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Morlais Project
Environmental Statement

Chapter 21: Noise and Vibration

Volume I

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Chapter 21: Noise and Vibration

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GLOSSARY OF ABBREVIATIONS

AAWT	Annual Average Weekday Traffic
BAT	Best Available Technology
BPM	Best Practicable Means
BS	British Standard
CNMP	Construction Noise Management Plan
CoCP	Code of Construction Practice
CRTN	Calculation of Road Traffic Noise
DMRB	Design Manual for Roads and Bridges
EPA	Environmental Protection Act
EPP	Evidence Plan Process
eVDV	Estimated Vibration Dose Value
HVAC	High Voltage Alternating Current
ISO	International Standards Organisation
LOAEL	Lowest Observed Adverse Effect Level
NOEL	No Observed Effect Level
NPF	National Planning Framework
NPPG	National Planning Practice Guidance
NSR	Noise Sensitive Receptor
OAE	Observed Adverse Effect
PDS	Project Design Statement
PPG	Planning Practice Guidance
PPV	Peak Particle Velocity
PPW	Planning Policy Wales
SLM	Sound Level Meter
SOAEL	Significant Observed Adverse Effect Level
SPSS	Strategic Planning Policy Statement
TAN	Technical Advice Note
TMP	Traffic Management Plan
TRL	Transport Research Laboratory
TRRL	Transport and Road Research Laboratory
UAE	Unacceptable Adverse Effect
UAEL	Unacceptable Adverse Effect Level
VDV	Vibration Dose Value
WG	Welsh Government
WHO	World Health Organisation

GLOSSARY OF TERMINOLOGY

Construction consolidation sites	Compounds which will contain laydown, storage and work areas for onshore construction works. The HDD construction compound will also be referred to as a construction consolidation site.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting)

	which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
dB(Z) (or previously L_{Leq})	Decibels measured on a sound level meter incorporating a flat frequency weighting (Z weighting) across the frequency range.
Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 µPa, the threshold of normal hearing is 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions. Under normal conditions a change in noise level of 3 dB(A) is the smallest perceptible change.
Horizontal Directional Drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
$L_{A10,T}$	The A weighted noise level exceeded for 10 % of the specified measurement period (T). L_{A10} is the index generally adopted to assess traffic noise.
$L_{A90,T}$	The A weighted noise level exceeded for 90 % of the specified measurement period (T). In BS 4142:2014+A1:2019 it is used to define the 'background' noise level.
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
Mitigation areas	Areas captured within the Development Area specifically for mitigating expected or anticipated impacts.
SoundPLAN	Noise Modelling Software used to predict noise impacts from Construction and Operational Phases associated with the Project.

21. NOISE AND VIBRATION

21.1. INTRODUCTION

1. This chapter of the Environmental Statement (ES) considers the potential airborne noise and vibration impacts of the Morlais Project (hereafter 'the Project'). This chapter provides an overview of the baseline noise conditions for the onshore development area and identifies potentially sensitive receptors to noise and vibration. The chapter presents an assessment of the potential impacts and associated mitigation for the construction, operation and decommissioning of the Project on these receptors.

2. The assessment also considers cumulative impacts of other proposed projects. The proposed methodology adhered to for the Environmental Impact Assessment (EIA) and Cumulative Impact Assessment (CIA) is discussed in **Section 21.13**.

3. This chapter is supported by **Appendix 21.1** Baseline Noise Survey (**Volume III**), **Appendix 21.2** Construction Phase Assessment (**Volume III**), **Appendix 21.3** Operational Phase Assessment (**Volume III**) and **Appendix 21.4** Morlais Noise and Vibration Consultation Responses (**Volume III**). Figures which accompany this chapter are provided in **Volume II**.

4. The onshore development area is detailed in **Figure 21.1** (**Volume II**). The key components of the onshore works associated with the Project include:

    - Landfall cable installation works;
    - Landfall substation at Ty-Mawr (hereafter referred to as Landfall Substation);
    - Switchgear Building at Parc Cybi (hereafter referred to as Switchgear Building);
    - Grid Connection Substation at Orthios (hereafter referred to as Grid Connection Substation);
    - Onshore cable route joint bays (along onshore cable route between Landfall Substation and Grid Connection Substation); and
    - Onshore cable circuits installed between Landfall Substation and Grid Connection Substation.

5. Potential impacts in relation to noise and vibration inter-relate with other technical topics as presented within other chapters of the ES. These are referenced within this chapter and consist of:

    - **Chapter 11**, Marine Ornithology;
    - **Chapter 19**, Onshore Ecology;
    - **Chapter 20**, Onshore Archaeology;
    - **Chapter 23**, Traffic and Transport; and
    - **Chapter 25**, Socio-economics, Tourism and Recreation and Human Health.

6. The chapter has been prepared by Royal HaskoningDHV.

21.2. POLICY, LEGISLATION AND GUIDANCE

7. This section provides details on key international and UK legislation which is relevant to this chapter.

21.2.1. Environmental Protection Act 1990

8. Section 79 of the Environmental Protection Act 1990 (the EPA 1990) defines statutory nuisance with regard to noise and determines that local authorities have a duty to detect such nuisances in their area.

9. The EPA 1990 also defines the concept of 'Best Practicable Means' (BPM) as:

"'Practicable' means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications;

The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and structures;

The test is to apply only so far as compatible with any duty imposed by law; and

The test is to apply only so far as compatible with safety and safe working conditions, and with the exigencies of any emergency or unforeseeable circumstances."

10. Section 80 of the EPA 1990 provides local authorities with powers to serve an abatement notice requiring the abatement of a nuisance or requiring works to be executed to prevent their occurrence.

21.2.2. The Control of Pollution Act 1974

11. Section 60 of the Control of Pollution Act 1974 provides powers to local authority officers to serve an abatement notice in respect of noise nuisance from construction works.

12. Section 61 provides a method by which a contractor can apply for 'prior consent' for construction activities before commencement of works. The 'prior consent' is agreed between the local authority and the contractor and may contain a range of agreed working conditions, noise limits and control measures designed to minimise or prevent the occurrence of noise nuisance from construction activities. Application for a 'prior consent' is a commonly used control measure in respect of potential noise impacts from major construction works.

21.2.3. National Planning Policy

21.2.3.1. National Policy Statements (NPS)

13. The Project is seeking consent for a Transport and Works Act Order from the Welsh Ministers and a Marine Licence from Natural Resources Wales (NRW). Although this Project is not seeking a Development Consent Order (DCO), its size (240 MW) means it is representative of a Nationally Significant Infrastructure Project (NSIP), therefore guidance relevant to NSIPs is

considered appropriate to use for this Project. Guidance that is relevant to assessing impacts on marine water and sediment quality for NSIPs are set out within National Policy Statements (NPSs) which are the principal decision-making documents for NSIPs. Those relevant to noise and vibration include:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC) 2011a);
- NPS for Renewable Energy Infrastructure (EN-3), July 2011 (DECC, 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2011c).

14. Details of specific policies within EN-1 and EN-3 used to inform this assessment are provided in **Table 21-1** below. The specific assessment requirements for noise and vibration are detailed, together with an indication of the paragraph numbers of the chapter where each is addressed.

Table 21-1 Summary of NPS Requirements

NPS Requirement	NPS Reference	ES Chapter Reference
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 as appropriate; ▪ An assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas; and ▪ Measures to be employed in mitigating noise. ▪ The nature and extent of the noise assessment should be proportionate to the likely noise impact.	EN-1, paragraph 5.11.4	Refer to **Section 21.6** for the assessment methodology for assessing potential noise and vibration impacts, **Section 21.8** for details on the existing noise environment including the identification of noise sensitive receptors and **Section 21.9** where any changes in noise levels as a result of the Project are assessed, and any potential impacts and potential mitigation measures are identified.
The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered.	EN-1, paragraph 5.11.5	Refer to **Section 21.9** where any changes in noise levels as a result of the Project from ancillary works, for example vehicle movements, are assessed and any potential impacts and potential mitigation measures are identified.
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	EN-1, paragraph 5.11.6	Noise assessment described within EN-3 and EN-5 relates to the offshore environment. Those potential noise impacts

NPS Requirement	NPS Reference	ES Chapter Reference
may be contained in the technology-specific NPSs. In particular, for renewables (EN-3) and electricity networks (EN-5) there are 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.		are considered separately within **Chapter 10, Fish and Shellfish Ecology** and **Chapter 12, Marine Mammals**. The current relevant British Standards (BS) have been used within this assessment detailed within **Section 21.4**.
The applicant should consult EA and Natural England (NE), or the Countryside Council for Wales (CCW), as necessary and in particular with regard to 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 taken into account.	EN-1, paragraph 5.11.7	Noise impacts on terrestrial protected species or other wildlife is considered within **Chapter 11, Ornithology and Chapter 19, Onshore Ecology**.
While standard methods of assessment and interpretation using the principles of the relevant British Standards are satisfactory for dry weather conditions, they are not appropriate for assessing noise during rain. This is when overhead line noise mostly occurs, and when the background noise itself will vary according to the intensity of the rain. Therefore, an alternative noise assessment method to deal with rain-induced noise is needed, such as the one developed by National Grid as described in report TR (T) 94,199319. This follows recommendations broadly outlined in ISO 1996 (BS 7445:1991) and in that respect, is consistent with BS 4142:1997. The IPC [now the Planning Inspectorate and the Secretary of State] is likely to be able to regard it as acceptable for the applicant to use this or another methodology that appropriately addresses these particular issues.	EN-5, paragraphs 2.9.8 and 2.9.9	Construction of a new overhead line will not be required. BS 4142:1997 was superseded in 2014. A full revision was published in 2014, with an amendment in 2019. Where BS 4142 is referred to in this document, the 2014 revision with 2019 amendments has been applied which is in accordance with current best practice. See **Chapter 4, Project Description** for more information on works related to onshore infrastructure and National Grid connections.

15. EN-1 states in paragraph 4.1.5 that:

"*Other matters that the Infrastructure Planning Commission (IPC) may consider important and relevant to its decision-making may include Development Plan Documents or other documents in the Local Development Framework. In the event of a conflict between these or any other documents and an NPS, the NPS prevails for the purposes of IPC decision making given the national significance of the infrastructure*".

21.2.4. Noise and Soundscape Action Plan for Wales 2018-2024 (Draft)

16. The Preface to the 2018 Draft revision states:

"*Under the Environmental Noise Regulations, the Welsh Ministers have an obligation to draw up action plans for places near major roads and major railways, and for agglomerations. The Regulations apply to environmental noise to which humans are exposed in particular in built-up areas, in public parks or other quiet areas in an agglomeration, and near schools, hospitals and other noise-sensitive buildings and areas*."

21.2.5. Planning Policy Wales, 2018

17. The Planning Policy Wales (PPW) was originally published by the Welsh Government in 2002 and sets the context for planning in Wales, under which Local Planning Authorities prepare their statutory Development Plans. It is the principal and authoritative source of national planning policy.

18. Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government (WG). The planning policy is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales.

19. Updates to the national planning policy are issued for consultation and then incorporated into the latest version of PPW. Planning Policy Wales (Edition 10) is the latest version of PPW and stipulates the following in relation to noise:

20. Paragraph 6.7.6 states the following in relation to noise issues arising from new developments:

"*6.7.6 - 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".

21.2.6. Technical Advice Note (Wales) 11, 1997

21. TAN11 contains noise specific guidance and recommends that it is read in conjunction with Planning Guidance (Wales). The document considers controls for noise generating and noise-sensitive developments (construction and operational), mitigation measures, provides examples of assessment of noise from different sources, and details noise exposure categories (NECs) for dwellings.

22. Further standards and guidance are referenced which are superseded; BS4142:1990, BS8233:1987, BS5228 Parts 1-4:1984.

21.3. LOCAL PLANNING POLICY

23. The onshore development area also falls within the jurisdiction of Isle of Anglesey County Council (IoACC).

21.3.1. Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026

24. Isle of Anglesey County Council stipulates the following noise impacts policy:

Policy PCYFF 2: Development Criteria – Planning permission will be refused where the proposed development would have an unacceptable adverse impact on:

"*7. The health, safety or amenity of occupiers of local residences, other land and property uses or characteristics of the locality due to increased activity, disturbance, vibration, noise, dust, fumes, litter, drainage, light pollution, or other forms of pollution or nuisance*."

25. **Table 21-2** sets out national and regional policies that are of relevance to Noise and Vibration.

Table 21-2 National and Regional Policy Requirements Relevant to Noise and Vibration

Policy Description	Reference	ES Reference
MPS		
Noise from marine activities can also affect people. An EU Directive on Environmental Noise (EU 2002/49/EC) that deals with noise impacts on people is currently under review. Excessive noise can have wide ranging impacts on the quality of human life, health, and use and enjoyment of areas, including those with high visual quality. Its impact therefore needs to be considered and managed appropriately.	2.6.3.3	Refer to **Section 21.6** for the assessment methodology for assessing potential noise and vibration impacts, **Section 21.8** for details on the existing noise environment including the identification of noise sensitive receptors and **Section 21.9** where any changes in noise levels as a result of the Project are assessed, and any potential impacts and potential mitigation measures are identified.
Planning Policy Wales		
The planning system must protect amenity and it is not acceptable to rely on statutory nuisance under the Environmental Protection Act 1990 to do so.	6.7.3	The current relevant British Standards (BS) have been used within this assessment detailed within **Section 21.4**.
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.	6.7.6	The baseline noise survey detailed in **Section 21.8** and **Appendix 21.1** (**Volume III**) outlines the existing soundscape within the study area of the Project. The impact assessment is presented in **Section 21.10**.
To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment	6.7.7	The Existing Environment with regards to Noise is

Policy Description	Reference	ES Reference
to be undertaken by a suitably qualified and competent person on behalf of the developer.		presented in **Section 21.7**.
Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose,	6.7.8	A Construction Noise Management Plan will be produced in line with The Control Of Pollution Act and BS 5228 (**Section 21.10.7**).
Relevant considerations in making planning decisions for potentially polluting development are likely to include: • the risk and impact of potential pollution from the development, insofar as this might lead to the creation of, or worsen the situation in, an air quality management area, a noise action planning priority area or an area where there are sensitive receptors; and	6.7.16	Menter Môn has committed to providing a final design of the Project which is able to meet the rigorous standards of low noise emissions expected by both the UK regulatory bodies and stakeholders. (**Para. 213**)
The potential impacts of noise pollution arising from existing development, be this commercial, industrial, transport related or cultural venues (such as music venues, theatres or arts centres), must be fully considered to ensure the effects on new development can be adequately controlled to safeguard amenity and any necessary measures and controls should be incorporated as part of the proposed new development.	6.7.24	Please see the impact assessment (**Sections 21.10, 21.11** and **21.12**) and the Cumulative Impact Assessment (**Section 21.13**).
Planning authorities should identify areas of cultural or historic importance to be given special consideration in terms of soundscape where this may be necessary to safeguard the vibrancy of places or provide tranquil, restorative environments within busy built-up areas.	6.7.25	Noise Sensitive Receptors are defined in **Section 21.6**.
Anglesey and Gwynedd Joint Local Development Plan (JLDP)		
Planning permission will be refused where the proposed development would have an unacceptable adverse impact on the health, safety or amenity of occupiers of local residences, other land and property uses or characteristics of the locality due to increased activity, disturbance, vibration, noise, dust, fumes, litter, drainage, light pollution, or other forms of pollution or nuisance	Policy PCFF 2: Development Criteria	An impact assessment on residential and commercial areas is presented in **Sections 21.10, 21.11** and **21.12.**
1. All impacts on landscape character, heritage assets and natural resources have been adequately mitigated, ensuring that the special qualities of all locally, nationally and internationally important landscape, biodiversity and heritage designations, including, where appropriate, their settings are conserved or enhanced; 3. That the proposal is mitigated to ensure that there aren't any significant unacceptable effects on sensitive uses located nearby;	Policy ADN 3: Other Renewable Energy and Low Carbon Technologies	An impact assessment and proposed mitigation measures are for residential and commercial areas is presented in **Sections 21.10, 21.11** and **21.12.**
Wellbeing of Future Generations (Wales) Act 2015		

Policy Description	Reference	ES Reference
A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).	A resilient Wales	See **Section 21.9** for the impact assessment results.

21.4. GUIDANCE

26. The guidance in the following sections has been applied to the noise and vibration assessment. Planning Policy Wales and supporting guidance (TAN11) refer to some standards which have been revised, and thus superseded, i.e. BS4142:1997 was replaced with BS4142:2014. Further changes were included in a 2019 amendment. Where a revision has occurred, the assessment herein relates to the most recent published document.

21.4.1. British Standard (BS) 4142:2014+A1:2019 – Method for Rating and Assessing Industrial and Commercial Sound

27. BS4142:2014+A1:2019 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incidental.

21.4.2. BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise

28. Part 1 of this Standard provides recommendations for basic methods of noise and vibration control relating to construction and open sites where work activities/operations generate significant noise and/or vibration levels. The legislative background to noise and vibration control is described and recommendations are given regarding procedures for the establishment of effective liaison between developers, site operators and local authorities. This British Standard provides guidance on methods of predicting and measuring noise and assessing its impact on those exposed to it.

21.4.3. BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration

29. Part 2 of this Standard gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels. The Standard includes tables of vibration levels measured during piling operations throughout the UK. It provides guidance concerning methods of mitigating vibration from construction, particularly with regard to percussive piling.

21.4.4. BS 6472-1:2008 – Guide to Evaluation of Human Exposure to Vibration in Buildings

30. This standard provides general guidance on human exposure to building vibration in the range of 1Hz to 80Hz and includes curves of equal annoyance for humans. It also outlines the measurement methodology to be employed. It introduces the concept of Vibration Dose Value (VDV) and estimated Vibration Dose Value (eVDV) for the basis of assessment of the severity

of impulsive and intermittent vibration levels, such as those caused by a series of trains passing a given location.

21.4.5. BS 7445: Parts 1 and 2 – Description and Measurement of Environmental Noise

31. This Standard provides details of the instrumentation and measurement techniques to be used when assessing environmental noise and defines the basic noise quantity as the continuous A-weighted sound pressure level (LAeq). Part 2 of BS 7445 replicates International Standards Organisation (ISO) 1996-2.

21.4.6. BS 8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings

32. This Standard provides a methodology to calculate the noise levels entering a building through facades and facade elements and provides details of appropriate measures for sound insulation between dwellings. It includes recommended internal noise levels which are provided for a variety of situations and are based on World Health Organisation (WHO) recommendations.

21.4.7. Calculation of Road Traffic Noise (CRTN) 1988

33. The Calculation of Road Traffic Noise (CRTN) document provides a method for assessing noise from road traffic in the UK and a method of calculating noise levels from the Annual Average Weekday Traffic (AAWT) flows and from measured noise levels. Since publication in 1988 this document has been the nationally accepted standard in predicting noise levels from road traffic. The calculation methods provided include correction factors to take account of variables affecting the creation and propagation of road traffic noise, accounting for the percentage of heavy goods vehicles (HGV), different road surfacing, inclination, screening by barriers and relative height of source and receiver.

21.4.8. Design Manual for Roads and Bridges, 2011

34. Volume 11, Part 3, Section 7 provides guidance on the environmental assessment of noise impacts from road schemes. The Design Manual for Roads and Bridges (DMRB) contains advice and information on transport-related noise and vibration, which has relevance regarding the construction and operational traffic impacts affecting sensitive receptors adjacent to road networks. It also provides guideline significance criteria for assessing traffic related noise impacts.

21.4.9. ISO 3744

35. ISO 3744 specifies a method for measuring the sound pressure levels on a measurement surface enveloping a noise source, under essentially free field conditions near one or more reflecting planes, to calculate the sound power level produced by the noise source.

21.4.10. ISO 717

36. ISO 717 defines single-number quantities for airborne sound insulation in buildings and of building elements such as walls, floors, doors, and windows.

21.4.11. ISO 9613-2

37. ISO 9613 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 noise source.

21.4.12. WHO (1999) Guidelines for Community Noise

38. These guidelines present health-based noise limits intended to protect the population from exposure to excess noise. They present guideline limit values at which the likelihood of particular effects, such as sleep disturbance or annoyance, may increase. The guideline values are 50 or 55 dB L_{Aeq} during the day, related to annoyance, and 45 dB L_{Aeq} or 60 dB L_{Amax} at night, related to sleep disturbance.

39. The Guidance states:

"*The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 dB L_{Aeq} for continuous noise and 45 dB L_{Amax} for single sound events. Lower noise levels may be disturbing depending on the nature of the source*."

40. The WHO guidance also highlights that:

"*Night-time, outside sound levels about 1 metre from facades of living spaces should not exceed 45 dB L_{Aeq}, so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15 dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35 dB L_{Aeq}. To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development*."

21.4.13. WHO (2009) Night Noise Guidelines for Europe

41. In 2009, the WHO published the Night Noise Guidelines for Europe, which it describes as an extension to the WHO Guidelines for Community Noise (1999). It concludes that:

"*Considering the scientific evidence on the thresholds of night noise exposure indicated by L_{night} outside as defined in the Environmental Noise Directive (2002148/EC), an L_{night} outside of 40 dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. L_{night} outside value of 55 dB is recommended as an interim target for those countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach*."

21.4.14. WHO (2018) Environmental Noise Guidelines for the European Region

42. The guidance states:

"*The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. They provide robust public health advice underpinned by evidence, which is essential to drive policy action that will protect communities from the adverse effects of noise*."

21.4.15. Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment (2014)

43. This Institute of Environmental Management and Assessment (IEMA) guidance states:

"The NPPF/NPF/PPW/SPSS do not contain specific policies for nationally significant infrastructure projects for which particular considerations apply. These are determined in England and Wales in accordance with the decision-making framework set out in the Planning Act 2008 and relevant national policy statements for major infrastructure, as well as any other matters that are considered both important and relevant (which may include the National Planning Policy Framework). National policy statements form part of the overall framework of national planning policy, and are a material consideration in decisions on planning applications."

44. The IEMA guidance discusses concepts from toxicology which are being applied to noise impacts for EIA guidelines:

- LOAEL – Lowest Observed Adverse Effect Level; this is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant Observed Adverse Effect Level which is defined as the level above which significant effects on health and quality of life occur.

21.5. CONSULTATION

45. Consultation is a key part of the EIA process and is an ongoing process throughout the lifecycle of the Project, from the initial stages through to consent and post-consent.

46. Full details of the Project consultation process are presented within **Chapter 6, Consultation**. A scoping report was issued in 2015, 2017 and 2018.

47. A summary of the consultation undertaken for the Project and scoping opinion responses received specific to noise and vibration is provided in **Table 21-3**.

Table 21-3 Consultation Responses

Consultee	Date/Document	Comment	Response
IoACC - EHO	25 March 2019 Telephone call between Royal HaskoningDHV and IoACC	Telephone conversation to discuss baseline measurement survey and assessment approach.	N/A

Consultee	Date/Document	Comment	Response
IoACC - EHO	25 March 2019 Email sent to Royal HaskoningDHV from IoACC	Email follow up from Major Consents Planning Manager to Royal HaskoningDHV stating the relevant EHO will be in contact 26 March 2019.	N/A
IoACC - EHO	26 March 2019 Email sent to Royal HaskoningDHV from IoACC	Email follow up from EHO providing contact details.	N/A
IoACC - EHO	26 March 2019 Email sent from Royal HaskoningDHV to IoACC	Email follow to EHO providing baseline measurement survey and assessment approach.	N/A
IoACC - EHO	26 March 2019 Email sent to Royal HaskoningDHV from IoACC	Email follow up from EHO providing comments. Approval of methodology BS4142:2014 and BS5228:2009+A1:2014. Highlight the use of TAN11. Increase measurement period from 30 minutes to 1 hour at the 4 cable corridor locations. Use of 1/3rd Octave Band measurements.	Consultation with the Environmental Health Officers at Isle of Anglesey County Council was undertaken. Details are provided in **Appendix 21.4** (**Volume III**). A baseline noise survey was undertaken at various locations representative of the nearest sensitive receptors as agreed with the relevant local authorities. Full details in **Appendix 21.2** (**Volume III**) and Section 21.8.
Planning Inspectorate	2018 Scoping	"Site-specific survey and noise sensitive receptors: It is recommended that the baseline survey and assessment methodology and choice of NSRs should be agreed with the relevant Environmental Health Officers. The choice of receptors and assessment of impacts arising during construction and operation should be based on a justified worst case scenario."	Consultation with the Environmental Health Officers at Isle of Anglesey County Council was undertaken. Details provided in **Appendix 21.4** (**Volume III**). A baseline noise survey was undertaken at various locations representative of the nearest sensitive receptors as agreed with the relevant local authorities. Full details in **Appendix 21.2** (**Volume III**) and **Section 21.8**.
Planning Inspectorate	2018 Scoping	"Operational impacts: With the exception of noise arising from activities at Holyhead Harbour, Table 9-8 of the Scoping Report does not consider noise during operation. It is agreed that operational noise from movement of the offshore TECs would be unlikely	Refer to **Section 21.7.5**.

Consultee	Date/Document	Comment	Response
		to result in significant effects to onshore receptors. Similarly, having regard to the characteristics of the Proposed Works, operation of the electrical connection is unlikely to result in significant effects. However, in absence of a defined location for the onshore substation(s) and potential switch gear facility, it is considered that the ES should assess potential operational noise and vibration impacts from the substation. It is also noted that Section 9.12 (Health) of the Scoping Report proposes to assess noise disturbance from operation of the substation and National Grid infrastructure."	
Planning Inspectorate	2018 Scoping	"Noise generating activities: The ES should provide a description of the noise generating elements of the Proposed Works during both the construction and operation stages. Any distinctive tonal, impulsive or low frequency characteristics of the noise should be identified and assessed"	Refer to **Section 21.7.1** for Construction. Refer to **Section 21.7.5** for Operational.
Planning Inspectorate	2018 Scoping	"Impacts to ecological receptors: The results of the noise and vibration assessment should be used to inform the assessment of impacts on ecological receptors."	Not covered in this Chapter. Refer to **Chapter 19, Onshore Ecology**.
NRW	2018 Scoping	We currently have no comments to make on this topic.	Not Applicable.

21.6. METHODOLOGY

21.6.1. Study Area

48. The study area for this noise and vibration assessment comprises the entire onshore development area, as described in **Chapter 4, Project Description** and as shown in **Figure 21.1** (**Volume II**). Noise measurement positions (for the baseline survey) and noise receptor locations identified within the study area can be found in **Figure 21.1** (**Volume II**) and **Section 21.6.4**.

49. The study area for the Landfall Substation, onshore cable route, Switchgear Building and Grid Connection Substation and identified traffic routes (Onshore Development Area) are located within the administrative region of IoACC.

50. The extent of the study area for the construction phase road traffic noise and vibration assessment was based on details provided in **Chapter 23, Traffic and Transport**.

51. This noise and vibration assessment draws on the information provided within **Chapter 4, Project Description** in order to define worst case assumptions which are outlined in **Section 21.9**. These assumptions have been used in the noise and vibration impact assessments in **Section 21.9**.

21.6.2. Data Sources

52. In order to inform this assessment, consideration of the project infrastructure and surrounding environment within the onshore development area utilised existing available geographical information including aerial and satellite photography and mapping data. This data was used in order to determine the nearest noise sensitive receptors (NSRs) or groups of receptors and noise sources present within the study area for use in the assessment.

53. The data sources used and their associated confidence levels which informed the desk-based assessment are provided in **Table 21-4**.

Table 21-4 Data Sources

Data	Year	Coverage	Confidence
Google Maps Aerial Photography	2018	Noise and Vibration study area	High
OS Mastermap	2019	Noise and Vibration study area	High
NRW Open Licence LIDAR data	2018	Noise and Vibration study area	High
OS 5050	2019	Noise and Vibration study area	High
Construction Phasing	2019	Landfall: Duct installation including HDD works; and Cable pulling, jointing and commissioning. Onshore cable route: Duct installation works; and Cable pulling, jointing and commissioning. Landfall Substation: Temporary works; Onshore infrastructure installation and commission.	High
Operational	2019	Landfall Substation	High

54. The boundary of the Onshore Development Area is illustrated in **Figure 1-2** (**Volume II**). This a complex terrestrial boundary and will therefore not be represented as co-ordinates in this chapter.

55. Landfall will be located within the bay on the western coast of Holy Island known as ‘Abraham’s Bosom’. The landfall consists of exposed rocky shore, backed by a hinterland of coastal heath and farmland. The landfall substation location is currently farmed land in the area of Holy Island known as Penrhos Feilw.

56. From the Landfall Substation the majority of the onshore cable will be trenched within the existing minor road network (**Figure 1-2, Volume II**). The proposed cable corridor follows South Stack Road, Porthdafarch Road and Mill Road towards the Switchgear Building.

57. The cable will be trenched from the Switchgear Building to the Grid Connection Substation, with a section installed via Horizontal Directional Drilling (HDD) beneath the A55 and the Holyhead to Bangor rail line.

58. The Landfall Substation is located in an area rural in nature near Abraham's Bosom, close to South Stack Road. South Stack Road is a minor road through Anglesey (see **Chapter 23, Traffic and Transport** for more details).

59. The Switchgear Building is close to the A55, a major road link, with the A5 further to the north. The immediate area is generally undeveloped or commercial property, with a retail park on the opposite side of the A55 to the north. The area detailed as Kingsland and Holyhead form the largest concentration of residential properties. Smaller villages and individual residential properties are also located within the study area.

60. The Grid Connection Substation is proposed on the former Anglesey Aluminium Metal Limited works between the A55 located to the south and the A5 situated to the north. The nearest residential properties are approximately 300m to the north along the London Road. Identified NSRs are detailed in **Section 21.6.4**.

21.6.3. Anticipated Trends in Baseline Conditions

61. The baseline noise survey detailed in **Section 21.8** and **Appendix 21.1** (**Volume III**) outlines the existing soundscape within the study area of the Project. Noise is managed and driven by EU, UK and local legislation and policies. The UK's noise strategy and standards are enacted through management actions at a local authority level as detailed in **Section 21.2**. There is a policy trend towards the achievement and maintenance of the noise environment across the UK, which is reflected in the local planning policies detailed in **Sections 21.2.4**, **21.2.5**, **21.2.6**, and **21.3**.

62. Predicted noise levels due to a change in land use, new developments and associated vehicles are assessed as part of the development planning and consent process. Potential impacts to the prevailing soundscape should be minimised, avoided, or mitigated to suitable levels (in accordance with current legislation, policy and guidance), avoiding an adverse impact, where possible. In addition to planning controls there is a clear trend for noise from vehicle, commercial and industrial sources to be reduced, in compliance with stricter legislation and guidance. Consequently, in relation to the Project and its immediate receiving environment it is reasonable to predict a general steady baseline soundscape would be maintained.

21.6.4. Data Sources – Desk Study

63. Consideration of the project infrastructure and surrounding environment within the onshore development area was used in order to determine the nearest NSRs present within the study area for use in the assessment. The nearest sensitive receptors are detailed in **Table 21-5** and on **Figure 25.1** (**Volume II**).

Table 21-5 Noise Sensitive Receptors – Landfall Substation, Grid Connection Substation and Switchgear Building

Assessment Receptor Identifier	Baseline Noise Survey Identifier	Classification	Location	Coordinates	
				X	Y
NSR1	LF1	Residential	Landfall Substation	221542.4	381627.0
NSR2	LF1	Residential		221933.5	381573.0
NSR3	LF1	Residential		221688.5	381846.5
NSR4	LF1	Residential		221439.3	381740.8
NSR5	SS2	Residential	Switchgear Building and Grid Connection Substation	226395.7	380082.0
NSR6	SS1	Residential		227059.5	381056.4
NSR7	SS1	Residential		227115.4	381161.0
NSR8	SS2	Residential/Hotel		225300.3	381080.6
NSR9	SS1	Residential		227015.9	381265.4
NSR10	SS2	Residential		225974.2	380222.6

21.6.1. Data Sources – Site-Specific Surveys and Reports

64. Measurements of the existing ambient noise level were required to be taken at locations considered representative of nearby NSRs that had the potential to be affected by the construction and operation of the Project.

65. Further details of the baseline noise survey are discussed in **Section 21.8** and full details can be found in **Appendix 21.1** (**Volume III**).

21.7. IMPACT ASSESSMENT METHODOLOGY

66. This section presents the potential noise impacts associated with the construction and operation of the Project.

21.7.1. Construction Phase Noise Assessment

67. BS 5228:2009+A1:2014 describes several methods for assessing noise impacts during construction projects.

68. The approach outlined and utilised in this ES chapter is the threshold based 'ABC' method. The method, as detailed within BS 5228, specifies a construction noise limit based on the existing ambient noise level and for different periods of the day. The predicted construction noise levels were assessed against noise limits derived from advice within Annex E of BS 5228. **Table 21-6**, reproduced from BS 5228:2009+A1:2014 Table E.1, presents the criteria for selection of a noise limit for a specific receptor location.

Table 21-6 Construction Noise Threshold Levels Based on the ABC Method (BS 5228)

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A[A)]	Category B[B)]	Category C[C)]
Night time (23.00 – 07.00)	45	50	55
Evenings and weekends D)	55	60	65

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A[A)]	Category B[B)]	Category C[C)]
Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00)	65	70	75
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.			

69. The 'ABC method' described in BS 5228 establishes that there is no impact below the three thresholds presented above.

70. BS 5228 states:

"*If the site noise level exceeds the appropriate category 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*."

71. The SoundPLAN construction noise model used in the assessment of cumulative Landfall Substation works, Switchgear Building and cumulative Grid Connection Substation works incorporated noise sources located in the study area, nearby residential dwellings and other buildings, intervening ground cover and topographical information.

72. Noise levels for the construction phase were calculated using the methods and guidance in BS 5228. This 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; and
- Ground type.

73. Construction noise impacts were assessed using the impact magnitude presented in **Table 21-7** for the daytime period, **Table 21-8** for the evening and weekend periods, and **Table 21-9** for the night time.

Table 21-7 Day Time Construction Noise Significance Criteria

Impact magnitude	Construction noise level (dB)		
	A 65 dB threshold	B 70 dB threshold	C 75 dB threshold
No Impact	<65	<70	<75
Negligible Adverse	>65.1 - <65.9	>70.1 - <70.9	>75.1 - <75.9
Minor Adverse	>66.0 - <67.9	>71.0 - <72.9	>76.0 - <77.9

Impact magnitude	Construction noise level (dB)		
	A 65 dB threshold	B 70 dB threshold	C 75 dB threshold
Moderate Adverse	>68.0 - <69.9	>73.0 - <74.9	>78.0 - <79.9
Major Adverse	>70	>75	>80

Table 21-8 Evening and Weekends Construction Noise Significance Criteria

Impact magnitude	Construction noise level (dB)		
	A 55 dB threshold	B 60 dB threshold	C 65 dB threshold
No Impact	<55	<60	<65
Negligible Adverse	>55.1 - <55.9	>60.1 - <60.9	>65.1 - <65.9
Minor Adverse	>56.0 - <57.9	>61.0 - <62.9	>66.0 - <67.9
Moderate Adverse	>58.0 - <59.9	>63.0 - <64.9	>68.0 - <69.9
Major Adverse	>60	>65	>70

Table 21-9 Night Time Construction Noise Significance Criteria

Impact magnitude	Construction noise level (dB)		
	A 45 dB threshold	B 50 dB threshold	C 55 dB threshold
No Impact	<45	<50	<55
Negligible Adverse	>45.1 - <45.9	>50.1 - <50.9	>55.1 - <55.9
Minor Adverse	>46.0 - <47.9	>51.0 - <52.9	>56.0 - <57.9
Moderate Adverse	>48.0 - <49.9	>53.0 - <54.9	>58.0 - <59.9
Major Adverse	>50	>55	>60

74. A proposed construction phase programme is provided in **Chapter 4, Project Description**. Noise modelling scenarios considered in the assessment are:

- Cumulative Landfall Substation HDD works, temporary works areas, temporary access tracks, duct installation concurrently during the daytime;
- HDD works at Landfall Substation during the night time;
- Cumulative Grid Connection Substation HDD works, temporary works areas, temporary access tracks, duct installation, Switchgear Building concurrently during the daytime; and
- HDD works at Grid Connection Substation during the evening and night time.

75. Noise propagation calculations were undertaken for the indicated activities expected along the cable corridor:

- Duct installation during the daytime only; and
- Cable pulling during the daytime only.

76. Noise measurements were taken at representative locations at the Landfall Substation search area, Grid Connection Substation and Switchgear Building search areas, and along the cable route during the baseline survey. These noise levels were used to determine the 'ABC' threshold category in accordance with BS5228:2009+A1:2014 for use in the assessment and are detailed in **Table 21-10**.

Table 21-10 BS5228 Threshold Category

Baseline Noise Survey Identifier	Classification	Location	BS5228 'ABC' threshold category (limit)		
			Daytime	Evening and Weekends	Night time
LF1	Residential	Landfall Substation	A (65)	A (55)*	C (55)
LF2	Residential		A (65)	A (55)*	C (55)
CC1	Residential	Cable Corridor	A (65)	A (55)*	B (50)[1]
CC2	Residential	Cable Corridor	A (65)	A (55)*	B (50)
CC3	Residential	Cable Corridor	A (65)	A (55)*	C (55)
CC4	Residential	Cable Corridor	A (65)	A (55)*	C (55)
SS1	Residential	Switchgear Building/Grid Connection Substation	A (65)	A (55)*	C (55)
SS2	Residential		A (65)	A (55)*	C (55)[2]
*taken as the lowest category based on daytime measurements [1]taken from CC2 measurement, [2]taken from SS1 measurement					

21.7.2. Assumptions and Indicative Plant List

77. Based on **Chapter 4, Project Description**, an indicative list of construction equipment has been developed and is detailed in **Table 21-11** to **Table 21-15**.

Table 21-11 Construction Noise – Grid Connection Substation and Landfall Substation

Name	No.	Source Type	BS5228 Reference	LwA dB(A)	On time Correction
Tracked Excavator	2	Point	C2.17	103.9	75 %
Backhoe Loader	2	Point	C2.8	95.8	75 %
Bulldozer	2	Point	C2.11	106.9	75 %
Dumper	2	Point	C2.32	101.9	75 %
Mobile Crane	2	Point	C4.38	106.2	75 %
Cement Mixer Truck (Discharging)	1	Point	C4.18	103.1	50 %
Truck Mounted Concrete Pump and Boom Arm	1	Point	C4.32	105.8	50 %

Table 21-12 Construction Noise – Duct Installation (per Workfront)

Name	No.	Source Type	BS5228 Reference	LwA dB(A)	On time Correction
Bulldozer	1	Point	C2.11	106.9	75 %
Dump Truck	1	Point	C2.30	107.0	75 %
Tracked Excavator	1	Point	C2.17	103.9	75 %

Name	No.	Source Type	BS5228 Reference	LwA dB(A)	On time Correction
Generator	1	Point	C4.76	89.4	100 %
Water Pump	1	Point	C2.45	93.1	75 %
Dump Truck	1	Point	C2.30	107.0	50 %
Lorry	1	Point	C4.53	104.9	50 %

Table 21-13 Construction Noise – Temporary Access Tracks and Pre-Construction Works

Name	No.	Source Type	BS5228 Reference	LwA dB(A)	On time Correction
Bulldozer	1	Point	C2.11	106.9	75 %
Tracked Excavator	1	Point	C2.17	103.9	75 %
Dump Truck	1	Point	C2.30	107.0	75 %
Asphalt spreader and road roller*	1	Point	C5.33	103.6	75 %
*Permanent access road to Landfall Substation only					

Table 21-14 Construction Noise – Trenchless Crossing (including Landfall Works and Grid Connection Substation Works)

Name	No.	Source Type	BS5228 Reference	LwA dB(A)	On time Correction
Tracked Excavator	1	Point	103.9	107	50 %
Backhoe Loader*	1	Point	95.8	96	50 % (25 %)*
Bulldozer	1	Point	106.9	108	50 %
Dumper*	1	Point	101.9	101	50 % (25 %)*
Mobile Crane	1	Point	106.2	106	25 %
Cement Mixer Truck (Discharging)	1	Point	103.1	103	25 %
Truck Mounted Concrete Pump and Boom Arm	1	Point	105.8	108	25 %
Drilling Rig*	1	Point	105.0	105	75 % (75 %)*
Water Pump*	1	Point	93.1	93	75 % (75 %)*
Generator*	1	Point	89.4	105	100 % (100 %)*
*Plant to be utilised would be limited to that at a trenchless crossing and outside of normal working hours					

Table 21-15 Construction Noise – Cable Pulling (per Workfront)

Name	No.	Source Type	BS5228 Reference	LwA dB(A)	On time Correction
Conveyor Drive Unit	1	Point	C10.22	97.2	100 %
Field Conveyor (Rollers)	2	Point	C10.23	80.5	100 %
Tracked Excavator	1	Point	C2.17	103.9	50 %
Cement Mixer Truck (Discharging)	1	Point	C4.18	103.1	50 %

Name	No.	Source Type	BS5228 Reference	LwA dB(A)	On time Correction
Dump Truck	1	Point	C2.30	107.0	50 %
Water Pump	1	Point	C2.45	93.1	75 %
Generator	1	Point	C4.76	89.4	100 %

21.7.3. Road Traffic Noise and Vibration Emissions Assessment

78. Following the methodology contained in DMRB (Volume 11, Section 3, Chapter 3) an initial screening assessment was undertaken to assess whether there would be any significant changes in traffic volume and composition on surrounding local roads as a result of the Project. Any road links with a predicted increase in traffic volume of 25 % or a decrease of 20 % were identified. Such changes in traffic volume would correspond to a 1 dB(A) change in noise level at the relevant road link. A change in noise level of less than 1 dB(A) is regarded as being imperceptible in the short term and, therefore, of negligible magnitude. If there are no increases greater than 25 % or a decrease of 20 % or greater, then the DMRB guidance indicates that no further assessment needs to be conducted.

79. Links showing an increase of greater than 25 % were assessed following the Basic Noise Level (BNL) calculation procedure within CRTN to predict a dBA change for each link. The calculation also incorporates a correction for mean traffic speed and the percentage of heavy vehicles.

80. Construction phase road link dBA change was assessed using the impact magnitude criteria in **Table 21-16**. The thresholds for differentiating the criteria are taken from DMRB for short-term impacts and are an indication of the relative change in ambient noise as a result of the Project.

Table 21-16 Magnitude Criteria for Relative Change Due to Road Traffic (Short Term)

Change in noise level ($L_{A10\ (18\ hour)}$ dB)	Impact magnitude
0.0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0+	Major

81. Screening of the baseline 2021 versus baseline 2021 (including development) road traffic flows was undertaken, in accordance with DMRB for the identified study area links during the construction phase and is detailed in **Table 21-17**.

Table 21-17 Screening of 18hr AAWT Road Traffic Flows and % Change Due to Construction (Short Term)

Link ID	Link Description	Speed (km/h)	Baseflows 2021		Baseflows 2021 + 'with development'		Change	
			18hr AAWT Total flows	Number HGVs	18hr AAWT Total flows	Number HGVs	18hr AAWT Total flows	Number HGVs
1	A5 London Road	60.0	6,735	139	6,833	179	1.5 %	**28.8 %**

Link ID	Link Description	Speed (km/h)	Baseflows 2021		Baseflows 2021 + 'with development'		Change	
			18hr AAWT Total flows	Number HGVs	18hr AAWT Total flows	Number HGVs	18hr AAWT Total flows	Number HGVs
2	A55 North Wales Expressway	70.0	12,037	968	12,217	1,008	1.5 %	4.1 %
3	A55 North Wales Expressway / Victoria Road	50.0	13,361	1,075	13,469	1,095	0.8 %	1.9 %
4	A5154	30.0	3,368	70	3,476	90	3.2 %	**28.6 %**
5	Market Street / Thomas Street / S Stack Road	25.9	3,382	101	3,490	121	3.2 %	19.9 %
6	Unnamed Road from Ty Mawr in South Stack to Penrhos Feliw	30.3	437	9	469	17	7.3 %	**93.4 %**
7	Longford Road / Plas Road	17.1	500	7	500	7	0.0 %	0.0 %
8	Unnamed Road from Penrhos Feliw to Porthdafarch Road	30.3	437	9	469	17	7.3 %	**93.4 %**
9	Lon Isalit	27.0	993	20	993	20	0.0 %	0.0 %
10	Lon Towyn Capel	28.3	1,215	339	1,273	367	4.8 %	8.2 %
11	Longford Road / Plas Road	43.2	1,942	114	1,974	122	1.6 %	7.0 %
12	A5153	30.0	8,745	188	8,875	236	1.5 %	**25.6 %**
13	B4545 Kingsland Road / Lon St Ffraid	34.6	4,173	145	4,173	145	0.0 %	0.0 %

82. For the assessment year 2021 'with development', road network links (1, 4, 6, 8, and 12) have been identified through the screening exercise as resulting in a change in composition or flow exceeding the DMRB criteria of -20 % to >25 %. Therefore, the CRTN Basic Noise Level (BNL) calculation procedure was followed to predict a dBA change for each link.

83. Any impacts would be temporary in nature. A Traffic Management Plan (TMP) will be developed to ensure that the spatial and temporal impacts associated with the construction phase are minimised. An Outline Traffic Management Plan (OTMP) has been prepared and submitted as part of **Chapter 23, Traffic and Transport**.

21.7.4. Construction Phase Vibration Assessment

84. 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, however vibration levels have to be of a significant magnitude for this effect to be manifested and such cases are rare.

85. High vibration levels generally arise from 'heavy' construction works such as piling, deep excavation, or dynamic ground compaction. The use of piling during the construction of the Landfall Substation may be required.

86. 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 a number of other parameters for vibratory compaction, dynamic compaction, percussive and vibratory piling, the vibration of stone columns and tunnel boring operations. These prediction equations are based on the energy approach. Use of these empirical formulae enables resultant PPV to be predicted and for some activities (vibratory compaction, vibratory piling and vibrated stone columns) they can provide an indicator of the probability of these levels of PPV being exceeded.

87. The empirical equations for predicting construction-related vibration provide estimates in terms of PPV. Therefore, the consequences of predicted levels in terms of human perception and disturbance can be established through direct comparison with the BS 5228-2:2009+1A:2014 guidance vibration levels.

88. Ground-borne vibration assessments may be drawn from the empirical methods detailed in BS 5228-2:2009+1A:2014, in the Transport and Road Research Laboratory (TRRL) 246: Traffic: Traffic induced vibrations in buildings, and within the Transport Research Laboratory (TRL) Report 429 (2000): Ground-borne vibration caused by mechanical construction works.

89. However, these calculation methods rely on detailed information, including the type and number of plant being used, their location and the length of time they are in operation. Given the mobile nature of much of the plant that has the potential to impart sufficient energy into the ground, and the varying ground conditions in the immediate vicinity of the construction works, it was considered that an accurate representation of vibration conditions using these predictive methods was not possible.

90. Consequently, a series of calculations, following the methodologies referred to above, were carried out based on typical construction activities that have the potential to impart sufficient energy into the ground, applying reasonable worst case assumptions in order to determine set-back distances at which critical vibration levels may occur.

91. Humans are very sensitive to vibration, which can result in concern being expressed at energy levels well below the threshold of damage. Guidance on the human response to vibration in buildings is found in BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings, Part 1, Vibration sources other than blasting.

92. BS 6472 describes how to determine the vibration dose value (VDV) from frequency-weighted vibration measurements. VDV is defined by the following equation:

$$VDV_{b/d,\ day/night} = (\int_0^T a^4(t)dt)^{0.25}$$

93. The VDV is used to estimate the probability of adverse comment which might be expected from human beings experiencing vibration in buildings. Consideration is given to the time of day and use made of occupied space in buildings, whether residential, office or workshop.

94. BS 6472 states that in homes, adverse comment about building vibrations is likely when the vibration levels to which occupants are exposed are only slightly above thresholds of perception.

95. BS 6472 contains a methodology for assessing the human response to vibration in terms of either the VDV, or in terms of the acceleration or the peak velocity of the vibration, which is also referred to as PPV. The VDV is determined over a 16-hour daytime period or 8-hour night-time period.

96. 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. For construction vibration, the vibration level and effects detailed in **Table 21-18** were adopted based on BS 5228. Limits for transient vibration, above which cosmetic damage could occur, are given numerically in terms of PPV.

Table 21-18 Transient Vibration Guide Values for Cosmetic Damage

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50mms-1 at 4Hz and above	
2	Un-reinforced or light framed structures Residential or light commercial type buildings	15mms-1 at 4Hz increasing to 20mms-1 at 15Hz	20mms-1 at 15Hz increasing to 50mms-1 at 40Hz and above

97. **Table 21-19** lists the minimum set-back distances at which vibration levels of reportable significance for other typical construction activities may occur. BS 5228 calculation methods were used to derive the set-back distances.

Table 21-19 Predicted Distances at Which Vibration Levels May Occur

Activity	Set-back distance at which vibration level (PPV) occurs			
	0.3 mm/s	1.0 mm/s	10 mm/s	15 mm/s
Vibratory Compaction (Start-up)	166m	65m	9m	6m
Vibratory Compaction (Steady State)	102m	44m	8m	6m
Percussive Piling	48m	19m	3m	2m
HGV Movement[1] on uneven Haul Route	277m	60m	3m	2m

[1] Vibration level based on an HGV moving at 5mph.

98. For construction vibration from sources other than blasting, the vibration level and effects presented in **Table 21-20** were adopted based on Table B-1 of BS 5228-2. These levels and effects are based on human perception of vibration in residential environments.

Table 21-20 Construction Vibration - Impact Magnitude

Vibration limit PPV (mm/s)	Interpreted significance to humans	Impact magnitude
<0.14	Vibration unlikely to be perceptible	No Impact
0.14 to 0.3	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction	Negligible - Adverse
0.3 to 1.0	Vibration might just be perceptible in residential environments	Minor – Adverse
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	Moderate – Adverse
>10.0	Vibration is likely to be intolerable for any more than a brief exposure to this level	Major – Adverse

21.7.5. Operation Phase Assessment

99. Where there are noise sources such as fixed plant associated with onshore assets, the most appropriate assessment guidance is BS4142:2014+A1:2019. The guidance describes a method of determining the level of noise of an industrial noise source and the existing background noise level.

100. BS4142:2014+A1:2019 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident, and combines procedures for assessing the impact in relation to:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

101. This standard is applicable to the determination of the following levels at outdoor locations:

"*a) rating levels for sources of sound of an industrial and/or commercial nature; and*

b) ambient, background and residual sound levels, for the purposes of:

1) investigating complaints;

2) assessing sound from existing, proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and

3) assessing sound at proposed new dwellings or premises used for residential purposes."

102. The standard is not intended to be applied to the assessment of indoor sound levels.

103. The standard incorporates a requirement for the assessment of uncertainty in environmental noise measurements and introduces the concepts of 'significant adverse impact' rather than likelihood of complaints. Common principles with the previous edition are the consideration of the characteristics of the sound under investigation, time of day and frequency of occurrence.

104. BS4142:2014+A1:2019 applies to industrial/commercial and background noise levels outside residential buildings and for assessing whether existing and new industrial/commercial noise sources are likely to give rise to significant adverse impacts on the occupants living in the vicinity.

105. Assessment is undertaken by subtracting the measured background noise level from the rating level; the greater this difference, the greater the magnitude of the impact.

106. BS4142+A1:2019 refers to the following:

"*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 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".

107. When assessing the noise from a source, which is classified as the Rated Noise Level, it is necessary to have regard to the acoustic features that may be present in the noise. Section 9.1 of BS 4142:2014+A1:2019 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*."

108. For clarity, an explanation of each penalty correction type (taken from BS4142:2014+A1:2019, page 13 and 14) is provided here:

Tonality

For sound ranging from not tonal to prominently tonal a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just

perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is impulsive. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Other sound characteristics

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

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 3 dB can be applied.

109. An operational assessment in accordance with BS4142:2014+A1:2019 has been undertaken for the Landfall Substation, Switchgear Building and Grid Connection Substation; the only noise sources associated with the operation phase.

110. Due to the separation distance and existing ambient soundscape, no penalty corrections for intermittency, tonality, other characteristics or impulsivity have been included at the Grid Connection Substation or Switchgear Building. These acoustic features are added based on perceptibility at the receptor location.

111. Due to the separation distance no penalty corrections for intermittency, impulsivity or other characteristics have been included at the Landfall Substation. A +2 dBA penalty for tonality (just perceptible at the noise receptor) has been included in the Rating Level.

112. An indicative layout of the Landfall Substation, Switchgear Building and Grid Connection Substation are detailed in **Appendix 21.3** (**Volume III**).

113. The determination of the specific sound level free from sounds influencing the ambient sound at the assessment location is obtained by measurement or a combination of measurement and calculation. This is to be measured in terms of the $L_{Aeq,T}$, where 'T' is a reference period of:

- 1 hour during daytime hours (07:00 to 23:00 hours); and
- 15 minutes during night-time hours (23:00 to 07:00 hours).

114. The assessment of noise from proposed fixed plant and infrastructure associated with the Project was considered at the nearest receptors.

115. To predict the noise from the operational aspects of the Project, SoundPLAN noise modelling software was utilised. The model incorporated proposed buildings based on elevation drawings,

proposed fixed plant and additional noise sources (such as temporary generating plant) associated with the Project. The model also included nearby residential dwellings and other buildings in the onshore development area, intervening ground cover and topographical information.

116. Noise levels for the operational phase were predicted at the same Noise Sensitive Receptor (NSR) locations detailed in **Table 21-5**. The calculation algorithm described in ISO 9613 was used in the operational noise propagation modelling exercise.

117. The magnitude of impacts based on a quantitative assessment of noise impact using BS 4142:2014+A1:2019 and applied to the operational assessment are summarised in **Table 21-21**.

Table 21-21 Operational Noise Impact Magnitude Criteria for Industrial/Commercial Noise Sources

Rating level ($L_{Ar, Tr}$ dB)	**Impact magnitude**
≤ Measured LA90	No impact
= Measured LA90 dB to +3 dB	Negligible
Measured LA90 + 3 dB to 5 dB	Minor
Measured LA90 + 5 dB to 9.9 dB	Moderate
≥ Measured LA90 + 10 dB	Major

21.7.6. Landfall Substation

118. The impact assessment has been undertaken using the proposed design for the components that could be used at the Landfall Substation and based on the fixed plant requirements detailed in **Chapter 4, Project Description** and presented in **Table 21-22**, **Table 21-23** and **Table 21-24**.

119. Operations at the Landfall Substation are proposed 24 hours a day. A detailed SoundPLAN noise model was created to assess noise levels as a result of the proposed plant required. Ground absorption was incorporated into the SoundPLAN model using a coefficient of 0.5 to represent the mixed ground between the sound sources and receiver for the topographical data.

Table 21-22 Modelled Noise Sources – Landfall Substation

Name/Description	**No. Of Units**	**Sound Power Level dB(A)**	**Sound Pressure Level dB(A)**	**Height (m)**	**On-time (%)**
Building Internal Reverberant Noise Level	3	N/A	85	7 (building maximum to apex)	100
Main External Transformers (3No. at 60MVA)	3	87	N/A	7.1 (maximum height)	100
Externally mounted auxiliary transformer (500kVA)	1	60	N/A	1.5	100
Backup diesel generator (200kVA, intermittent operation)	1	N/A	89	1.5	25
Annex located Cooler Fans (for converter cooling)	9	65	N/A	1.5	100

Name/Description	No. Of Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Height (m)	On-time (%)
Building 2 Air Conditioning Unit	1	79	N/A	1	100
Building 2 extract ventilation	1	N/A	50 at 3m	>2m	100
Building 1 extract ventilation	1	N/A	50 at 3m	>2m	100

120. Spectral data for plant included in the noise model of the Landfall Substation are detailed in **Table 21-23**.

Table 21-23 Frequency Spectrum 1/1 Octave – Landfall Substation Plant

Plant	Octave Band Centre Frequency (Hz)/ dB(A)							
	63	125	250	500	1K	2K	4K	8K
Building Internal Reverberant Noise Level	34	34	49	61	77	80	81	76
Annex located Coolers Fans	46	56	68	68	70	65	54	42
Backup Diesel Generator (200 kVA)	82	86	76	79	81	77	74	64
Building 2 Air conditioning Unit	51	61	73	73	75	70	59	47
Main external Transformers (60 MVA)	75	75	77	77	71	70	85	64
Externally mounted aux. Transformer (500 kVA)	55	56	49	45	42	35	33	51

121. Spectral sound reduction values included in the noise model for the Landfall Substation are detailed in **Table 21-24**.

Table 21-24 Landfall Substation Building Envelope Sound Reduction Index Frequency Spectrum 1/1 Octave

Element	Rw	Octave Band Centre Frequency (Hz)/ dB(A)							
		63	125	250	500	1K	2K	4K	8K
Building 1, 2, 3	41	10	20	29	43	48	56	57	47
Access to Building 1 Bay 1 to Bay 9	35	8	18	23	33	43	48	39	29
Acoustic Enclosure for Backup Diesel Generator (200 kVA)	32	5	15	20	28	37	43	40	30

21.7.7. Switchgear Building (Parc Cybi)

122. Operations at the Switchgear Building are proposed 24 hours a day. A detailed SoundPLAN noise model was created to assess noise levels as a result of the proposed plant required.

123. The impact assessment has been undertaken using the proposed design for the components that could be used at the Switchgear Building and presented in **Table 21-25** and **Table 21-26**.

Table 21-25 Modelled Noise Sources – Switchgear Building and Metering Annexe

Name/Description	No. Of Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Height (m)	On-time (%)
Switchgear Building Internal Reverberant Noise Level	1	N/A	85	4.0m (building maximum to apex)	100
Switchgear Building Metering Annexe Internal Reverberant Noise Level	1	N/A	85	3.5m (building maximum to apex)	100

Table 21-26 Switchgear Building and Annexe Building Envelope Sound Reduction Index Frequency Spectrum 1/1 Octave

Element	Rw	Octave Band Centre Frequency (Hz)/ dB(A)							
		63	125	250	500	1K	2K	4K	8K
Switchgear Building and Metering Annexe Building	48	30	34	37	42	49	55	65	62

21.7.8. Grid Connection Substation

124. Operations at the Grid Connection Substation are proposed 24 hours a day. A detailed SoundPLAN noise model was created to assess noise levels as a result of the proposed plant required.

125. The impact assessment has been undertaken using the proposed design for the components that could be used at the Grid Connection Substation and based on the fixed plant requirements detailed in **Chapter 4, Project Description** and presented in **Table 21-27**, **Table 21-28** and **Table 21-29**.

Table 21-27 Modelled External Noise Sources – Grid Connection Substation

Name/Description	No. Of Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Height (m)	On-time (%)
Battery storage system cast resin transformers (each at 1800kVA)	7	65	N/A	3.4 including concrete plinth	100
Battery storage system converters	14	73	N/A	2.5	100
Battery storage HVAC – pumps	7	79	N/A	2	100
Battery storage HVAC – fans	7	79	N/A	2	100
Battery storage HVAC – compressors	7	79	N/A	0.5	100
Shed (132kV grid substation building) Internal Reverberant Noise Level	1	N/A	85	9 (top of building above ground level)	100

Name/Description	No. Of Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Height (m)	On-time (%)
Shed (132kV Morlais substation building) Internal Reverberant Noise Level	1	N/A	85	9 (top of building above ground level)	100
33kV substation Internal Reverberant Noise Level	1	N/A	85	9 (top of building above ground level)	100
Externally mounted auxiliary transformer (500kVA)	1	68	N/A	1.5	100
Backup diesel generator (200kVA, intermittent operation)	1	N/A	89	1.5	10
Air Coolers	16	80 per unit	N/A	2	100
STATCOM HVAC Unit	4	79 per unit	N/A	2	100
STATCOM Air core reactor	3	88/3 phase	N/A	2	100
STATCOM Filter Air Core Reactor	3	75/3 phase	N/A	2, 4 and 5	100
STATCOM Filter Capacitor Bank	3	88/3 phase	N/A	2, 4 and 5	100
Aux. Transformer for STATCOM	2	67	N/A	2	100
132 kVA/33kV 20MVA transformer external	1	87	N/A	1.5	100
Shed (132kV grid substation building) extract ventilation	2	N/A	50 at 3m	2m	100
Shed (132kV Morlais substation building) extract ventilation	2	N/A	50 at 3m	2m	100
33kV substation building extract ventilation	4	N/A	50 at 3m	2m	100

126. Spectral data for plant included in the noise model of the Grid Connection Substation are detailed in **Table 21-28**.

Table 21-28 Frequency Spectrum 1/1 Octave – Grid Connection Substation Plant

Plant	Octave Band Centre Frequency (Hz)/ dB(A)							
	63	125	250	500	1K	2K	4K	8K
Shed (132kV grid substation building) Internal Reverberant Noise Level	34	34	49	61	77	80	81	76
Shed (132kV Morlais substation building) Internal Reverberant Noise Level	34	34	49	61	77	80	81	76
33kV substation building Internal Reverberant Noise Level	34	34	49	61	77	80	81	76
132kVA/33kV 20 MVA external transformer	75	75	77	77	71	70	85	64
Backup Diesel Generator (200 kVA)	82	86	76	79	81	77	74	64
STATCOM HVAC Unit	51	61	73	73	75	70	59	47
STATCOM Air core reactor	44	80	45	77	75	18	14	14

Plant	Octave Band Centre Frequency (Hz)/ dB(A)							
	63	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**
STATCOM Filter Air Core Reactor	31	67	32	64	62	5	1	1
STATCOM Filter Capacitor Bank	44	80	45	77	75	18	14	14
Externally mounted auxiliary transformer (500kVA)	63	64	57	53	50	43	41	59
Aux. Transformer for STATCOM	**62**	**63**	**56**	**52**	**49**	**42**	**40**	**58**
Battery Converter	**45**	**55**	**67**	**67**	**69**	**64**	**53**	**41**
Battery storage HVAC – pumps	51	61	73	73	75	70	59	47
Battery storage HVAC – fans	52	62	74	74	76	71	60	60
Battery storage HVAC – compressors	51	61	73	73	75	70	59	47

127. Spectral sound reduction values included in noise model for the Grid Connection Substation are detailed in **Table 21-29**.

Table 21-29 Grid Connection Substation Building Envelope Sound Reduction Index Frequency Spectrum 1/1 Octave

Element	Rw	Octave Band Centre Frequency (Hz)/ dB(A)							
		63	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**
Shed (132kV grid substation building)	41	10	20	29	43	48	56	57	47
Shed (132kV Morlais substation building)	41	10	20	29	43	48	56	57	47
33kV substation building	41	10	20	29	43	48	56	57	47

128. Calculated operational noise levels have been determined at GF – Ground Floor (Daytime) and 1st Floor levels (Night time) and compared with the background noise levels at each receptor, which have been derived from the measured baseline noise data contained within **Appendix 21.1** (**Volume III**).

129. The impact of the predicted noise levels from the substation at surrounding residential receptors (medium sensitivity) are presented in **Section 21.7.11**. The magnitude of effects has been assessed in accordance with BS 4142:2014+A1:2019 and against the impact criteria within **Table 21-21**. Noise contour plots are provided in **Appendix 21.3** (**Volume III**).

21.7.9. Sensitivity

130. Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and noise sensitive commercial premises. **Table 21-30** presents the definitions used relating to the sensitivity of the receptor.

Table 21-30 Definitions of the Different Sensitivity Levels for Noise and Vibration

Sensitivity	Definition	Examples
High	Receptor has very limited tolerance of effect	Noise Receptors have been categorised as high sensitivity where noise may be detrimental to vulnerable receptors. Such receptors include certain hospital wards (e.g. operating theatres or high dependency units) or care homes at night. Vibration Receptors have been categorised as high sensitivity where the receptors are listed buildings or Scheduled Monuments.
Medium	Receptor has limited tolerance of effect	Noise Receptors have been categorised as medium sensitivity where noise may cause disturbance and a level of protection is required but a level of tolerance is expected. Such subgroups include residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities, national parks, (during the day); and temporary holiday accommodation at all times. Vibration Receptors have been categorised as medium sensitivity where the structural integrity of the structure is limited but the receptor is not a listed building or Scheduled Monument.
Low	Receptor has some tolerance of effect	Noise Receptors have been categorised as low sensitivity where noise may cause short duration effects in a recreational setting although particularly high noise levels may cause a moderate effect. Such subgroups include offices, shops, outdoor amenity areas, long distance footpaths, doctor's surgeries, sports facilities and places of worship. Vibration Receptors have been categorised as low sensitivity where the structural integrity of the structure is expected to be high. The level of vibration required to cause damage is very high and such levels are not expected to be reached during the Project.
Negligible	Receptor generally tolerant of effect.	Noise Receptors have been categorised as negligible sensitivity where noise is not expected to be detrimental. Such subgroups include warehouses, light industry, car parks, and agricultural land. Vibration Receptors have been categorised as negligible sensitivity where vibration is not expected to be detrimental.

131. The closest human receptors to the Project were determined during consultation with IoACC. For each identified receptor or group of receptors a representative location was chosen for the assessment as detailed on **Figure 21.1** (**Volume II**) and in **Table 21-5**. All receptors detailed in **Table 21-5**, and along the cable corridor are classified as Medium sensitivity for the purposes of this assessment.

21.7.10. Magnitude

132. Impact magnitude has been defined with consideration to the relevant guidance, spatial extent, duration, frequency and severity of the effect. Impact magnitude is defined in **Table 21-31**.

Table 21-31 Definitions of Magnitude Levels for Noise and Vibration Receptors

Magnitude	Definition
Major	Fundamental, permanent / irreversible changes, over the whole receptor, and / or fundamental alteration to key characteristics or features of the particular receptors character or distinctiveness.
Moderate	Considerable, permanent / irreversible changes, over the majority of the receptor, and / or discernible alteration to key characteristics or features of the particular receptors character or distinctiveness.
Minor	Discernible, temporary (throughout project duration) change, over a minority of the receptor, and / or limited but discernible alteration to key characteristics or features of the particular receptors character or distinctiveness.
Negligible	Discernible, temporary (for 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 receptors character or distinctiveness.
No Impact	No discernible, temporary change, or change for any length of time, over a small area of the receptor, and/no alteration to key characteristics or features of the particular receptors character or distinctiveness.

21.7.11. Impact Significance

133. Following the identification of receptor sensitivity and magnitude of the effect, it is possible to determine the significance of the impact. A matrix is presented in **Table 21-32** and will be used wherever relevant.

Table 21-32 Impact Significance Matrix

		Negative magnitude				
		Major	**Moderate**	**Minor**	**Negligible**	**No Impact**
Sensitivity	High	Major	Major	Moderate	Minor	Minor
	Medium	Major	Moderate	Minor	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible

134. Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive, formulaic tool. Definition of the impact significant categories are provided in in **Table 21-33.**

Table 21-33 Impact Significance Definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.

Impact Significance	Definition
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No impact	No change, therefore no impact to receptor condition.

135. Note that for the purposes of this ES chapter, major and moderate impacts are considered to be significant. In addition, whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

136. Embedded construction mitigation at the Landfall Substation, Switchgear Building and Grid Connection Substation is presented in **Section 21.10** and will be referred to and included in the initial assessment of impact. If the impact does not require further mitigation (or none is possible) the residual impact will remain the same. If, however, mitigation is required there will be an assessment of the post-mitigation residual impact.

21.7.12. Cumulative Impact Assessment

137. For a general introduction to the methodology used for the Cumulative Impact Assessment (CIA), please refer to **Chapter 5, EIA Methodology**. This chapter will focus on those cumulative impacts that are specific to noise and vibration.

138. For further details of the methods used for the CIA for noise and vibration, see **Section 21.13**.

21.7.13. Transboundary Impact Assessment

139. There are no transboundary impacts with regards to noise and vibration as the onshore development area including access would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and will not be considered further.

21.8. EXISTING ENVIRONMENT

140. The characterisation of the existing environment is undertaken using data sources listed in the Data Sources sections above plus other relevant literature.

141. In order to characterise the existing noise climate within the Project study area, a baseline noise survey was undertaken at locations representative of the nearest sensitive receptors (see **Appendix 21.1, Volume III**) as agreed with the relevant local authorities during consultation. Measurements were conducted between 28th March and 29th March 2019.

142. Please refer to **Appendix 21.1** (**Volume III**) for further details on the baseline noise survey methodology.

21.8.1. Survey Practice

143. Baseline survey measurements were conducted in accordance with current guidance, including BS4142:2014 Method for rating and assessing industrial and commercial sound[2] and BS 7445:2003 Description and measurement of environmental noise and the methodology used was agreed with relevant stakeholders during consultation.

144. Sound level meters (SLM) were fully calibrated, traceable to UKAS standards and satisfied the requirements of BS EN 61672-1:20131F for a 'Class 1' Sound Level Meter (SLM).

145. For all measurement locations during the noise survey, SLMs were set to record the following:

- L_{Aeq} – the equivalent continuous sound pressure level over the measurement period. This parameter was standardised as pertinent for land use within BS 7445;
- L_{Amax} – the maximum sound pressure level occurring within the defined measurement period;
- L_{A90} – the sound pressure level exceeded for 90 % of the measurement period and is indicative of the background noise level; and
- L_{A10} - the sound pressure level exceeded for 10 % of the measurement period. The L_{A10} index is used within the CRTN as an appropriate descriptor of traffic noise.

146. The equivalent continuous sound pressure level (L_{Aeq}) is the conventional descriptor of environmental noise and is defined below:

$$L_{eq,T} = 10 \times \log\left[\frac{1}{T}\int \frac{\rho^2(t)\partial t}{\rho_0^2}\right] dB$$

147. Noise measurements are normally taken with an A-weighting (denoted by a subscript 'A') to approximate the frequency response of the human ear.

148. Noise measurements were conducted with the SLMs mounted on tripods at a height of between 1.2 m and 1.5 m above ground level and 3.5 m away from any reflecting surface other than the ground, i.e. in free-field conditions. The instruments were calibrated before and after the survey using a portable calibrator. No significant deviation in the calibration level was observed.

149. A record of the meteorological conditions during the survey was made. Any measurements taken during periods of rain or when average wind speeds exceed 5 ms-1 were screened from the results.

[2] Baseline survey undertaken in 2019 before amendments to latest BS4142 in 2019. A review confirmed compliance with BS4142:2014+A1:2019 requirements

21.8.2. Deriving Background Levels

150. Background noise levels used in the assessment were obtained from the baseline measurements. The measurement locations used were considered to be representative of the nearest NSR and have been agreed with stakeholders during consultation for the Project.

151. The background noise levels for the unattended measurement periods (up to 24hrs) were assessed using statistical analysis of the measured L_{A90} values.

152. Assessment values for receptor locations at the Landfall Substation have been derived from long term and short-term measurements. Details of the baseline noise survey are presented in **Appendix 21.1** (**Volume III**). At some locations, there was no long-term monitor set up, due to land access issues. At these locations, short-term attended monitoring was conducted. These locations are identified and discussed further in **Appendix 21.1** (**Volume III**).

21.9. IMPACT ASSESSMENT

21.9.1. Overview of Potential Impacts

153. This section identifies those parameters during construction, operation and decommissioning relevant to potential impacts on noise and vibration.

21.9.2. Mitigation

21.9.2.1. Embedded Mitigation

154. During the development of the detailed engineering design, a number of embedded mitigation measures have been included to reduce the potential impacts of the project. Full details of these are included in **Chapter 4, Project Description**. The embedded mitigation measures specific to Noise and Vibration comprise the inclusion of a 3.5 m high acoustic demountable fence located around the equipment and a 2 m high solid hoarding fence around the compound boundary. Both measures apply to the landfall location only.

21.9.2.2. Additional Mitigation

155. Where significant adverse impacts have been identified as a result of the Project, additional site specific mitigation measures are proposed to seek to reduce residual impacts to acceptable (non-significant) levels. These are described where required within **Section 21.10** and follow guidance in identifying the appropriate good practice mitigation measures required based on the findings of the initial impact assessment.

21.9.3. Worst Case Scenario

156. The onshore project infrastructure will consist of an HVAC converter substation. There will be a single Landfall Substation, with a Switchgear Building at Parc Cybi, and a Grid Connection Substation.

157. For the purposes of assessing the onshore infrastructure, the Project consists of a Landfall Substation, a Switchgear Building and a Grid Connection Substation, using worst case equipment quantities.

158. As such, the Landfall Substation will comprise of:

- Building 1 – housing developer bays, 33kV switchgear, 33kV battery room, junction room, equipment and power electronics for connection to the national grid;
- Building 2 – offices and welfare, lv supply, metering;
- Building 3 and external compound – Outdoor compounds will contain three transformers;
- Access roads – for operation and maintenance access to equipment; and
- Associated connections between equipment via overhead busbar and cabling, including buried earthing system.

159. The Switchgear Building will comprise of:

- Building 1 – housing switchgear, metering annexe;
- Access roads – for operation and maintenance access to equipment; and
- Associated connections between equipment and cabling, including buried earthing system.

160. The Grid Connection Substation will comprise of:

- Building – housing 33kV switchgear, 33kV battery room, junction room, equipment and power electronics for connection to the national grid;
- Building (Morlais substation) – housing 132kV indoor substation complete with controls/SCADA room, battery room, facilities;
- Building (Grid substation) – housing 132kV indoor substation complete with controls/SCADA room, battery room, facilities;
- External compound – will contain 7 battery sets, converters, transformers, HVAC pumps, fans and compressors;
- External compound – will contain a Statcom, filters, reactors, transformers;
- Access roads – for operation and maintenance access to equipment; and
- Associated connections between equipment and cabling, including buried earthing system.

161. The largest element of equipment within the Landfall Substation will be the buildings with an approximate height of 7 m, all other equipment will not exceed a height of 8 m.

162. A worst case approach has been incorporated throughout the assessment within the calculation methodologies, modelling and assumptions in order to present a conservative estimation of any potentially adverse effects of noise and vibration and ensure the correct level of mitigation measures are to be taken forward into the detailed design stage.

163. **Chapter 4 Project Description** outlines the timings to be assessed in relation to the phasing of the works. In all cases for noise and vibration; the construction phase option at the Landfall Substation, Switchgear Building, and Grid Connection Substation, where duct installation, HDD works, temporary lay-down areas, construction of access tracks is undertaken simultaneously is assumed to be the worst case. This is due to the number of potential noise sources operating

together, and that there will be a requirement to undertake 24-hour HDD works, therefore nearest sensitive receptors will be potentially impacted by the Project. Therefore, the noise and vibration assessment has considered the most realistic worst case scenario for the cumulative activities at the landfall location during construction.

164. As discussed in **Chapter 4, Project Description**, should HDD not be feasible, the alternative method of construction at the landfall is open cut trenching. This would involve cutting shallow trenches across the beach and pinning and /or ducting the subsea cable, within a split-pipe to the cliff face. From the cliff top, cables will be buried in trenches that cross the fields and South Stack Road to the transition pits and onwards to the Landfall Substation. The activities and equipment involved in the trenching works (i.e. duct installation and cable pulling) are assessed along the onshore cable route and separation distances to 65 dB(A) provided within the impact assessment for the worst case HDD scenario. For the works required to pin and/or duct the cable to the cliff face, the separation distance from the preferred location on the cliff face to the nearest sensitive receptors is greater than the distance from the receptors to the modelled cumulative activities involved for the proposed HDD works.

165. Therefore, the impacts of the alternative open cut trenching construction method are expected to be no greater at the nearest sensitive receptors at the landfall location, than the HDD works at the landfall. Furthermore, these works would be restricted to daylight hours. The embedded mitigation measures that form part of the BPM for the HDD works would also be incorporated at this work front. The anticipated short and sharp characteristics of the noise on the cliff face would be comparative to the short and sharp noise characteristics of the activities associated with duct installation, the construction of temporary works areas and the construction of temporary access tracks.

21.9.4. Assumptions and Limitations

166. Landowner access was arranged for baseline noise surveys; however, some locations where access was not agreed were subject to shorter term, attended baseline noise monitoring surveys, on publicly accessible/adjacent land where possible (identified in **Appendix 21.1, Volume III**).

167. Following agreement with stakeholders (IoACC) as detailed in **Section 21.5**, the baseline measurements collected are considered representative of the receptors identified.

21.9.5. Construction Assumptions

168. The following assumptions for the construction programme have been made:

- For the purposes of this assessment it was assumed construction activities would normally take place between 07:00 and 19:00 hours Monday to Friday and between 07:00 and 13:00 hours on Saturday;
- For the purposes of this assessment it was assumed that construction activities that may require 24-hour working would be during duct installation for the HDD at the landfall and at trenchless crossing zones;
- All ground was assumed to have an absorption factor of 0.5 to represent the mixed ground conditions in the area;

- All noise sources were modelled as point sources at a height of 1.5m;
- All trenchless crossing zones (e.g. HDD) have been considered as requiring the specific plant associated with trenchless drilling operations;
- Residential properties were modelled as two-storey buildings at a height of 8.5m;
- Receiver levels were predicted at ground floor level (+1.5m) considered representative of daytime resting and amenity space;
- Acoustic propagation effects were calculated using the BS 5228 methodology which takes into account distance attenuation, barriers and ground absorption; and
- For the derivation of buffer zones along the cable route, all plant was assumed to be located at the edge of the Onshore Development Area.

169. The results of the calculation are presented as the dB $L_{Aeq,T}$ noise level in **Appendix 21.2** (**Volume III**), covering the activity period highlighted in the assumptions section above, representing a conservative prediction of the noise level that might affect adjacent receptors during construction activity.

21.9.6. Operation Phase Assumptions

170. The following assumptions for the operation phase were made:

- No specific noise mitigation has been embedded into the design of the electrical infrastructure;
- All sound power levels were calculated using typical sound power level data for associated plant taking source type, dimensions and relative height into consideration within calculations;
- All sources were modelled using 100 % output at all times, unless otherwise stated in **Table 21-22** to **Table 21-29**, to present a conservative assessment;
- Residential properties were modelled as two-storey buildings at a height of 8.5m (industry standard);
- Receiver levels were predicted at ground floor (+1.5m) and 1st floor level (+4.0m) considered representative of both daytime and night time, resting and amenity space; and
- Acoustic propagation effects were calculated using the ISO 9613-2 method. The calculation methodology takes into account distance attenuation, barriers and ground absorption, air absorption, topographical screening effects and light downwind conditions from source to receptor.

171. The results of the calculations are presented as the dB $L_{Aeq,T}$ noise level covering the daytime (07:00 to 23:00 hours) and night time (23:00 to 07:00 hours) reference periods representing a conservative prediction of the noise level that might affect adjacent receptors during operation of the onshore assets.

21.10. POTENTIAL IMPACTS DURING CONSTRUCTION

172. This section presents the potential noise impacts associated with the construction of the Project based upon the proposed phasing, as detailed in **Chapter 4, Project Description**.

173. For the SoundPLAN construction noise modelling at the Landfall Substation, Grid Connection Substation and Switchgear Building, calculated noise levels have been determined at the receiver floor level (GF – Ground Floor) and compared with the BS 5228 construction threshold noise limit for each receptor which has been derived from the measured baseline noise data contained within **Appendix 21.1** (**Volume III**).

174. Noise levels from proposed construction activities along the cable corridor/route were calculated to achieve a No Impact i.e. no greater than the BS5228:2009+A1:2014 'ABC' threshold for each receptor. **Figure 21.3** (**Volume II**) details the unmitigated and mitigated buffer distance for each proposed activity according to the BS5228 threshold for the reference daytime, evening and weekends and night time periods.

175. The results of the daytime weekday (07:00 to 19:00 hours) and Saturday (07:00 to 13:00 hours) noise propagation calculations are presented in **Appendix 21.2** (**Volume III**) and noise receptor locations are shown on **Figure 21.1** (**Volume II**).

176. Evening and night-time calculations are also presented for the Landfall Substation, Grid Connection Substation and Switchgear Building receptors closest to the trenchless crossing works as there may be the requirement to undertake construction activity over a 24 hour/7-day week programme during trenchless crossing operations. The need to extend into longer working hours is generally dependent on locations where ground conditions are less favourable/stable and where risk to the integrity of the works may increase if left in a partially complete state overnight. Continuous, or extended working hours could also be expected at significant crossings where completing the works in one occasion is considered to reduce any risks. This is often requested at railway or major highway crossings where the asset, such as the tracks or highway surface is required not to be in use or in reduced use for the duration of the works.

177. Impact magnitudes have been assessed in accordance with the criteria detailed in **Table 21-7**, **Table 21-8**, and **Table 21-9** and the significance criteria in **Table 21-32**.

178. The assessment of construction generated noise is based on worst case assumptions. It should be noted that most noisy construction activities within the onshore cable route adjacent to each respective receptor will be of relatively short duration as the active work fronts progress along the onshore cable route in sections, rather than works taking place throughout the onshore area for the duration of construction.

21.10.1. Daytime Construction noise

179. **Table 21-34** summarises the potential daytime construction noise impacts at the agreed receptor locations for the combined Landfall Substation, Grid Connection Substation and Switchgear Building locations (further details included in **Appendix 21.2, Volume III**). Impact magnitudes have been assessed in accordance with the criteria detailed within **Table 21-7** and the significance criteria detailed in **Table 21-32**.

180. For the scenarios detailed in **Table 21-34** construction noise mitigation measures included a 3.5 m high acoustic demountable fence located around the equipment at the landfall location only. Furthermore, it was assumed a 2 m high solid hoarding fence would be built around the compound boundary at the landfall location only. These measures were not included in the Grid

Connection Substation and Switchgear Building locations. Mitigation measures are denoted by shading in the table to show embedded mitigation.

Table 21-34 Predicted Daytime Construction Noise – Landfall Substation, Grid Connection Substation and Switchgear Building Receptors

Phase	BS5228 Daytime Threshold dB(A)	Predicted Daytime noise level $L_{Aeq,T}$ dB	Impact Significance
Landfall Substation receptors			
Cumulative Duct Installation/Temp Access Tracks and Pre-construction works/Temporary works areas/HDD and Trenchless crossing works	65	46.7 to 60.4	No Impact
Grid Connection Substation and Switchgear Building receptors			
Cumulative Duct Installation/Temp Access Tracks and Pre-construction works/Temporary works areas/HDD and Trenchless crossing works	65	46.1 to 49.6	No Impact
Required Mitigation Key			
No additional mitigation required beyond standard Best Practicable Measures (BPM) measures to avoid significant adverse impacts.			
Embedded construction mitigation techniques included to avoid significant adverse impact. Specific construction mitigation measures will be agreed during the detailed design stage.			

181. **Table 21-34** demonstrates that a No impact magnitude is predicted at the assessed receptors when incorporating the specified mitigation measures; therefore, at a medium sensitivity receptor, a Negligible impact significance.

182. **Table 21-35** summarises the potential daytime construction noise impacts at the agreed receptor locations for each proposed activity (further details included in **Appendix 21.2, Volume III**). The approach calculates a buffer/set-back distance from the unmitigated works to achieve a No Impact magnitude in accordance with the criteria detailed within **Table 21-7** and the significance criteria detailed in **Table 21-32**.

183. The lower section of **Table 21-35** summarises the potential daytime construction noise impacts at the agreed receptor locations for each proposed activity calculating a buffer/set-back distance from the mitigated works (using BPM) to achieve a No Impact magnitude in accordance with the criteria detailed within **Table 21-7** and the significance criteria detailed in **Table 21-32**.

Table 21-35 Predicted Daytime Construction Noise Buffers

Phase/Activity	**BS5228 Daytime Threshold dB(A)**	**Buffer distance (m) to achieve Daytime BS5228 threshold**	**Impact Significance**
Landfall Substation, Cable Route, Grid Connection Substation, Switchgear Building Receptors			
Landfall Substation and Grid Connection Substation	65 (A)	107.0	No Impact
Cable Pulling (per workfront)	65 (A)	52.5	No Impact
Duct Installation (per workfront)	65 (A)	82.5	No Impact
Temporary access tracks and Pre-construction works	65 (A)	74.0	No Impact
Trenchless Crossing	65 (A)	70.0	
Temporary works areas	65 (A)	41.0	No Impact
Landfall Substation, Cable Route, Grid Connection Substation, Switchgear Building Receptors			
Phase/Activity	**BS5228 Daytime Threshold dB(A)**	**Buffer distance to achieve Daytime threshold) with BPM mitigation**	**Impact Significance**
Grid Connection Substation	65 (A)	60.5	No Impact
Cable Pulling (per workfront)	65 (A)	29.5	No Impact
Duct Installation (per workfront)	65 (A)	46.5	No Impact
Temporary access tracks and Pre-construction works	65 (A)	42.0	No Impact
Trenchless Crossing	65 (A)	39.5	No Impact
Temporary works areas	65 (A)	23.0	No Impact
Required Mitigation Key			
Mitigation incorporating standard Best Practical Measures (BPM) measures to avoid significant adverse impacts.			

184. **Table 21-35** demonstrates that a No impact magnitude is predicted at the assessed receptors when the activity specific buffer zone/separation distance between the construction activity and the receptors is maintained. Through incorporating the BPM mitigation measures; the separation distance can be reduced between the construction activity and the receptors.

185. Therefore, where the buffer zone/separation distance is maintained and through using BPM, at a medium sensitivity receptor, a Negligible impact significance is predicted.

21.10.2. Evening and Weekends Construction Noise

186. **Table 21-36** summarises the potential evening and weekends construction noise impacts at the agreed receptor locations for the combined Landfall Substation, Grid Connection Substation and Switchgear Building locations (further details included in **Appendix 21.2, Volume III**). Impact

magnitudes have been assessed in accordance with the criteria detailed within **Table 21-8** and the significance criteria detailed in **Table 21-32**.

187. For the scenarios detailed in **Table 21-36** construction noise mitigation measures included a 3.5 m high acoustic demountable fence located around the equipment at the landfall location only. Furthermore, it was assumed a 2 m high solid hoarding fence would be built around the compound boundary at the landfall location only.

188. These measures were not included in the Grid Connection Substation and Switchgear Building locations. Mitigation measures are denoted by shading in the table to show embedded mitigation.

Table 21-36 Predicted Evening and Weekends Construction Noise – Landfall Substation, Grid Connection Substation, Switchgear Building Receptors

Phase	BS5228 Evening and Weekends Threshold dB(A)	Predicted Evening and Weekends noise level $L_{Aeq,T}$ dB	Impact Significance
Landfall Substation receptors			
HDD and Trenchless crossing works	55	37.5 to 49.5	No Impact
Grid Connection Substation and Switchgear Building receptors			
HDD and Trenchless crossing works	55	37.0 to 41.4	No Impact
Required Mitigation Key			
No additional mitigation required beyond standard Best Practical Measures (BPM) measures to avoid significant adverse impacts.			
Embedded construction mitigation techniques included to avoid significant adverse impact. Specific construction mitigation measures will be agreed during the detailed design stage.			

189. **Table 21-36** demonstrates that a No impact magnitude is predicted at the assessed receptors when incorporating the specified mitigation measures; therefore, at a medium sensitivity receptor, a Negligible impact significance.

21.10.3. Night time Construction Noise

190. **Table 21-37** summarises the potential evening and weekends construction noise impacts at the agreed receptor locations for the combined Landfall Substation, Grid Connection Substation and Switchgear Building locations (further details included in **Appendix 21.2, Volume III**). Impact magnitudes have been assessed in accordance with the criteria detailed within **Table 21-9** and the significance criteria detailed in **Table 21-32**.

191. For the scenarios detailed in **Table 21-37** construction noise mitigation measures included a 3.5 m high acoustic demountable fence located around the equipment at the landfall location

only. Furthermore, it was assumed a 2 m high solid hoarding fence would be built around the compound boundary at the landfall location only.

192. These measures were not included in the Grid Connection Substation and Switchgear Building locations. Mitigation measures are denoted by shading in the table to show embedded mitigation.

Table 21-37 Predicted Night Time Construction Noise – Landfall Substation, Grid Connection Substation and Switchgear Building Receptors

Phase	BS5228 Night time Threshold dB(A)	Predicted Night time noise level $L_{Aeq,T}$ dB	Impact Significance
Landfall Substation receptors			
HDD and Trenchless crossing works	50	37.5 to 49.5	No Impact
Grid Connection Substation and Switchgear Building receptors			
HDD and Trenchless crossing works	55	37.0 to 41.4	No Impact
Required Mitigation Key			
No additional mitigation required beyond standard Best Practical Measures (BPM) measures to avoid significant adverse impacts.			
Embedded construction mitigation techniques included to avoid significant adverse impact. Specific construction mitigation measures will be agreed during the detailed design stage.			

193. **Table 21-37** demonstrates that a No impact magnitude is predicted at the assessed receptors when incorporating the specified mitigation measures; therefore, at a medium sensitivity receptor, a Negligible impact significance.

194. It should be noted that noise impacts would be short term and temporary in nature. The assessment undertaken assumes that all plant would be operating at a static location on the boundary of the works; whereas in reality, plant is likely to be more mobile within the onshore cable route.

21.10.4. Construction Road Traffic Noise Emissions

195. An assessment was undertaken following the methodology contained in DMRB (Volume 11, Section 3, Chapter 3) to assess whether there would be any significant changes in traffic volumes and composition on surrounding local roads as a result of the Project. The significance of any predicted change in noise level was then assessed in accordance with the criteria contained in the DMRB.

196. Traffic impacts were assessed for the construction phase years of 2021 and 2024 (as per the programme details in **Chapter 23, Traffic and Transport**), taking base flows, annual growth and Project-generated construction traffic into consideration. Traffic flows and assumptions are detailed within **Chapter 23 Traffic and Transport** and, for the 2021 construction phase scenario screening, detailed in **Table 21-17**. The predicted $L_{10,18hr}$ relative change in noise level from Baseline 2021 versus Baseline 2021 'with development' (construction related traffic) is detailed in **Table 21-38**.

Table 21-38 18hr AAWT Road Traffic Flows and dBA Change Due to Construction (Short Term)

Link ID	Link Description	Predicted noise level change (dBA)	Impact Magnitude	Impact Significance
1	A5 London Road	0.2	Negligible	Negligible Impact
2	A55 North Wales Expressway	0.1	No change	No Impact
3	A55 North Wales Expressway / Victoria Road	0.1	No change	No Impact
4	A5154	0.3	Negligible	Negligible Impact
5	Market Street / Thomas Street / S Stack Road	0.3	Negligible	Negligible Impact
6	Unnamed Road from Ty Mawr in South Stack to Penrhos Feliw	0.9	Negligible	Negligible Impact
7	Longford Road / Plas Road	0.0	No change	No Impact
8	Unnamed Road from Penrhos Feliw to Porthdafarch Road	0.9	Negligible	Negligible Impact
9	Lon Isalit	0.0	No change	No Impact
10	Lon Towyn Capel	0.3	Negligible	Negligible Impact
11	Longford Road / Plas Road	0.1	Negligible	Negligible Impact
12	A5153	0.2	Negligible	Negligible Impact
13	B4545 Kingsland Road / Lon St Ffraid	0.0	No change	No Impact

197. Relative change in ambient noise as a result of construction road traffic noise emissions is not expected to be greater than 0.9 dB in 2021 on any associated road links. In accordance with the DMRB criteria detailed in **Table 21-16**, it is anticipated that Project generated construction traffic will have at most a negligible adverse impact.

198. **Chapter 23 Traffic and Transport** outlines links in the study area where there is a potential impact and introduces potential mitigation measures to reduce the severity of these impacts.

199. Traffic management measures are to be implemented through a TMP. Through the development of a TMP, Menter Mon and its contractors would engage stakeholders (detailed in Chapter 24 Traffic and Transport) to try and establish opportunities to co-ordinate activities and avoid peak traffic impacts.

21.10.5. Vibration

200. Construction modelling along the onshore cable route assumed that all plant was located at the closest point to each sensitive receptor. At this stage the exact location of works is not known,

and any drilling required at trenchless crossing zones (e.g. HDD) and landfall will need to be located subject to vibration criteria.

201. Sources of vibration such as HGV movements on uneven haul routes may be perceptible at receptor locations in the vicinity of the landfall. HGV activity within the site would rarely be at the site boundary for any extended period, and given the proximity of receptors to adjacent roads, noise management controls, and restricted vehicle speeds, this activity would not be expected to generate vibration effects any greater than present at receptor locations in the vicinity of the Project.

202. In order to prevent cosmetic damage to buildings in the vicinity of the works priority should be given to drilling methods which minimise vibration (subject to suitable ground conditions).

21.10.6. Standard Mitigation (BPM)

203. Standard construction noise mitigation practices and good practice construction management will be adopted throughout the construction phase. These will be captured within a Construction Noise Management Plan (CNMP) which forms part of the Code of Construction Practice (CoCP). A summary of the measures is set out in the following sections.

21.10.7. Construction Noise Management Plan

204. The Control of Pollution Act and BS 5228 define a set of Best Practice working methods and mitigation measures, referred to as BPM. Examples of these measures include:

- Where possible, locating temporary plant so that it is screened from receptors by on-site structures, such as site cabins;
- Using modern, quiet equipment and ensuring such equipment is properly maintained and operated by trained staff;
- Applying enclosures to particularly noisy equipment where possible;
- Ensuring that mobile plant is well maintained such that loose body fittings or exhausts do not rattle or vibrate;
- Ensuring plant machinery is turned off when not in use;
- Providing local residents with 24 hour contact details for a site representative in the event that disturbance due to noise from the construction works is perceived; and
- Establishing a community engagement process including informing local residents about the construction works, detailing the timing and duration of any particularly noisy elements, and providing a contact telephone number to them;
- Keeping noisy deliveries to the middle of the day where possible.

205. Although the effect of adopting such methods cannot be precisely quantified, these methods are considered to typically reduce noise levels by between 5 – 10 dB(A).

21.10.8. Training of Construction Staff

206. The site induction programme and site rules should include good working practice instructions for site staff, managers, visitors and contractors to help minimise noise whilst working on the site.

207. Good working practice guidelines/instructions could include, but not be limited to, the following points:

- Avoiding unnecessary revving of engines;
- Plant used intermittently should be shut-down between operational periods, where possible;
- Avoiding reversing wherever possible;
- Reporting any defective equipment/plant as soon as possible so that corrective maintenance can be undertaken; and
- Handling material in a manner that minimises noise.

208. Maintenance of construction plant

- Maintenance of temporary plant should be carried out routinely and in accordance with the manufacturers' guidance.
- A regular inspection of all plant and equipment should be undertaken to ensure that:
- All plant is in a good state of repair and fully functional;
- Any plant found to be requiring interim maintenance has been identified and taken out of use;
- Acoustic enclosures fitted to plant are in a good state of repair;
- Doors and covers to such enclosures remain closed during operation; and
- Any repairs are being undertaken by a fully qualified maintenance engineer.

21.10.9. Enhanced Mitigation

209. In order to ensure these impacts are mitigated as far as reasonably possible, the aforementioned standard mitigation should (where necessary) be augmented by a suite of enhanced mitigation measures. The detail of the enhanced mitigation measures will be drawn up and agreed as part of the Construction Noise Management Plan (CNMP).

210. The enhanced mitigation measures will include the selection and deployment of particularly low noise plant near the identified receptors.

21.10.10. Use of Noise Barriers as Enhanced Mitigation

211. The use of noise barriers is well tried and documented mitigation measure to reduce noise impacts at receptor locations. As an example of the relative effectiveness of applying a temporary localised noise barrier BS 5228 states:

"*as a working approximation, if there is a barrier or other topographic feature between the source and the receiving position, assume an approximate attenuation of 5 dB when the top of the plant is just visible to the receiver over the noise barrier, and of 10 dB when the noise screen completely hides the sources from the receiver. High topographical features and specifically designed and positioned noise barriers could provide greater attenuation*."

21.10.11. Use of Construction Plant Selection as Enhanced Mitigation

212. Careful scrutiny of plant selection at procurement stage would ensure that the associated noise impact of the aforementioned plant is reduced as much as reasonably possible.

213. Initial calculations determined that with the application of standard mitigation measures as detailed in **Table 21-34**, **Table 21-35**, **Table 21-36**, and **Table 21-37** and where necessary an increased separation distance from the noisiest mobile and stationary plant, would ensure that the BS 5228 daytime construction noise thresholds are not exceeded.

214. With the incorporation of enhanced mitigation measures, it is predicted that the separation distance between construction activities and sensitive receptors could be reduced whilst ensuring a no impact to minor magnitude of impact for all medium sensitivity receptors during all phases of construction; using the significance matrix detailed in **Table 21-32**, this represents a negligible impact.

21.11. POTENTIAL IMPACTS DURING OPERATION

215. This section presents a worst case overview of potential noise impacts associated with the operation of the onshore infrastructure. The only onshore operational noise sources associated with the Project are expected to be from the Landfall Substation, Switchgear Building and Grid Connection Substation.

21.11.1. Predicted Operational Noise

216. SoundPLAN noise modelling software was utilised to predict noise from the normal anticipated site operational aspects of the Project. Operations are proposed 24 hours a day at the Landfall Substation, Switchgear Building and the Grid Connection Substation. Equipment assumptions and on-time of plant were defined in **Table 21-22** (Landfall Substation), **Table 21-25** (Switchgear Building), and **Table 21-27** (Grid Connection Substation).

217. The impact assessment has been undertaken using the unmitigated worst case scenario for the potential components that could be used at the substation. The aim of this worst case assessment is to inform the design of mitigation that may be required to ensure the Project can be operated without causing a significant impact on the noise environment of communities around them.

218. TAN11 refers to a superseded version of the standard (BS4142:1997); it was therefore considered prudent to use the current guidance for the EIA. BS4142:2014+A1:2019 is the most suitable current guidance for the assessment of sound of an industrial or commercial nature impacting on residential premises.

219. The soundscape within the vicinity of the Landfall Substation receptor locations is dominated by sea noise; around the Switchgear Building and Grid Connection Substation, principally by road traffic noise from the A55 and A5.

220. Calculated operational noise levels have been determined at GF – Ground Floor and 1st Floor levels and compared with the background noise levels at each receptor, which have been derived from the measured baseline noise data contained within **Appendix 21.1** (**Volume III**). The highest predicted noise level of each building façade was derived and corrected to free-field using a 3 dBA reduction.

221. The magnitude of effects has been assessed in accordance with BS 4142:2014+A1:2019 derived thresholds, detailed within **Table 21-21**, and the significance criteria detailed in **Table 21-32**.

21.11.2. Landfall

222. The Landfall Substation footprint is defined in **Figure 21.1** (**Volume II**) and the SoundPLAN modelling was based on the infrastructure being operational at this location.

223. **Table 21-39** contains a summary of the potential unmitigated operational noise impacts associated with the Landfall Substation at the agreed NSRs. A BS 4142:2014+A1:2019 +2 dBA tonal character penalty was applied.

224. A contour isopleth showing the predicted operational noise from the Landfall Substation infrastructure is detailed in **Appendix 21.3** (**Volume III**).

Table 21-39 Predicted Landfall Substation Worst Case Operational Noise Impacts

NSR	Floor	Landfall Substation Noise Level Contribution at Receptor [dB(A)]		Background Noise Level at Receptor L_{90} [dB(A)]		BS4142 derived Impact Magnitude (Night time)	BS4142 Impact Significance (Night time)
		Daytime	Night Time	Daytime	Night Time		
NSR1	GF (Ground Floor)	20.0	20.0	36.5	38.5	No Impact	No Impact
	FF (First Floor)	20.1	20.1	36.5	38.5	No Impact	No Impact
NSR2	GF	27.0	27.0	36.5	38.5	No Impact	No Impact
	FF	26.6	26.6	36.5	38.5	No Impact	No Impact
NSR3	GF	18.6	18.6	36.5	38.5	No Impact	No Impact
	FF	19.8	19.8	36.5	38.5	No Impact	No Impact

NSR	Floor	Landfall Substation Noise Level Contribution at Receptor [dB(A)]		Background Noise Level at Receptor L_{90} [dB(A)]		BS4142 derived Impact Magnitude (Night time)	BS4142 Impact Significance (Night time)
		Daytime	Night Time	Daytime	Night Time		
NSR4	GF	17.0	17.0	36.5	38.5	No Impact	No Impact
	FF	18.5	18.5	36.5	38.5	No Impact	No Impact

225. **Table 21-39** shows that there are no predicted impacts at the Landfall Substation based on the design and details presented in **Table 21-22**, **Table 21-23**, and **Table 21-24**. Therefore, at a medium sensitivity receptor, **no impact significance**.

21.11.3. Grid Connection Substation and Switchgear Building

226. The Grid Connection Substation and Switchgear Building footprints are defined in **Figure 21.1** (**Volume II**) and the SoundPLAN modelling was based on the infrastructure being operational at these locations.

227. **Table 21-40** contains a summary of the potential unmitigated operational noise impacts associated with the Grid Connection Substation and Switchgear Building at the agreed NSRs. No BS 4142:2014+A1:2019 character penalties have been applied.

228. A contour isopleth showing the predicted operational noise from the Grid Connection Substation and Switchgear Building infrastructure is detailed in **Appendix 21.3 Volume III**).

Table 21-40 Predicted Grid Connection Substation and Switchgear Building Worst Case Operational Noise Impacts

NSR	Floor	Grid Connection Substation and Switchgear Building Noise Level Contribution at Receptor [dB(A)]		Background Noise Level at Receptor L_{90} [dB(A)]		BS4142 derived Impact Magnitude (Night time)	BS4142 Impact Significance (Night time)
		Daytime	Night Time	Daytime	Night Time		
NSR5	GF (Ground Floor)	24.6	24.6	49.0	45.5	No Impact	No Impact
	FF (First Floor)	25.0	25.0	49.0	45.5	No Impact	No Impact
NSR6	GF	31.7	31.7	49.0	45.5	No Impact	No Impact
	FF	32.2	32.2	49.0	45.5	No Impact	No Impact
NSR7	GF	29.2	29.2	49.0	45.5	No Impact	No Impact
	FF	29.5	29.5	49.0	45.5	No Impact	No Impact

NSR	Floor	Grid Connection Substation and Switchgear Building Noise Level Contribution at Receptor [dB(A)]		Background Noise Level at Receptor L_{90} [dB(A)]		BS4142 derived Impact Magnitude (Night time)	BS4142 Impact Significance (Night time)
		Daytime	Night Time	Daytime	Night Time		
NSR8	GF	16.9	16.9	49.0	45.5	No Impact	No Impact
	FF	17.2	17.2	49.0	45.5	No Impact	No Impact
NSR9	GF	28.1	28.1	49.0	45.5	No Impact	No Impact
	FF	28.3	28.3	49.0	45.5	No Impact	No Impact
NSR10	GF	20.1	20.1	49.0	45.5	No Impact	No Impact
	FF	22.5	22.5	49.0	45.5	No Impact	No Impact

229. **Table 21-40** shows that there are no predicted impacts at the Grid Connection Substation and Switchgear Building based on the design and details presented in **Table 21-25** to **Table 21-29**. Therefore, at a medium sensitivity receptor, **no impact significance**.

230. The magnitude of effect has been assessed in accordance with BS4142:2014+A1:2019 derived thresholds. The results of the modelling will inform the detailed design of the Grid Connection Substation and Switchgear Building, post-consent. Commitments relating to operational noise will be secured to ensure that noise emissions will avoid significant effects at the Landfall Substation and Grid Connection Substation receptor locations.

231. It should be noted the noise source data and assumptions are conservative for the purposes of a worst case assessment.

232. This assessment provides indicative information on the operational noise levels which would be required within the final design of the Landfall Substation, Switchgear Building and Grid Connection Substation (to be addressed at detailed design stage).

233. Menter Môn has committed to providing a final design of the Project which is able to meet the rigorous standards of low noise emissions expected by both the UK regulatory bodies and stakeholders.

21.12. POTENTIAL IMPACTS DURING DECOMMISSIONING

234. This section describes the potential impacts of the decommissioning of the onshore infrastructure with regards to impacts on noise and vibration. Further details with regards to decommissioning are provided in **Chapter 4, Project Description**.

235. No decision has been made regarding the final decommissioning policy for the onshore cables, as it is recognised that industry best practice, rules and legislation change over time. It is likely

the cables would be pulled through the ducts and removed, with the ducts themselves left in situ.

236. In relation to the landfall substations and associated infrastructure, the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology would be determined later within the Project lifetime, but are expected to include:

- Dismantling and removal of outside electrical equipment from outside of the Landfall Substation, Switchgear Building and Grid Connection Substation;
- Removal of cabling from site;
- Dismantling and removal of electrical equipment from within the Landfall Substation, Switchgear Building and Grid Connection Substation;
- Removal of Landfall Substation, Switchgear Building and Grid Connection Substation and minor services equipment;
- Demolition of the support buildings and removal of fencing;
- Landscaping and reinstatement of the site (including land drainage); and
- Removal of areas of hard standing.

237. Whilst details regarding the decommissioning of the Landfall Substation, Switchgear Building and Grid Connection Substation is currently unknown, considering the worst case which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be no worse than those during construction.

238. The decommissioning methodology would need to be finalised nearer to the end of the lifetime of the Project to be in line with current guidance, policy and legislation at that point. Any such methodology would be agreed with the relevant authorities and statutory consultees. The decommissioning works could be subject to a separate licencing and consenting approach.

21.13. CUMULATIVE IMPACTS

239. The potential for cumulative impacts to occur as a result of the interaction between the Project and other plans, projects and activities was considered. Firstly, the potential for impacts identified in the noise and vibration assessment to act cumulatively with other projects was identified. This includes consideration of projects identified for potential cumulative impacts, and any relevant development applications submitted since consultation. Cumulative projects have been considered and their anticipated potential for cumulative impact are detailed in **Table 21-41**.

Table 21-41 Potential for Cumulative Impacts

Impact	Potential for Cumulative Impact	Data Confidence	Rationale
Construction			
Construction phase Noise and vibration	Yes	High	Multiple projects could lead to increases in noise and vibration, human health and ecological impacts at receptors.
Construction phase road traffic noise	Yes	High	Multiple projects could lead to increases in traffic flows which may lead to impacts at human and ecological receptors.
Operation			
Operational phase noise and vibration	No	High	There are not anticipated to be any substantial noise and vibration sources, or traffic movements generated during the operational phase, that would give rise to significant cumulative impacts at human or ecological receptors.
Operational phase road traffic emissions	No	High	
Decommissioning			
Decommissioning phase noise and vibration	No	High	There are not anticipated to be any substantial noise and vibration sources, or traffic movements generated during the decommissioning phase that would give rise to significant cumulative impacts at human or ecological receptors.
Decommissioning phase road traffic noise	No	High	

240. The next stage of the CIA is to identify other plans or projects which have a spatial or temporal overlap with the potential effects considered in this assessment.

241. All offshore cumulative projects were scoped out of the noise and vibration CIA, as it was assumed that the potential for significant impacts to occur in combination with the onshore aspects considered in this assessment was minimal.

242. The projects considered in the CIA included those on Holy Island only, as due to the geography of the area is it not considered that traffic associated with projects elsewhere in North Wales would impact upon roads on Holy Island. Cumulative road traffic noise impacts may occur where the same road network will be used for multiple projects, plans or activities.

243. Traffic flow data for a base year (2021) and peak construction year of the Project (2021) were detailed in **Table 21-17**. The uplift in traffic flows between the 2019 and 2021 scenarios includes additional traffic associated with smaller-scale committed developments within the Holy Island area.

244. There are several larger-scale projects on Holy Island which are principally located in the vicinity of Holyhead Port. It is anticipated that increases in road traffic emissions associated with these projects would primarily occur on the A55 and A5, as these are the main routes on to Holy Island.

245. Given that the predicted traffic flows associated with the construction of the Project were well below the relevant screening criteria, it is not anticipated that additional traffic associated with cumulative projects would give rise to a significant noise impacts at receptors. Furthermore, the Project will generate the largest amount of traffic during the construction phase, which is temporary in nature, and therefore the potential for any significant impacts to occur would be limited to a relatively short duration.

246. Given the above, cumulative impacts associated with road traffic noise are not anticipated to be significant and have therefore not been considered further in this assessment.

247. A summary of the potential for cumulative impacts to occur is detailed in **Table 21-42**.

Table 21-42 Potential for Cumulative Impacts to Occur

Project	Status	Distance from Project (km)	Included in CIA	Rationale
Extensions to dwelling	Consented 13/03/19, construction status unknown	0	No	Due to the small scale of this project it is not anticipated that significant construction noise impacts would occur cumulatively with the Project.
Parc Cybi	Consented, construction status unknown	0	No	If a temporal overlap of the construction phases were to occur, it is anticipated that the cumulative project would employ best-practice methods to minimise noise generated during construction, as recommended for the Project. With the implementation of these measures, significant cumulative noise impacts have limited potential to occur.
Roadking Parc Cybi	Consented, construction status unknown	0	No	If a temporal overlap of the construction phases were to occur, it is anticipated that the cumulative project would employ best-practice methods to minimise noise generated during construction, as recommended for the Project. With the implementation of these measures, significant cumulative noise impacts have limited potential to occur.
Penrhos Coastal Park	Consented, construction status unknown	0.35	No	If a temporal overlap of the construction phases were to occur, it is anticipated that the cumulative project would employ best-practice methods to minimise noise generated during construction, as recommended for the Project. With the implementation of these measures, significant cumulative noise impacts have limited potential to occur.
Conversion of outbuilding	Consented, construction status unknown	0.4	No	Due to the small scale of this project it is not anticipated that significant impacts would occur cumulatively with the Project.

Project	Status	Distance from Project (km)	Included in CIA	Rationale
Penrhos Industrial Estate	Application validated: 06/03/2019	0.5	No	If a temporal overlap of the construction phases were to occur, it is anticipated that the cumulative project would employ best-practice methods to minimise noise generated during construction, as recommended for the Project. With the implementation of these measures, significant cumulative noise impacts have limited potential to occur.
Trearddur Bay Hotel	Consented, construction status unknown	1.3	No	Due to the separation distance, cumulative construction phase noise impacts would not be expected to occur.
Holyhead Port	Application validated: 23/11/2018	1.3	No	Due to the separation distance, cumulative construction phase noise impacts would not be expected to occur.
Breakwater Country Park	Application validated: 04/03/2019, awaiting decision	1.6	No	Due to the separation distance, cumulative construction phase noise impacts would not be expected to occur.
Holyhead	Application validated: 03/01/2019	1.8	No	Due to the separation distance, cumulative construction phase noise impacts would not be expected to occur.
Tyn Towyn Caravan Park	Consented, construction status unknown Date valid: 26/03/2019	1.8	No	Due to the separation distance, cumulative construction phase noise impacts would not be expected to occur.
Porth Diana Boat Yard	Application validated: 28/02/2019, awaiting decision	2.4	No	Due to the separation distance, cumulative construction phase noise impacts would not be expected to occur.

21.14. INTER-RELATIONSHIPS

248. This assessment considered the potential noise and vibration impacts at human receptor locations during the construction, operation and decommissioning phases of the Project. The approach to the assessment was informed by the Scoping Opinion and through additional consultation with IoACC. A summary of the impact assessment is detailed in **Table 21-45**.

249. **Table 21-43** lists the inter-relationships between this chapter and other chapters within the ES.

Table 21-43 Inter-Topic Relationships

Topic and description	Related Chapter	Where addressed in this Chapter	Rationale
Onshore Ecology	Chapter 19	**Section 21.10** (construction phase impacts) **Section 21.11** (operational phase impacts)	Both chapters consider the potential effects of the Project during the construction phase. Both chapters consider the potential effects of the Project during operational phase.
Onshore Archaeology	Chapter 20	**Section 21.10** (construction phase impacts) **Section 21.11** (operational phase impacts)	Both chapters consider the potential effects of the Project during the construction phase. Both chapters consider the potential effects of the Project during operational phase.
Traffic and Transport	Chapter 23	**Section 21.10** (construction phase impacts) **Section 21.11** (operational phase impacts)	Both chapters consider the potential effects of the Project during the construction phase. Both chapters consider the potential effects of the Project during operational phase.
Seascape, Landscape and Visual Impact Assessment	Chapter 24	**Section 21.10** (construction phase impacts) **Section 21.11** (operational phase impacts)	Both chapters consider the potential effects of the Project during the construction phase. Both chapters consider the potential effects of the Project during operational phase.
Socio-Economics	Chapter 25	**Section 21.10** (construction phase impacts) **Section 21.11** (operational phase impacts)	Both chapters consider the potential effects of the Project during the construction phase. Both chapters consider the potential effects of the Project during operational phase.

21.15. INTERACTIONS

250. The impacts identified in **Table 21-43** have the potential to interact with each other, which could give rise to synergistic impacts because of that interaction. The interactions are detailed in **Table 21-44**.

Table 21-44 Potential Interaction Between Impacts

Potential interaction between impacts		
Construction	Construction traffic using Highways	Construction related activities and plant
Construction traffic using Highways	-	Yes
Construction related activities and plant	Yes	-
Operation	Operational noise at Ecological receptors	Operational noise at Human receptors

Potential interaction between impacts		
Construction	Construction traffic using Highways	Construction related activities and plant
Operational noise at Ecological receptors	-	No
Operational noise at Human receptors	No	-
Decommissioning		
It is anticipated that the decommissioning impacts will be no worse than those during construction.		

21.16. SUMMARY

251. This assessment considered the potential noise and vibration impacts at human receptor locations during the construction, operation and decommissioning phases of the Project. The approach to the assessment was informed by the Scoping Opinion and through additional consultation with IoACC. A summary of the impact assessment is detailed in **Table 21-45**.

252. Impacts associated with offshore aspects of the Project were scoped out of the assessment, as it was considered that there was limited potential for effects at receptors onshore.

253. A cumulative impact assessment was carried out to identify the potential for significant impacts through the interaction of the Project with other plans and projects. No significant cumulative effects were identified.

Table 21-45 Summary of Noise and Vibration Impact Assessment

Potential Impact	**Receptor**	**Sensitivity**	**Magnitude**	**Significance**	**Additional Mitigation Measures**	**Residual Impact**
Construction and operational phase noise and vibration impacts	Human receptors	Medium	No Impact	No Impact	Best practice measures. Noise and Vibration Management Plan.	Not significant
	Ecological receptors	Considered in **Chapter 11, Marine Ornithology** and **Chapter 19, Onshore Ecology**.				N/A
Construction, operational and decommissioning phase road traffic noise and vibration impacts	Human receptors within road network study area	Medium	Negligible at worst	Negligible Impact	Not required	Not significant
	Ecological receptors	Considered in **Chapter 11, Marine Ornithology** and **Chapter 19, Onshore Ecology**.				N/A

21.17. REFERENCES

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