projects within each ZoI that will be shortlisted in Stage 2. This list of plans and projects/activities is drawn up through a desk study of planning applications, development plan documents, relevant development frameworks and any other available sources to identify 'other development' within the ZoI. Information on each project (location, development type, status, etc.) is documented, along with the certainty or tier assigned to the 'other development' (i.e. confidence it will take place in the current form and when it will take place in relation to the project). PINS notes that the project should then consult with the relevant planning authority/ authorities and statutory consultees regarding the long list.
Stage 2	Screening of the long list identified in Stage 1, to establish a short list for the CEA. Screening is based on the criteria presented in the scoping report and subsequent comments by the regulator and statutory consultees. PINS has provided inclusions/ exclusion threshold criteria, against which the potential for 'other development to give rise to significant cumulative effects by virtue of overlaps in temporal scope, the scale and nature of the 'other developments' and /or receiving environment, or any other relevant factors is assessed. From this assessment, a shortlist of 'other developments' to be included in the CEA is produced. It is noted that documented information on each of the 'other developments' is likely to be high level at this stage, outlining the key issues to take forward.
Stage 3	Gathering of all information available on short listed projects generated in Stage 2. At this stage all available data and information about the shortlisted projects that will be included in the CEA is collected to inform the assessment. This should utilise the most current information for each project in the public domain, and assess the assumptions and limitations of the information collected on each shortlisted project.
Stage 4	Each of the shortlisted projects are reviewed in turn by the different topics to assess whether cumulative effects may arise and the nature of those effects (i.e. beneficial or adverse). The significance of the effects on environmental receptors

CEA Stage	Activity
	is established within each ES technical chapters. Where significant adverse cumulative effects are identified, mitigation measures are also considered within the CEA alongside the mechanism to secure that mitigation, e.g. consent condition requirements.

15.10.2. Scope of Cumulative Effects Assessment Noise and Vibration

114. Cumulative noise effects during installation and operation phases may occur when developments are located nearby to a common receptor. For cumulative developments outside the Study Area (300 m for construction and decommissioning noise and 1 km for operational noise illustrated in **Volume 5: Figure 15-1**), any interaction of noise emissions from multiple developments would be attenuated such that there would normally be no combined effect.

115. The following impacts have been scoped into the CEA for noise and vibration.

Construction and decommissioning

- Construction and decommissioning noise and vibration emissions – the interactions of any temporary construction or decommissioning works.
- Construction and decommissioning and traffic noise – the interactions of any temporary construction or decommissioning traffic noise.

Operation

- Operational noise – the interactions of any temporary construction or decommissioning traffic noise.

116. **Table 15-28** presents the short list of projects identified within 1 km of the Project and included within the CEA for noise and vibration. The location of these projects is illustrated in **Volume 5: Figure 30-1**.

Table 15-28 List of projects considered for the noise and vibration cumulative effects assessment

Project Name/Developer	Project Type	Tier and Status	Approx. distance from the proposed Project	Construction Timeframe
Battery Energy Storage System at Lambeth (Sirius Renewable Energy)	Energy storage	Scoping opinion issued	50 m	TBC
Pembroke Power Station – Synchronous condenser (RWE).	Inshore energy	Under-construction	100 m	2023-2025
Pembrokeshire Demonstration Zone (Celtic Sea Power).	Offshore wind Energy	Scoping opinion issued	Within the RLB	TBC

15.10.3. Cumulative Effect Assessment

Construction and Decommissioning

Noise and vibration

117. The precise scale of cumulative construction and decommissioning noise and vibration effects will be dependent on the exact works taking place at each location at any one time; however,

compliance with the mitigation measures detailed within the **Outline Pollution Prevention Management Plan and the Construction Noise Management Plan, Appendix 4A: Outline CEMP** will reduce these effects as far as possible. It has been assumed that the other developments will also be required to adopt BPM as standard working practices during their installation phases and that noise and vibration levels will comply with set limits in accordance with guidance in BS 5228-1 and BS 5228-2.

118. Based on the requirements to implement BPM, it is considered that any overlapping of construction phases between the proposed Project and the other nearby development schemes would not result in any in-combination cumulative effects at common sensitive receptors. Predicted construction and decommissioning noise effects from the proposed Project are not significant, and it is considered that cumulative effects of installation noise will remain unchanged from the residual effects and, therefore, the significance of effect would be, at worst, **Minor Adverse** and **not significant**.

Traffic noise

119. Project construction and decommissioning traffic result in very small changes in road traffic noise (maximum of +0.1 dB in **Table 15-23**). The smallest change in noise perceptible to the most sensitive person is 1 dB. It would require an increase in traffic of 25% (assuming consistent traffic composition) to result in an increase in noise of 1 dB. It would take a substantial amount of cumulative development traffic to cause a perceptible change in traffic noise. As such, cumulative development construction and decommissioning traffic is not considered to result in an increase in traffic noise of more than 1 dB and, therefore, the significance of effect would be, at worst, **Negligible** and **not significant**.

Operation and Maintenance

Traffic noise

120. Operational noise emissions from nearby developments will be designed to achieve appropriate operational noise limits that do not contribute to additional noise to the area. The control and mitigation of noise effects from surrounding development from cumulative developments will be the responsibility of the developer. Given the requirement for new developments to achieve operational noise standards, operational noise effects from the proposed Project will remain unchanged from the residual effects stated previously and therefore remain negligible to **Minor Adverse** and **not significant**.

15.11 Inter-related Effects of the proposed Project

121. The term 'Inter-related' considers the environmental interactions ('inter-relationships') with other receptors within the proposed Project. These are referred to in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 and further described in **Chapter 31 – Inter-related Effect Assessment.**

122. As set out in PINS Advice Note 17 (PINS) (PINS, 2019), *inter-related -project effects*, or ‘interrelationships between topics’, derive from combinations of different project specific impacts which, when acting together on the same receptor, could result in a new or different effect, or an effect of greater significance than the project effects, when considered in isolation.

123. Inter-related effects comprise the following:

- *Project lifetime effects*: effects that have the potential to occur during more than one phase of the proposed Project (i.e. construction, operation and maintenance and decommissioning) and also to interact in a way that could potentially create a more significant effect than if it was assessed in isolation.
- *Receptor-led effects*: effects that have the potential to interact, spatially and temporally, to create inter-related effects on a receptor.

124. **Chapter 31 - Inter-related Effects Assessment** details the approach to the inter-related effects assessment and includes a description of the likely inter-related effects that may occur because of the proposed Project on noise and vibration.

15.11.1. Inter-related Project lifetime effects

125. Inter-related effects may occur due to more than one phase of the project (installation, operation, and decommissioning) to interact to potentially result in a significant effect. However, as the phases of the project cannot overlap temporally, there is no potential for combined noise and vibration effects to occur.

15.11.2. Inter-related receptor-led effects

126. Inter-related effects may also occur when more than one source of noise or vibration affect a receptor. This is most likely to occur during the installation and decommissioning phases when both noise and vibration can affect a receptor. With mitigation measures in place, construction and decommissioning noise and vibration effects are not significant. Overall, no combined effects across the project phases are anticipated.

15.12 Transboundary Effects

127. A transboundary effect refers to the impacts or effects of a project that extend beyond the boundaries of the United Kingdom and have the potential to affect the environment of other countries within the European Economic Area (EEA). These effects can occur either from the proposed Project on its own or when combined with the effects of other projects or activities in the wider geographical area.

128. There are no trans-boundary effects likely to occur during the installation, operation and decommissioning of the Project with respect to noise and vibration.

15.13 References

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