Environmental Impact Assessment Report

Volume 1, Chapter 25: Onshore Noise and Vibration

MarramWind Offshore Wind Farm

December 2025

MarramWind

Document code:	MAR-GEN-ENV-REP-WSP-000064
Contractor document number:	852346-WEIS-IA-I6-RP-O7-592658
Version:	Final for Submission
Date:	08/12/2025
Prepared by:	WSP UK Limited
Checked by:	WSP UK Limited
Accepted by:	MarramWind Limited

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25. Onshore Noise and Vibration

25.1 Introduction

25.1.1.1 This onshore noise and vibration chapter of the Environmental Impact Assessment (EIA) Report presents the results of the assessment of the likely significant effects on residential receptors that may be experienced as a result of noise and vibration arising from the construction, operation and maintenance (O&M) and decommissioning of the onshore Project, landward of Mean Low Water Springs (MLWS). It should be read in conjunction with the project description provided in **Chapter 4: Project Description** and the relevant parts of the following Chapter:

- **Chapter 26: Traffic and Transport**: construction traffic data provided within Chapter 26 have been used to inform the construction noise assessment within this Chapter.

25.1.1.2 This Chapter describes:

- the legislation, planning policy, guidance and other documentation that has informed the assessment (**Section 25.2: Relevant legislative and policy context and technical guidance**);
- the outcome of consultation and engagement that has been undertaken to date, including how matters relating to noise and vibration have been addressed (**Section 25.3: Consultation and engagement**);
- the scope of the assessment for noise and vibration (**Section 25.4: Scope of the assessment);**
- the data sources and methods used for gathering baseline data including surveys where appropriate (**Section 25.5: Methodology for baseline data gathering**);
- the overall environmental baseline (**Section 25.6: Baseline conditions**);
- the basis for the EIA Report (**Section 25.7: Basis for EIA Report**);
- methodology for EIA Report (**Section 25.8: Methodology for EIA Report assessment**);
- the assessment of noise and vibration effects (**Section 25.9: Assessment of effects: construction stage**; **Section 25.10: Assessment of effects: O&M stage**; and **Section 25.11: Assessment of effects: decommissioning stage**);
- a summary of effects (**Section 25.12 Summary of effects**).
- consideration of transboundary effects (**Section 25.13: Transboundary effects**);
- consideration of inter-related effects and cumulative effects (**Section 25.14: Inter-related effects** and **Section 25.15: Assessment of cumulative effects**);
- a summary of residual likely significant effects for noise and vibration (**Section 25.16: Summary of residual likely significant effects**);
- a reference list is provided (**Section 25.17: References)**; and
- a glossary of terms and abbreviations is provided (**Section 25.18: Glossary of terms and abbreviations**).

25.1.1.3 This Chapter is also supported by the following Appendices in **Volume 3**:

- **Appendix 25.1: Noise and Vibration Relevant Legislation, Planning Policy and Technical Guidance**;
- **Appendix 25.2: Baseline Noise Survey**;
- **Appendix 25.3: Construction Stage Noise and Vibration Assessment**;
- **Appendix 25.4: Construction Stage Traffic Noise Assessment**; and
- **Appendix 25.5: Operational Stage Onshore Substation Noise Assessment**.

25.2 Relevant legislative and policy context and technical guidance

25.2.1 Legislative and policy context

25.2.1.1 This Section identifies the relevant legislation and policy context that has informed the scope of the noise and vibration assessment. Further information on policies relevant to this Chapter and their status is set out in **Chapter 2: Legislative and Policy Context**, which provides an overview of the relevant legislative and policy context for the Project. **Chapter 2: Legislative and Policy Context** is supported by **Volume 3, Appendix 2.1: Planning Policy Framework** and **Volume 3, Appendix 25.1**, which provides a detailed summary of international, national, marine and local planning policies of relevance to this Chapter. Individual policies of specific relevance to this assessment and associated appendices have been taken into account.

25.2.1.2 This summary provides a foundation for understanding the specific requirements that this Chapter must address in terms of assessing and mitigating impacts on receptors relating to noise and vibration.

25.2.1.3 The legislation relevant to noise and vibration include:

- The Environmental Protection Act 1990 (EPA); and
- Control of Pollution Act 1974.

25.2.1.4 The policies relevant to noise and vibration include:

- National Planning Framework 4 (NPF4), 2023 (Scottish government, 2023a);
- Aberdeenshire Council Local Development Plan 2023 (Aberdeenshire Council, 2023a);
- Planning Advice Note (PAN) 1/2011, Planning and Noise (PAN 1/2011), 2011; and
- Noise Policy Statement for England (NPSE), 2010.

25.2.1.5 It should be noted that NPSE is not directly applicable in Scotland, but it is included because it provides a useful framework for understanding how noise impacts are assessed and managed.

25.2.2 Relevant technical guidance

25.2.2.1 Other information and technical guidance relevant to the assessment undertaken for noise and vibration includes:

- International Standards Organisation (ISO) 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors. Part 2: Engineering method for the prediction of sound pressure levels outdoors (ISO 9613-2);
- British Standard (BS) 8233:2024 Guidance on sound insulation and noise reduction for buildings (BS 8233);
- BS 5228-1:2009+A1:2014 Code of practice for noise vibration control on construction and open sites – Part 1: Noise (BS 5228-1);
- BS 5228-2:2009+A1:2014 Code of practice for noise vibration control on construction and open sites – Part 2: Vibration (BS 5228-2);
- BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (BS 4142);
- Association of Noise Consultants BS 4142:2014+A1:2019: Technical Note;
- Technical Advice Note (TAN) Assessment of Noise, 2011;
- BS 7445:2003: Description and measurement of environmental noise (BS 7445);
- Calculation of Road Traffic Noise (CRTN), 1988; and
- Design Manual for Roads and Bridges (DMRB) LA 111 - Noise and Vibration.

25.3 Consultation and engagement

25.3.1 Overview

25.3.1.1 This Section describes the consultation and stakeholder engagement undertaken on the Project in relation to noise and vibration. This includes early engagement, the outcome of and response to the Scoping Opinions*:* Onshore Scoping Opinion (Aberdeenshire Council, 2023b) and Offshore Scoping Opinion (Scottish Government, 2023b) in relation to the noise and vibration assessment, non-statutory consultation, and the findings of the Project's Statutory Consultation. An overview of engagement undertaken for the Project as a whole can be found in Section 5.5 of **Chapter 5: Approach to the EIA**.

25.3.2 Key issues

25.3.2.1 A summary of the key issues raised during statutory and non-statutory consultation, specific to noise and vibration, is outlined below in **Table 25.1**, together with how these issues have been considered in the production of this Chapter.

Table 25.1 Stakeholder issues responses – noise and vibration

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
Aberdeenshire Council	18	28 September 2022, Stakeholder meeting.	*"Aberdeenshire Council noted their general agreement on the approach to the assessment method. Concern was raised in relation to substation noise, and the potential for low frequency issue if in close proximity to residents."*	Whilst the industry standard is considered to be an external assessment in accordance with BS 4142, the assessment of NR curve limits to address low frequency noise ingress at receptors has been undertaken. The operation stage assessment is presented in **Section 25.10.** Agreed operational onshore substation noise limits at residential receptors, including Noise Rating (NR) curve limits to address low frequency noise ingress at receptors (see **Section 25.10**).
Aberdeenshire Council	19	28 September 2022, Stakeholder meeting.	*"Additional concern by Aberdeenshire Council was raised regarding construction vehicles using low trafficked routes."*	It is considered that the use of the BS 5228 minimum threshold levels are sufficient to protect amenity where flows are very low, such that they cannot be predicted using CRTN (see **Section 25.9**).
Aberdeenshire Council	89	22 March 2023, Aberdeenshire Council Scoping Opinion (Aberdeenshire Council, 2023b).	*"The contents of this Chapter are noted, with main impacts considered to arise during the construction period for landfall, cable route and substation development, while operational impacts will be limited to the effect of the substation."*	The construction and O&M stage assessments are presented in **Section 25.9** and **Section 25.10**.
Aberdeenshire Council	90	22 March 2023, Aberdeenshire Council Scoping Opinion (Aberdeenshire Council, 2023b).	*"The Council agrees with the approaches indicated and does not suggest any topics be altered. The justifications given to scoping out impacts are noted and accepted."*	The scope of the completed assessment for noise and vibration is presented in **Section 25.4**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
Aberdeenshire Council	91	22 March 2023, Aberdeenshire Council Scoping Opinion (Aberdeenshire Council, 2023b).	*"The Council's Environmental Health service agrees with the proposed approach to the assessment as detailed within Section 6.7 of the Scoping Report."*	The scope of the completed assessment for noise and vibration is presented in **Section 25.4**.
Aberdeenshire Council	92	22 March 2023, Aberdeenshire Council Scoping Opinion (Aberdeenshire Council, 2023b).	*"Should this and other developments occur in the same vicinity at the same time, there may be cumulative effects. Consideration of this is welcomed."*	The consideration of cumulative effects is presented in **Chapter 33: Cumulative Effects Assessment**.
Aberdeenshire Council	93	22 March 2023, Aberdeenshire Council Scoping Opinion (Aberdeenshire Council, 2023b).	*"Transboundary effects, it is agreed, are unlikely."*	The consideration of transboundary effects is presented in **Section 25.13**.
Aberdeenshire Council	94	22 March 2023, Aberdeenshire Council Scoping Opinion (Aberdeenshire Council, 2023b).	*"The approach to the EIA Report is accepted."*	The completed assessment of noise and vibration is included in this Chapter.
Aberdeenshire Council	191	22 March 2023, Aberdeenshire Council Scoping Opinion (Aberdeenshire Council, 2023b).	*"The Environmental Health Service has reviewed the EIA – Scoping Report dated in respect of the above project and would comment as follows:* *Noise: Environmental Heath would agree with proposed approach to assessment detailed in Section 6.7 of the Scoping Report."*	The completed assessment of noise and vibration is included in this Chapter.
Aberdeenshire Council	691	19 December 2024, Aberdeenshire Council Pre-Application Report	*"Aberdeenshire Council asked whether there would be other projects considered for a cumulative operational noise impact?"*	The consideration of cumulative effects is presented in **Chapter 33: Cumulative Effects Assessment.**

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		(Aberdeenshire Council, 2024)		
Aberdeenshire Council	692	19 December 2024, Aberdeenshire Council Pre-Application Report (Aberdeenshire Council, 2024)	*"Aberdeenshire Council asked whether noise curves would be involved in the operational noise assessment?* *Aberdeenshire Council would require noise curves based on a generic house build should be included within the operational noise assessment, which is consistent with the noise assessments undertaken for other developments recently."*	Whilst the industry standard is considered to be an external assessment in accordance with BS 4142, the assessment of NR curve limits to address low frequency noise ingress at receptors has been undertaken. The operation stage assessment is presented in **Section 25.10**.
Aberdeenshire Council	884	19 December 2024, Aberdeenshire Council Pre-Application Report (Aberdeenshire Council, 2024)	*"The Environmental Health Service commented as follows:* *The applicant is expected to undertake a noise impact assessment to predict the impact on sensitive receptors and specify any necessary control measures. The assessment should be undertaken in accordance with BS 4142:2014+A1:2019 for external noise with the aim of achieving a low impact depending on context when compared to background L_{A90} and NR25 and NR20 Curve assessment for internal noise during the daytime and night time respectively.* *The applicant is also expected to consider a cumulative noise impact and demonstrate that it will not cause significant adverse impact on nearby residential amenity."*	The O&M stage assessment is presented in **Section 25.10**. The consideration of cumulative effects is presented in **Chapter 33: Cumulative Effects Assessment.**

25.4 Scope of the assessment

25.4.1 Overview

25.4.1.1 This Section sets out the scope of this EIA for onshore noise and vibration. The assessment scope has been developed as the Project's design has evolved and responds to stakeholder feedback received to-date, as set out in **Section 25.3**.The derivation of study area buffers have been set as conservative screening distances informed by the prediction methods and criteria adopted for the assessment to ensure that receptors with potential for significant effects are captured for assessment.

25.4.2 Spatial scope and study area

25.4.2.1 The spatial scope and study area buffers for the onshore noise and vibration assessment have been defined to encompass areas where significant noise and vibration effects could reasonably occur during the construction, O&M and decommissioning of the Project.

25.4.2.2 The assessment focuses on the nearest identified noise sensitive receptors (NSRs) to the proposed infrastructure of the maximum design scenario as outlined in **Table 25.2**. The assessment is based on the principle that if predicted impacts are acceptable at these nearest NSRs, they are likely to be acceptable at locations further away, where noise levels are expected to be lower due to increased distance and attenuation. This approach ensures that the assessment is precautionary, receptor-led, and consistent with best practice in environmental noise and vibration assessment.

25.4.2.3 The spatial scope of the noise and vibration assessment study areas adopted for the assessment are as follows:

- Site construction and decommissioning noise – noise arising from the construction of stage of the Project has been assessed at selected NSRs within a buffer zone of approximately 500m buffer zone from the Onshore Red Line Boundary. This includes the landfall(s) works below Mean High Water Springs (MHWS), that may otherwise be considered as marine works but have the potential to give rise to adverse effects at onshore receptors.
- Construction traffic noise – the adopted study area includes all routes likely to be used during the construction stage of the Project.
- Site construction vibration – vibration arising from the construction and decommissioning stage of the Project has been assessed at selected vibration sensitive receptors within a buffer zone of approximately 100m from the Onshore Red Line Boundary where any piling or compaction activities are proposed.
- Operational site noise – noise arising from the operational stage of the project has been assessed at selected sensitive receptors within a buffer zone of approximate 1000m from the boundary of the onshore substation site.

25.4.2.4 The cumulative assessment zone of influence for is 1000m from the Onshore Red Line Boundary for construction stage noise, 100m from the Onshore Red Line Boundary for construction stage vibration and 2000m from the Onshore Substation site for operational stage noise. For the construction and operational stage noise assessments the zone of influence is double the respective study areas adopted for the Project.

25.4.3 Temporal scope

25.4.3.1 The temporal scope of the assessment of noise and vibration is the entire lifetime of the Project, which therefore covers the construction, O&M, and decommissioning stages.

25.4.3.2 Each stage presents distinct noise and vibration generating activities and potential impacts on sensitive receptors as follows:

- Construction stage: Includes activities such as site preparation, horizontal directional drilling (HDD) (or similar trenchless technique), onshore export cable installation, and the onshore substation site construction. These are typically short-term but may involve elevated noise levels, particularly during peak construction periods. In relation to trenchless crossings, HDD (or similar trenchless technique) has been presented in the EIA. Whilst other trenchless methods are available, HDD (or similar trenchless technique) is presented herein as it is likely to have the largest construction impact.
- O&M stage: covers ongoing noise emissions from infrastructure such as the onshore substations and associated equipment. These are expected to be continuous but at lower levels than construction activities.
- Decommissioning stage: involves dismantling and removal of infrastructure, with noise impacts similar in nature and duration to those during construction.

25.4.3.3 It is anticipated that the construction of the Project will commence in 2030, with the first phase becoming fully operational by 2037. It is anticipated that the second phase of the Project would become fully operational by 2040 and the third phase by 2043. The operational lifetime of the Project for each phase is expected to be 35 years.

25.4.3.4 The assessment adopts the Project's assumed working hours (see **Chapter 4: Project Description**) and the day, evening and night assessment periods as appropriate. Where construction stage activities may occur out-of-hours separate night-time assessments are undertaken. Stage durations are also set out in **Chapter 4: Project Description** and have been used to inform exposure and significance judgements.

25.4.3.5 Embedded mitigation by stage (Construction Environmental Management Plan (CEMP), operational plant selection and acoustic design) is accounted for in the residual effects assessment.

25.4.3.6 This staged approach ensures that the assessment captures both short-term and long-term noise and vibration effects, enabling a comprehensive understanding of potential impacts across the Project's lifetime.

25.4.4 Identified receptors

25.4.4.1 The spatial and temporal scope of the assessment enables the identification of receptors that may experience a change as a result of the Project. The receptors identified that may experience likely significantly effects for noise and vibration are outlined in **Table 25.2**.

Table 25.2 Identified receptors requiring assessment for noise and vibration

Receptor group	Receptors included within group
Residential receptors	Residential receptors nearest to the landfall(s), including residences north of Peterhead and south of St Fergus.
	Residential receptors near to the onshore export cable corridor, including residences of St Fergus, Inverugie and Torterston.

Receptor group	Receptors included within group
	Residential receptors nearest to the onshore substation site, including residences surrounding Longside Airfield.

25.4.5 Potential effects

25.4.5.1 Potential effects on noise and vibration receptors that have been scoped in for assessment are summarised in **Table 25.3**.

Table 25.3 Potential effects for noise and vibration

Receptor	Activity or impact	Potential effect
Construction and decommissioning stage		
Residential receptors	Site construction and decommissioning noise: noise generation from construction and decommissioning activities associated with the temporary construction compounds (TCCs), landfall(s) works, onshore export cable corridor, trenchless crossings, onshore substations and access works.	Potential for significant adverse noise effects during the construction and decommissioning stages.
	Construction traffic noise: changes to road traffic noise due to traffic movements associated with the construction of the Project.	Potential for significant adverse noise effects during the construction stage.
	Site construction and decommissioning vibration: vibration generation from piling or compaction activities associated with the construction and decommissioning stage of the Project.	Potential for significant adverse vibration effects during the construction and decommissioning stage.
O&M stage		
Residential receptors	Operational site noise: operational noise from the onshore substations.	Potential for levels of noise (including low frequency noise) giving rise to significant adverse noise effects and likelihood of complaint during the O&M stage.

25.4.6 Effects scoped out of assessment

25.4.6.1 A number of potential effects have been scoped out from further assessment, resulting from a conclusion of no likely significant effect. These conclusions have been made based on the knowledge of the baseline environment, the nature of planned works and the professional judgement on the potential for impact from similar projects more widely. The conclusions follow (in a site-based context) existing best practice. Each scoped out activity or impact is considered in turn in **Table 25.4**.

Table 25.4 Activities or effects scoped out of assessment

Activity or impact	Rationale for scoping out
Construction and operational stage noise from the offshore wind farm	The offshore wind farm and associated substations are at least 75km distance from onshore NSRs, and the offshore Reactive Compensation Platform(s) are at least 31.85km from onshore NSRs. Taking into the account the distance between the offshore wind farm (including the RCP(s)) and onshore NSRs, noise associated with the construction and operation of the offshore wind farm will therefore be **Negligible** and has been scoped out of the assessment.
Operational site vibration	There is no rotating or reciprocating machinery to give rise to vibration associated with out-of-balance forces. Vibration from the onshore substations will therefore be **Negligible** at any sensitive receptor and has been scoped out of this assessment.
Operational traffic noise	Operational traffic will be limited to infrequent and small-scale vehicular traffic for the purposes of maintenance and repair of the onshore substations and onshore export cables. The traffic flows will be substantially below the level required for an adverse noise effect to be apparent at sensitive receptors.
Decommissioning traffic noise	Traffic associated with the decommissioning stage is anticipated to be significantly less than that generated during construction. Decommissioning road traffic has therefore been scoped out of **Chapter 26: Traffic and Transport**. As such, it is considered that decommissioning traffic will not be the source of significant noise and is scoped out of this assessment.
Construction, O&M and decommissioning traffic vibration	The vibration generated by traffic movements associated with the construction, O&M and decommissioning of the Project would be similar to the vibration caused by any other similar vehicles that could legally use the routes. It is, therefore, anticipated that significant effects are unlikely to occur and this has been scoped out of the assessment.

25.5 Methodology for baseline data gathering

25.5.1 Overview

25.5.1.1 Baseline data collection has been undertaken to obtain information over the study area described in **Section 25.4**. The current and future baseline conditions are presented in **Section 25.6.**

25.5.2 Desk study

25.5.2.1 A desk study has been undertaken to assist in determining the baseline conditions, this has included:

- identification of NSRs, including those with the greatest potential to be subject to a significant adverse impact from the Project;
- identification of possible local noise sources in the vicinity of the identified receptors; and
- identification of a sample of representative locations at which baseline noise monitoring can be undertaken.

25.5.2.2 The data sources that have been collected and used to inform this noise and vibration assessment are summarised in **Table 25.5**.

Table 25.5 Data sources used to inform the noise and vibration chapter

Source	Date	Summary	Coverage of study area
Ordnance Survey	Date accessed: August 2025	1:25000 OS Explorer mapping	Full coverage of study area
Ordnance Survey	Date accessed: August 2025	1:50000 OS Land Ranger mapping	Full coverage of study area
Google	Date accessed: August 2025	Publicly available satellite mapping	Full coverage of study area
Google	Date accessed: August 2025	Publicly available street photography	Full coverage of study area
Baseline noise surveys	October 2024 – May 2025	Baseline data collected to inform the assessment.	Monitoring locations representative of sensitive receptor groups identified in **Table 25.2**.

25.5.3 Site surveys

25.5.3.1 The site surveys that have been conducted and used to inform this noise and vibration assessment are summarised in **Table 25.6**.

Table 25.6 Site surveys undertaken

Survey type	Scope of survey	Coverage of study area
Baseline noise survey between 1 to 10 October 2024. Further details are provided in **Volume 3, Appendix 25.2**	A noise survey was undertaken at locations representative of residential receptors at the onshore substation site, including residences around the Longside Airfield.	Operational stage (i.e. 1000m from the onshore substation site).
Baseline noise survey between 22 May 2025 and 3 June 2025. Further details are provided in **Volume 3, Appendix 25.2**	A noise survey was undertaken at locations representative of residential receptors along the onshore export cable corridor. Including residences close to the strategic road network (SRN) to determine appropriate construction noise thresholds for locations near to trenchless crossings. As the nearest residential receptors to the landfall(s) are removed from the SRN, it was considered that noise surveys were not needed, i.e. the most stringent construction noise threshold was applied at these locations.	Limited to construction stage study areas specifically where HDD (or similar trenchless technique) is proposed in areas close to the SRN.

25.5.4 Data limitations

25.5.4.1 Any measurement of existing ambient or background sound levels are subject to a degree of uncertainty as environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a short sample of the ambient levels. Every effort was made to ensure that measurements were undertaken in such a way to provide a representative sample of conditions, such as:

- avoiding periods of adverse weather conditions (rain, wind speeds above five m/s) and/or if adverse weather conditions take place during any sound level measurements, the contaminated data are omitted from the dataset; and
- avoiding school holidays and other such periods / events which are known to often result in atypical sound levels.

25.5.4.2 In the absence of detailed information from a construction contractor, assumptions have been made about the types of plant and equipment which are likely to be used for construction works. These assumptions are considered representative of the maximum design scenario.

25.5.4.3 The construction vibration predictions have been made using calculations which have been developed in-house (by WSP) and based on BS 5228-2 methodologies. The vibration predictions have been made using empirical data provided in BS 5228-2. However, the accuracy of such predictions is necessarily limited by assumptions that have to be made regarding the number and type of plant used, their location, detailed operating

arrangements, and the ground conditions. Whilst this information would be clarified as the detailed design progresses and when resources are mobilised, other information (such as exactly where the plant operates and for how long) would remain uncertain, even after works have commenced. It has therefore been necessary to perform a construction stage vibration assessment, focussing on key activities, with the aim of identifying whether significant temporary vibration effects are likely to arise at the closest sensitive receptors.

25.5.4.4 The O&M stage assessment for the onshore substations has been based on maximum design scenario information available at this stage. This is subject to change as the detailed design progresses and therefore the final noise emitting electrical infrastructure associated with the onshore substation plant may have either slightly lower or higher sound power levels than that assessed.

25.6 Baseline conditions

25.6.1 Current baseline

25.6.1.1 The following Section provides an overview of the existing baseline conditions at the closest NSRs to the Onshore Red Line Boundary. Details of the baseline noise survey procedures and full survey results are provided in **Volume 3, Appendix 25.2**.

25.6.1.2 The baseline noise levels at the NSRs are consistent with the lowest ambient noise category from BS 5228-1, Category A for the daytime, evening and weekend periods. However, for the night-time period, there are a number of NSRs where the baseline noise levels are consistent with Category B and Category C.

25.6.1.3 The onshore substation site is a semi-rural location and baseline sound levels are generally low and typical of a rural environment. The A950 bounds the site to the north, which is the main route east from Peterhead, together with the operational Longside Airfield located beyond the A950 to the north of the onshore substation site. The baseline noise levels were generally influenced by road traffic with additional anthropogenic sources closer to areas of habitation.

25.6.1.4 A summary of the baseline sound survey results used to inform the O&M noise assessment of the onshore substations are provided in **Table 25.7**. To be conservative, the background sound levels (dB $L_{A90\ T}$) identified for each receptor correspond to the 25th percentile. The measurement locations are shown in **Volume 2, Figure 25.1: Baseline noise monitoring locations**. The O&M stage NSRs are shown in **Volume 2, Figure 25.3: Operational stage noise sensitive receptors**.

Table 25.7 Summary of the onshore substation site baseline background sound levels

O&M Stage NSRs	Measurement Reference	Background sound level, $L_{A90,T}$ (dB)	
		Assessment period	Selected background sound level
NSR1 Hawthorn Cottage	LT2	Daytime	38
		Night-time	33
NSR2 Howiemuir, NSR3 Denholm	LT3	Daytime	33
		Night-time	28
NSR4 East Thunderton	LT4	Daytime	40
		Night-time	32

25.6.2 Future baseline

25.6.2.1 It is reasonable to assume that, over time, ambient and background noise levels at the closest NSRs to the Project will generally remain unchanged due to dominant noise sources being natural (wind induced noise and noise from the coastline / sea etc). There is the potential for slight increases in road traffic noise in line with natural growth and possible increases in local vehicle use.

25.6.2.2 It should be noted that the future baseline is likely to include additional anthropogenic noise from planned energy infrastructure in the Peterhead area, including transmission and distribution projects (e.g., the Netherton hub) and other offshore wind farm connections. Whilst it is assumed these developments will be designed to minimise a creep in background noise levels, they could introduce low-level continuous operational noise from onshore substations and associated equipment, as well as intermittent construction activity over an extended period. Road traffic noise may also increase slightly due to general growth and project-related vehicle movements, particularly during any potential overlapping construction stages. These factors have been considered in the cumulative assessment presented in **Section 25.13**.

25.7 Basis for EIA Report

25.7.1 Maximum design scenario

25.7.1.1 The process of assessing using a parameter-based design envelope approach means that the assessment considers a maximum design scenario whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the planning application, marine licences applications and Section 36 consent.

25.7.1.2 The assessment of the maximum design scenario for each receptor establishes the maximum potential adverse effect and as a result effects of greater adverse significance would not arise should any other scenario (as described in **Chapter 4: Project Description**) to that assessed within this Chapter be taken forward in the final scheme design.

25.7.1.3 The maximum design scenario parameters that have been identified to be relevant to onshore noise and vibration are outlined in **Table 25.8** and are in line with the project design envelope (**Chapter 4: Project Description**).

25.7.1.4 The maximum design scenario for noise and vibration during the construction stage, will be based on the following:

- landfall(s): the construction of landfall(s) at Lunderton and Scotstown;
- onshore export cable corridor: the maximum design scenario will contain trenched the onshore export cable corridor and trenchless crossings; and
- onshore substations: the maximum design will assess the construction activities to prepare the site and construct all three onshore substations. The maximum design scenario for onshore substation site construction will also include construction of permanent access roads associated with the onshore substations, ecology mitigation, landscaping and drainage works.

25.7.1.5 The maximum design scenario for the O&M stage noise assessment will assess all three onshore substations operating simultaneously with downwind propagation conditions to the nearest sensitive receptors assessed in accordance with ISO 9613-2. The maximum design scenario will also reflect the scenario where the onshore substations are partially enclosed as described in **Chapter 4: Project Description**.

25.7.1.6 The Aberdeenshire Council Environmental Health Officer (EHO) has identified at Scoping that Aberdeenshire Council requires an internal noise assessment to determine that levels achieve maximum NR20 rating curve inside habitable rooms in residential development (in accordance with Annex B of BS 8233) at night; and for daytime, maximum BS 4142 rating levels of 35dB L_{ArTr} are sought outside residential development, and levels inside habitable rooms shall meet NR 25. Mitigation measures will be developed through detailed design with a view to meeting the Aberdeenshire limits for all three onshore substations operating simultaneously.

Table 25.8 Maximum design scenario for impacts on noise and vibration

Impact / activity	Maximum design scenario parameter	Justification
Construction		
Impact C1: Temporary noise and vibration from the primary and secondary TCCs	• nine locations for primary and secondary TCCs have been identified (three primary and six secondary), indicative locations are shown on **Volume 2, Figure 4.1 Onshore Red Line Boundary and indicative onshore infrastructure**; • the size of each of the primary TCCs will be up to 125m x 125m in area. • the size of each of the secondary TCC's will be up to 100m x 100m in area; • core working hours are Monday to Friday 08:00-18:00 hours and Saturday 08:00-13:00 hours; • prior to and following the core working hours on Monday to Friday, a 'shoulder hour' for mobilisation and shut down will be applied (07:00-08:00 and 18:00-19:00) for which restrictions are described further in **Volume 4: Outline Construction Environmental Management Plan (CEMP)**; • sound levels for construction plant are based upon typical plant items and reported in Annex C of BS 5228-1; • the full construction plant / equipment list, including sound power levels and percentage on-time are detailed in **Volume 3, Appendix 25.3;** and • the maximum design scenario for construction vibration will only consider construction activities that require impact or vibratory piling or compaction as all other vibration sources were screened out based on negligible risk and will not have the potential to give rise to significant effects.	These parameters represent the maximum design scenario in terms of number of locations for proposed noise sources, the geographical extent and temporal extent. These parameters cover all notable work elements which could result in adverse noise or vibration effects.
Impact C2: Temporary noise from the construction of access and haul roads	• core working hours are Monday to Friday 08:00-18:00 hours and Saturday 08:00-13:00 hours; • prior to and following the core working hours on Monday to Friday, a 'shoulder hour' for mobilisation and shut down will be applied (07:00-08:00 and 18:00-19:00) for which restrictions are described further in **Volume 4: Outline CEMP**; • sound levels for construction plant are based upon typical plant items and reported in Annex C of BS 5228-1; • the full construction plant / equipment list, including sound power levels and percentage on-time are detailed in **Volume 3, Appendix 25.3**.	The assumptions allow assessment of noise from the construction of access and haul roads and is considered to provide assessment of a maximum design scenario.

Impact / activity	Maximum design scenario parameter	Justification
Impact C3: Temporary noise and vibration from landfall(s) works (including installation of transition jointing bays), trenchless crossing (HDD) (or similar trenchless technique), duct installation and export cables	• maximum construction footprint of the landfall(s) includes nearshore offshore export cables routing to landfall(s) transition joint bays which will be installed by HDD (or similar trenchless technique); • landfall(s) transition joint bays constructed subsurface. Associated onshore and offshore export cables are underground; • core working hours are Monday to Friday 08:00-18:00 hours and Saturday 08:00-13:00 hours; • prior to and following the core working hours on Monday to Friday, a 'shoulder hour' for mobilisation and shut down will be applied (07:00-08:00 and 18:00-19:00) for which restrictions are described further in **Volume 4: Outline CEMP**; • time-sensitive activities may be constrained by tide times and continuous work may be required for HDD (or similar trenchless technique) and therefore, the assessment has considered 24 hour working days; • sound levels for construction plant are based upon typical plant items and reported in Annex C of BS 5228-1; • the full construction equipment list, including sound power levels from BS 5228-1 and percentage on-time are detailed in **Volume 3, Appendix 25.3**; and • the maximum design scenario for construction vibration will only consider construction activities that require impact or vibratory piling or compaction as all other vibration sources were screened out based on negligible risk and will not have the potential to give rise to significant effects.	The duration of HDD (or similar trenchless technique) will depend on ground conditions. As this will not be known until exploratory testing, these parameters provide a maximum design scenario.
Impact C4: Temporary noise and vibration from the construction of the onshore substations	• work will commence during core working hours only, i.e. Monday to Friday 08:00-18:00 hours and Saturday 08:00-13:00 hours; • prior to and following the core working hours on Monday to Friday, a 'shoulder hour' for mobilisation and shut down will be applied (07:00-08:00 and 18:00-19:00) for which restrictions are described further in **Volume 4: Outline CEMP**; • the onshore substations will be constructed utilising a combination of concrete foundations and piled or screwed foundations with concrete foundations typically used for buildings and piled or screwed foundations for electrical equipment such as busbars; however, vibratory (piling or vibro-compaction) site works will not be conducted within 100m of residences; • sound levels for construction plant are based upon typical plant items and reported in Annex C of BS 5228-1. • the full construction equipment list, including sound power levels from BS 5228-1 and percentage on-time are detailed in **Volume 3, Appendix 25.3**; and	These parameters cover for all notable work elements which could result in adverse noise or vibration effects.

Impact / activity	Maximum design scenario parameter	Justification
	• the maximum design scenario for construction vibration will only consider construction activities that require impact or vibratory piling or compaction as all other vibration sources were screened out based on negligible risk and will not have the potential to give rise to significant effects.	
Impact C5: Temporary noise and vibration from onshore export cable trenching works (including, where required HDD (or similar trenchless technique), installation of joint bays), and duct and subsequent onshore export cable installation	• onshore export cable construction work will commence during core working hours only, i.e. Monday to Friday 08:00-18:00 hours and Saturday 08:00-13:00 hours; • prior to and following the core working hours on Monday to Friday, a 'shoulder hour' for mobilisation and shut down will be applied (07:00-08:00 and 18:00-19:00) for which restrictions are described further in **Volume 4: Outline CEMP**; • sound levels for construction plant are based upon typical plant items and reported in Annex C of BS 5228-1; • the full construction equipment list, including sound power levels from BS 5228-1 and percentage on-time are detailed in **Volume 3, Appendix 25.3**; and • the maximum design scenario for construction vibration only considers construction activities that require impact or vibratory piling or compaction as all other vibration sources were screened out based on negligible risk and will not have the potential to give rise to significant effects.	The duration of HDD (or similar trenchless technique) will depend on ground conditions. These assumptions cover for all notable work elements which could result in adverse noise effects.
Impact C6: Temporary noise from construction traffic accessing the public highway	• with the exception of abnormal indivisible loads, heavy goods vehicles (HGV) movements will only occur during core hours plus one shoulder hour either side of core hours, i.e. Monday to Friday 07:00-19:00 hours and Saturday 08:00-13:00 hours; • prior to and following the core working hours on Monday to Friday, a 'shoulder hour' for mobilisation and shut down will be applied (07:00-08:00 and 18:00-19:00) for which restrictions are described further in **Volume 4: Outline CEMP**; • the construction vehicle numbers during the construction stage presents the peak construction month, with the following data presented in **Volume 3, Appendix 25.4**: ▸ Baseline 18 Hour Annual Average Weekday Traffic two-way flows; ▸ Baseline percentage HGV; and ▸ Peak construction traffic numbers: heavy vehicles (two-way flow). • for low flow roads, i.e. below 1000 vehicle movements between 06:00 and 00:00, the BS 5228-1 haul road calculation has been used to predict the HGV noise level for the peak construction traffic data at 10m.	The parameters represent the maximum design scenario to screen whether potential traffic noise effects may occur.

Impact / activity	Maximum design scenario parameter	Justification
O&M		
Impact O1: Onshore substations operational noise	• the onshore substations to be located within the Onshore Red Line Boundary as identified in **Volume 2, Figure 4.1**; • the full equipment list, including sound power levels are detailed in **Volume 3, Appendix 25.5**; • the assessment assumes all three onshore substations operate simultaneously; • the assessment assumes that all noise generating electrical equipment will be operational at night; • the assessment will exclude emergency operating equipment; and • at this stage a decision has not been made on whether the electrical components and equipment necessary to connect the electricity generated by the Project to the national electricity transmission network will be fully housed in buildings or whether this equipment will be partially placed outdoors, incorporating sufficient mitigation to meet the necessary noise limits. The assessment considers both fully enclosed and partially enclosed onshore substation options.	These parameters represent the maximum design scenario, and the plant list is taken from similar sites.
Decommissioning		
Impact D1: Onshore infrastructure decommissioning stage	• at this stage it is anticipated that the onshore export cables will be left in-situ with ends cuts, sealed and buried to minimise environmental effects associated with removal. The underground structures of the joint bays/transition joint bays, fibre optic cable junction boxes and link boxes will be removed only if it is feasible with minimal environmental disturbance or if their removal is required to return the land to its current agricultural use; and • the majority of the activities associated with the decommissioning stage of the onshore substations' construction will be similar to the activities associated with the onshore substations' construction stage.	It is likely that many aspects of decommissioning stage will be similar to or result in less noise and vibration effects to the construction stage.

25.7.2 Embedded environmental measures

25.7.2.1 As part of the Project design process, a set of embedded environmental measures has been adopted to reduce the potential for adverse impacts on noise and vibration effects. These embedded environmental measures have evolved over the design process as the EIA has progressed and in response to consultation.

25.7.2.2 The embedded measures include good/standard practice actions and measures required to meet existing legislation expectations. Because the Project is commitment to implementing these measures, together with standard sectoral practices and procedures, they are treated as inherently to the Project design and are set out in this Chapter.

25.7.2.3 **Table 25.9** summarises the relevant embedded measures relevant to noise and vibration and how they are secured. Detailed commitments, including ownership and implementation routes of these measures are set out in **Volume 3, Appendix 5.2: Commitments Register**.

Table 25.9 Relevant noise and vibration embedded environmental measures

ID	Environmental measure proposed	Project stage measure introduced	How the environmental measures will be secured	Relevance to noise and vibration assessment
M-063	An CEMP will be implemented by the contractor in accordance with **Volume 4: Outline CEMP**. The contractor will ensure that the relevant environmental measures within the CEMP and health and safety procedures are implemented. The CEMP identifies the project management structure roles and responsibilities with regard to managing and reporting on the environmental impact of the construction stage.	Scoping Amended at EIA Report	**Volume 4: Outline CEMP** and planning conditions.	The CEMP will be adopted to minimise temporary disturbance to residential properties and existing land users and will provide details of measures to protect human receptors where appropriate.
M-090	Construction noise and vibration to be managed within **Volume 4: Outline CEMP** to minimise temporary disturbance to residential properties, recreational users, and existing land users.	Scoping	**Volume 4: Outline CEMP** and planning conditions.	The Outline CEMP will be adopted to minimise temporary disturbance to residential properties and existing land users and will provide details of measures to protect human receptors where appropriate.
M-091	Highways condition surveys will be undertaken before, during and after the construction stage and repairs conducted to any damage to highways, as a result of construction HGVs on the highways related to the Project. This commitment is included within this Chapter as it minimises the risk from vibration effects at residences from HGVs passing over holes in the road.	Scoping Amended at EIA Report	**Volume 4: Outline CEMP** and planning conditions.	This measure will identify where there is a risk of significant effects from irregularities in the road adjacent to vibration sensitive receptors.
M-183	Operational noise from the onshore substations shall not give rise to levels in excess of NR25 (in habitable rooms of residential receptors) during the day (07:00 - 23:00) or NR20 (in bedrooms) at night (23:00 - 07:00).	EIA Report	Planning conditions.	Provides a design limit upon which to base mitigation requirements to allow no significant effects from operational noise of the onshore substations.

ID	Environmental measure proposed	Project stage measure introduced	How the environmental measures will be secured	Relevance to noise and vibration assessment
M-184	Construction noise and vibration mitigation and monitoring requirements are specified within a Noise and Vibration Management Plan (NVMP) included as part of **Volume 4: Outline CEMP**.	EIA Report	**Volume 4: Outline CEMP** and planning conditions.	The CEMP will be adopted to minimise temporary disturbance to residential properties and existing land users and will provide details of measures to protect human receptors where appropriate.
M-212	After detailed design, and before the commencement of the construction stage, a NVMP will be agreed with the Local Authorities and will set out the noise mitigation measures needed for trenchless crossing and landfall(s) works outside of core hours to meet the required limits.	EIA Report	**Volume 4: Outline CEMP** and planning conditions.	This measure will be adopted to minimise temporary disturbance from the trenchless crossing activities outside of core working hours where appropriate.

25.7.2.4 Further detail on the embedded environmental measures in **Table 25.9** is provided in the **Volume 3, Appendix 5.2**, which sets out how and where particular embedded environmental measures will be implemented and secured.

25.8 Methodology for EIA Report

25.8.1 Introduction

25.8.1.1 The project-wide approach to assessment is set out in **Chapter 5: Approach to EIA.** Whilst this has informed the approach that has been used in this noise and vibration assessment, it is necessary to set out how this methodology has been applied, and adapted, as appropriate, to address the specific needs of the noise and vibration assessment.

Construction noise

25.8.1.2 Construction noise calculations have been completed for the key construction activities associated with landfall(s), onshore export cable corridor construction, trenchless crossings, TCCs, accesses and onshore substations at the nearest NSRs. The assessment of construction noise is based on comparing predicted construction noise levels during the construction stage, to threshold level criteria selected accounting for the ambient noise levels at receptors.

25.8.1.3 The assessment of construction noise has included the following steps:

- identify the nearest noise-sensitive receptors to the construction activity;
- select a representative sample of the identified noise-sensitive receptors for assessment, ensuring a good geographic spread across the local area;
- set noise threshold level criteria based on the guidance contained in BS 5228-1, namely, the thresholds detailed in the ABC method;
- identify the key construction activities, source noise levels for the associated plant for use in the prediction of construction noise and core construction working hours;
- undertake construction noise predictions for the key construction activities of the maximum design scenario at the closest selected NSRs;
- assessment of the predicted construction noise levels against the construction noise threshold level criteria;
- determining the resulting impact magnitude and significance of effect at the identified receptors; and
- consideration of available noise mitigation measures for any exceedance of the noise threshold level criteria.

Construction traffic noise

25.8.1.4 The assessment of construction stage traffic noise has been undertaken based on the scheme traffic data for a peak month which presents a reasonable maximum design scenario for the assessment of construction traffic noise.

25.8.1.5 Construction traffic noise predictions have been undertaken in accordance with the CRTN calculation methodology. The noise levels for the ‘with’ and ‘without’ (for the time of construction) construction traffic scenarios have been compared to provide the change in

traffic noise as a result of the construction works. The difference between the 'with' and 'without' scenarios has been assessed using short-term criteria within DMRB LA111.

25.8.1.6 Basic Noise Level (BNL) calculations have been carried out in general accordance with CRTN, being undertaken for a notional receptor location 10m from the edge of the carriageway of each road considered. A notional receptor has been used because the change in traffic noise level adjacent to any given road will be the same at all distances where noise from that route is dominant. Traffic noise calculations have been undertaken to establish the change in the daytime $L_{A10,18hr}$ noise level for the peak number of daily trips for each construction route.

25.8.1.7 For roads with low flow, the BS 5228-1, Annex F, Haul road method has been used. The resultant $L_{Aeq,T}$ has been compared against the BS 5228-1 ABC threshold for the nominal receptor.

Construction vibration

25.8.1.8 The assessment of construction vibration has been undertaken based on the guidance contained within BS 5228-2. Drawing upon the historic ground-borne vibration measurement data, and vibration prediction methods contained within this Standard, a series of typical set-back distances have been determined, at which different degrees of human exposure to ground-borne vibration arise. Set-back distances have been determined for a sample of different vibration generating construction operations. The distances of vibration sensitive receptors have then been compared against the derived set-back distances to determine whether resulting effects would be significant or not.

Operational noise

25.8.1.9 A 3D noise model has been created using Datakustik CadnaA noise modelling software to predict the sound levels from the onshore substations at the nearest NSRs. The software allows for complex conditions / scenarios to be considered and implements the prediction algorithms in ISO 9613-2 (2024), which contains methods for calculating sound attenuation during outdoor propagation. The predicted noise levels have then been assessed in accordance with BS 4142.

25.8.1.10 The assessment of operational noise has included the following steps:

- identify the nearest NSRs to the onshore substations;
- select a representative sample of the identified NSRs for assessment, ensuring a good geographic spread across the local area;
- identify the operational noise sources of plant associated with the onshore substations and their associated source noise levels;
- predict noise levels for the maximum design scenario at the closest selected NSRs for the partially enclosed and fully enclosed scenarios;
- assess the predicted operational noise levels in accordance with BS 4142 and NR Curve Criteria;
- assess the operational noise impact magnitude criteria and determine the resulting impact magnitude and significance of effect; and
- consideration of available noise mitigation measures for any exceedance of the noise threshold level criteria.

25.8.2 Significance evaluation methodology

Overview

25.8.2.1 The significance level attributed to each effect has been assessed based on the value of the affected receptor and the magnitude of change resulting from the Project. The level of significance has then been determined by the combination of value and magnitude.

25.8.2.2 Different impact magnitude criteria have been determined for each assessed impact, to reflect the applicable guidance in each case. This approach ensures that the assessment is transparent, proportionate, and grounded in established guidance.

Value of receptor

25.8.2.3 The guidance contained within the TAN to PAN 1/2011 has been drawn upon in the generation of an appropriate set of receptor sensitivity criteria. These criteria are presented in **Table 25.10.**

Table 25.10 Receptor sensitivity

Receptor sensitivity	Description	Examples
High	Receptors where people or operational activities are particularly susceptible to noise and / or vibration.	Residential, schools, hospitals, places of worship.
Medium	Receptors where people or operational activities are moderately sensitive to noise and / or vibration, where it may cause some distraction or disturbance.	Offices, restaurants and sports grounds (where quiet conditions are necessary).
Low	Receptors where distraction or disturbance from noise and / or vibration for people or operational activities is minimal.	Unoccupied buildings or factories and working environments with existing levels of noise. Sports ground where noise is a normal part of the event.

25.8.2.4 In this assessment, all NSRs have been classified as high sensitive receptors, consistent with the guidance in TAN to PAN 1/2011.

Magnitude of changes

Construction noise

25.8.2.5 Construction noise thresholds have been determined for each receptor in accordance with the BS 5228-1 'ABC method', as shown in Table 4.1 in **Volume 3, Appendix 25.1**, and drawing on the results of the baseline noise surveys presented in **Volume 3, Appendix 25.2**.

25.8.2.6 The baseline noise levels at the NSRs are consistent with the lowest ambient noise category from BS 5228-1, Category A for the daytime, evening and weekend periods. Following the ABC assessment method from BS 5228-1, the Category A construction noise threshold criteria which apply are as follows:

- 65dB $L_{Aeq,T}$ during the daytime (i.e. Weekdays 07:00-19:00 and Saturdays 07:00-13:00); and
- 55dB $L_{Aeq,T}$ during the evening (i.e. Weekdays 19:00-23:00, Saturdays 13:00-23:00, Sundays 07:00-23:00).

25.8.2.7 For the night-time period, there are a number of NSRs where the baseline noise levels are consistent with Category B and Category C. These NSRs and their respect ABC Category for night-time works are identified in Table 3.4 in **Volume 3, Appendix 25.3**. In the absence of measurement data, the most stringent criteria, i.e. Category A, has been applied for the night-time period. Following the ABC assessment method in BS 5228-1, the construction noise threshold criteria which apply to the night-time works are as follows:

- Category A - 45dB $L_{Aeq,T}$;
- Category B: 50dB $L_{Aeq,T}$; and
- Category C: 55dB $L_{Aeq,T}$.

25.8.2.8 If noise levels exceed these threshold values a potential significant effect is indicated, but the significance could be tempered, for example if the exceedance is for a short duration.

25.8.2.9 When using the ABC method, there is a 5dB step between the absolute noise level associated with each category (e.g. between Categories A and B, or Categories B and C). To determine the impact magnitude associated with construction noise, this 5dB step has been applied to the adopted criteria. The resulting impact magnitude scale is detailed in **Table 25.11**. These thresholds reflect increasing levels of potential disturbance, with higher exceedances to the threshold values for Category A indicating greater likelihood of significant effects.

Table 25.11 Construction noise thresholds and impact magnitude criteria

Receptor construction noise level, dB $L_{Aeq,T}$	**Impact magnitude**
Day (Weekdays 07:00-19:00 and Saturdays 07:00-13:00)	
≥70dB(A)	High
≥65 to <70dB(A)	Medium
≥60 to <65dB(A)	Low
<60dB(A)	**Negligible**
Evening (Weekdays 19:00-23:00, Saturdays 13:00-23:00, Sundays 07:00-23:00)	
≥60dB(A)	High
≥55 to <60dB(A)	Medium
≥50 to <55dB(A)	Low
<50dB(A)	**Negligible**

Receptor construction noise level, dB $L_{Aeq,T}$	Impact magnitude
Night Category A (Weekdays, Saturdays, Sundays 23:00-07:00)	
≥50dB(A)	High
≥45 to <50dB(A)	Medium
≥40 to <45dB(A)	Low
< 40dB(A)	**Negligible**
Night Category B (Weekdays, Saturdays, Sundays 23:00-07:00)	
≥55dB(A)	High
≥50 to <55dB(A)	Medium
≥45 to <50dB(A)	Low
< 45dB(A)	**Negligible**
Night Category C (Weekdays, Saturdays, Sundays 23:00-07:00)	
≥65dB(A)	High
≥55 to <60dB(A)	Medium
≥50 to <55dB(A)	Low
< 50dB(A)	**Negligible**

Construction traffic noise

25.8.2.10 For construction traffic noise, the impact magnitude criteria have been determined based upon the classification of BNL changes as detailed within DMRB LA 111. The resulting magnitude of impact criteria are detailed in **Table 25.12**.

Table 25.12 Construction traffic noise impact magnitude criteria

Impact magnitude	Increase in BNL of closest public road used for construction traffic (dB)
High	Greater than or equal to 5.0
Medium	Greater than or equal to 3.0 and less than 5.0
Low	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

Construction vibration

25.8.2.11 For construction vibration, the magnitude of impact and effect level criteria have been determined according to the guidance contained within BS 5228-2 for human perception. **Table 25.13** details the resulting magnitude of impact and effect level criteria that have been applied.

Table 25.13 Construction vibration impact magnitude criteria

Impact magnitude	Vibration level (PPV, mm/s)
Medium -High	Greater than or equal to 1.0
Low	Greater than or equal to 0.3 and less than 1.0
Negligible	Less than 0.3

Operational Noise

25.8.2.12 The impact magnitude and effect level criteria for the operational noise associated with the onshore substations would be based upon the guidance contained within BS 4142. Its methodology considers the difference between the sound from the plant (including any correction(s) for noticeable acoustic characteristics) and the prevailing background sound levels. It also allows for the context and the sound levels in absolute terms to be considered. **Table 25.14** details the resulting magnitude of impact and effect level criteria that have been applied. In line with BS 4142, contextual factors such as the character of the noise, the acoustic environment, and the time of day have been considered in determining the likely significance of effects.

25.8.2.13 The concepts for No Observed Effect Level (NOEL), Lowest Observable Adverse Effect Level (LOAEL) and Significant Observable Adverse Effect Level (SOAEL) are introduced in the Noise Policy Statement for England (DEFRA, 2010) and they have been adopted for this assessment in absence of specific criteria in Scotland. The LOAEL and SOAEL effect levels adopted for the O&M stage noise assessment are also detailed within **Table 25.14**.

Table 25.14 Operational noise impact magnitude criteria

Impact magnitude	Increase of rating level over representative background sound level, dB (1), (2) (3)	Effect level (4)
High	≥ +10	SOAEL
Medium	≥ +5 and < +10	LOAEL-SOAEL
Low	≥ 0 and < +5	LOAEL
Negligible	< 0	NOEL
Notes **(1) The Impact Magnitude based upon the difference between rating and background levels is an initial estimate of impact, depending on context, these are not absolute criteria and may be increased or decreased depending on the environment of the receptor.**		

Impact magnitude	Increase of rating level over representative background sound level, dB (1), (2) (3)	Effect level (4)
(2) The above criteria apply equally to the daytime or night-time condition, i.e., daytime rating level, dB $L_{Ar,Tr}$, when compared with the daytime representative background sound level, dB $L_{A90,T}$; or the night-time rating level, dB $L_{Ar,Tr}$, when compared with the night-time representative background sound level, dB $L_{A90,T}$. (3) The representative daytime and night-time background sound levels are derived using the $L_{A90,15min}$ metric and following the procedure described in BS 4142. (4) The LOAEL and SOAEL will be set with reference to absolute levels and BS 4142 with the understanding of site context.		

Significance evaluation

25.8.2.14 The significance of effects for construction, O&M and decommissioning stage impacts has been determined by consideration to both the receptor sensitivity and the impact magnitude, by application of the matrix presented in **Table 25.15**.

Table 25.15 Construction noise (including construction traffic) and vibration, O&M noise and decommissioning noise and vibration significance matrix

Impact magnitude	Sensitivity of receptor		
	High	Medium	Low
High	Major (Significant)	Moderate (Significant)	Minor (Not Significant)
Medium	Moderate (Significant)	Minor (Not Significant)	Negligible (Not Significant)
Low	Minor (Not Significant)	Negligible (Not Significant)	Negligible (Not Significant)
Negligible	Negligible (Not Significant)	Negligible (Not Significant)	Negligible (Not Significant)

25.8.2.15 Effects assessed as **Moderate** or **Major** are considered '**Significant**' in EIA terms, while those assessed as **Minor** or **Negligible** are considered '**Not Significant**'.

25.9 Assessment of effects: construction stage

25.9.1 Introduction

25.9.1.1 This Section provides an assessment of the effects for noise and vibration from the construction of the onshore infrastructure elements of the Project.

25.9.1.2 The assessment methodology set out in **Section 25.8** has been applied to assess effects to noise and vibration from the Project.

25.9.2 Construction site noise

Overview

25.9.2.1 The maximum assessment scenarios relating to the construction stage are presented in **Table 25.8**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 25.8.2**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 25.9** have been implemented as part of the Project.

25.9.2.2 Construction noise predictions have been undertaken based on the BS 5228-1 calculation methodology and drawing on anticipated construction plant and methodologies. The assessment has considered key construction activities associated with the Project. Calculations have been undertaken based on all plant items positioned at a single location and located at the closest point of the Onshore Red Line Boundary to be the nearest NSR. The average scenario considers that all plant for each construction activity will be located at the approximate centre of the potential works. As the location of the works is dependent on the final design, the NSRs assume all prospective construction areas are viable. The construction stage NSRs are shown in **Volume 2, Figure 25.2: Construction stage noise sensitive receptors**.

25.9.2.3 As set out in **Chapter 4: Project Description,** the core working hours for the onshore construction works for the Project are as follows:

- 08:00 to 18:00 hours Monday to Friday; and
- 08:00 to 13:00 hours on Saturday.

25.9.2.4 No activity outside of these hours, including Sundays, public holidays or bank holidays will take place apart from under the following circumstances:

- where continuous periods (up to 24 hours, seven days per week) of construction work are required for HDD (or similar trenchless technique);
- for other works requiring extended working hours such as concrete pouring which will require the relevant Planning Authority to be notified at least 72 hours in advance;
- for the delivery of abnormal loads to the connection works, which may cause congestion on the local road network, where the relevant highway authority has been notified prior to such works 72 hours in advance;
- as otherwise agreed in writing with the relevant Planning Authority.

25.9.2.5 For the daytime period, the predicted construction noise levels have been assessed against the most stringent threshold values contained in BS 5228-1, i.e. Category A thresholds. For the night-time period, there are a number of NSRs where the baseline noise levels are consistent with Category B and Category C. These NSRs and their respect ABC Category for night-time works are identified in Table 3.1 in **Volume 3, Appendix 25.3**. The resulting impact magnitude and significance of effect have been determined in line with **Table 25.11**.

25.9.2.6 Further details of the construction noise assessment, including a full listing of the plant assumptions, is provided in **Volume 3, Appendix 25.3**.

25.9.2.7 During core working hours, the construction noise assessment indicates that when works are at their closest distance to the NSRs the daytime threshold criteria of 65dB $L_{Aeq,T}$ may be exceeded for the following activities:

- construction of TCCs supporting onshore works;

- general construction stage activities within TCCs;
- construction of trenchless crossings; and
- construction of temporary and permanent access routes associated with the onshore substations.

25.9.2.8 Outside of core working hours, the construction noise assessment indicated that when works are at their closest distance to NSRs the evening and weekend threshold criteria of 55dB $L_{Aeq,T}$, and the adopted night-time threshold criteria may be exceeded for the following activities:

- construction of landfall(s) TCC (considered to be weekend and evening activity only – not night-time);
- landfall(s) construction stage activity with TCCs (considered to be weekend and evening activity only – not night-time); and
- construction of trenchless crossings.

25.9.2.9 The majority of the activities which exceed the threshold of significance are likely to be for a duration of longer than one month, and therefore there is a need to provide mitigation measures to avoid significant effects. Section 4.2 of **Volume 3, Appendix 25.3** presents further details on the combinations of measures needed to meet the threshold of significance for the average and maximum design scenario activity sound levels. These mitigation measures will be implemented and secured through the NVMP and **Volume 4: Outline CEMP**.

25.9.2.10 In summary, the construction of trenchless crossing and landfall(s) works outside of core working hours will be managed to meet required limits by employing appropriate mitigation which could include one or a combination of the following:

- **management of the construction of trenchless crossings outside of core working hours**: Works will be managed to include an appropriate separation distance between the works and NSRs;
- **deployment of temporary acoustic barriers:** Mobile noise screens will be installed around high-noise plant and activities, particularly during trenchless crossings and landfall construction;
- **real-time noise monitoring and trigger protocols:** Noise monitors will be installed at representative NSRs. Trigger thresholds will be defined, and exceedances will initiate immediate review and corrective action; and
- **receptor-specific mitigation:** Where significant effects cannot be mitigated through site-based controls, additional measures such as temporary relocation will be considered on a case-by-case basis.

25.9.2.11 These measures will be reviewed and refined following detailed design and contractor engagement, and will be secured through planning conditions and the Commitments Register (see **Table 25.9** - reference M-063, M-090, M-184 and M-212).

Sensitivity or value of receptor

25.9.2.12 The closest NSRs are existing dwellings and therefore have been identified to be of **High** sensitivity.

Magnitude of impact

25.9.2.13 With the embedded environmental measures in place, the residual construction noise levels for each activity of the maximum design scenario would meet the relevant threshold of criteria, i.e. an impact magnitude of **Negligible** to **Low** magnitudes of change.

Significance of residual effect

25.9.2.14 The impact magnitude would be **Negligible** to **Low** and the sensitivity of the receptors are classified as **High**. Therefore, there is direct, temporary, residual effect of **Negligible to Minor Adverse** significance, which is **Not Significant** in EIA terms.

25.9.2.15 After detailed design, and before the commencement of the construction period, a NVMP will be produced and agreed with the Local Authorities setting out the requirements for noise and vibration mitigation measures.

25.9.2.16 A summary of the residual effects arising from the construction stage of the Project are provided in **Table 25.18**.

25.9.3 Construction traffic noise

Overview

25.9.3.1 Predictions have been undertaken for the following scenarios:

- Scenario 1: Baseline traffic alone; and
- Scenario 2: Baseline traffic plus traffic due to peak of construction of the Project.

25.9.3.2 The changes in road traffic noise have been determined by subtracting the noise level determined for Scenario 1, from that determined for Scenario 2. The resulting change is therefore that associated with the additional construction traffic movements.

25.9.3.3 The A90 road link is subject to the highest noise level changes which, during peak construction, range between +0.3dB and +0.9dB.

25.9.3.4 For low flow roads, i.e. below 1000 vehicle movements between 06:00 and 00:00, the haul road calculation in BS 5228-1 has been used to predict the HGV noise level for the peak construction traffic data at 10m. Whilst there is the potential for a noticeable change in noise due to HGV movements at residential receptors adjacent to these low-traffic roads, the highest noise level resulting from construction HGV traffic is predicted to be 52dB $L_{Aeq,1h}$. This is 13dB below the most stringent daytime construction noise threshold for Category A, i.e., 65dB $L_{Aeq,T}$.

25.9.3.5 Further details of the construction traffic noise assessment are included in **Volume 3, Appendix 25.4**.

Sensitivity or value of receptor

25.9.3.6 The NSRs are existing dwellings and therefore have been identified to be of **High** sensitivity.

Magnitude of impact

25.9.3.7 The worst-case impact magnitude is defined as **Negligible**.

Significance of residual effect

25.9.3.8 The worst-case impact magnitude is defined as **Negligible** and the sensitivity of the receptors are classified as **High**. Therefore, there is indirect, temporary, residual effect of **Negligible** significance, which is **Not Significant** in EIA terms.

25.9.4 Construction site vibration

Overview

25.9.4.1 At this stage, the type and number of vibration-generating construction plant items, the programme and working methodologies to be applied are not known; these would be based on the final design, the ground conditions, and plant selected by the Contractor, who would be appointed after planning approval.

25.9.4.2 Ground-borne vibration calculations have been performed for construction activities typically required for similar developments. The calculations are based on the empirical prediction procedures presented within BS 5228-2. The distances at which vibration levels are predicted to meet the criteria thresholds, based on a specified confidence limit (where applicable) are set out in **Volume 3, Appendix 25.3**.

25.9.4.3 The results of the assessment indicate that ground-borne vibration may be just perceptible within residential properties (defined as PPV < 0.3mm/s) when vibration-generating construction activities occur within 80m of the nearest sensitive receptors, particularly during the construction of temporary and permanent access routes associated with the onshore substations. For activities occurring beyond 80m from nearest receptors, vibration levels are predicted to remain below perceptibility thresholds (i.e., < 0.3mm/s). However, when vibratory rollers are operated within 30m of an sensitive receptor, vibration levels may exceed 1.0mm/s PPV, which has the potential to give rise to complaints.

25.9.4.4 The following sensitive receptors are those closest to the construction stage activities involving vibratory rollers, i.e. the construction of temporary and permanent access routes, and have the greatest potential to be subject to vibration effects:

- NSR6 Steading Cottage;
- NSR7 Cairnhill House;
- NSR8 Easterton of Barnyards;
- NSR14 of Tortorston Road (Westwyn);
- NSR18 Lunderton, (West of A90);
- NSR19 Cattlemans Cottage;
- NSR20 Meadowbank Inverugie; and
- NSR22 Tortoston Road (Oakdene Villa).

25.9.4.5 To reduce the predicted adverse effect at NSR22 Oakdene Villa from vibratory roller use within 30m, i.e. the only sensitive receptor potentially within 20m of the construction of temporary and permanent access routes associated with the onshore substations, the following mitigation measures will be implemented and secured through the NVMP and **Volume 4: Outline CEMP**:

- **alternative compaction methods:** where feasible, use lower-vibration compaction techniques (e.g. static rollers or vibro-compaction with reduced amplitude) in proximity to NSR22;

- **setback buffer enforcement:** establish a minimum buffer zone of 30m for vibratory roller operations near sensitive receptors unless vibration monitoring confirms compliance with PPV thresholds;
- **real-time vibration monitoring:** install vibration sensors at NSR22 to track PPV levels during compaction activities. Trigger thresholds will be set at 1.0mm/s, with automatic alerts and work stoppage protocols if exceeded;
- **shortened activity duration:** limit the duration of vibratory roller use near NSR22 to below the EIA-defined thresholds (i.e. no more than 10 days in any 15-day period or 40 days in six months); and
- **community notification and liaison:** provide advance notice to residents of NSR22 regarding timing and nature of vibration-generating works. A dedicated contact will be available for concerns and complaints.

25.9.4.6 These measures will be reviewed and refined following detailed design and contractor engagement and will be secured through planning conditions and the Commitments Register (see **Table 25.9** reference M-063, M-090 and M-184).

Sensitivity or value of receptor

25.9.4.7 The closest sensitive receptors are existing dwellings and therefore have been identified to be of **High** sensitivity.

Magnitude of impact

25.9.4.8 For the majority of the nearest sensitive receptors, vibration generating activities will take place outside of 80m and the impact magnitude would be **Negligible** to **Low**.

25.9.4.9 With the embedded environmental measures in place, it is considered that the residual impact magnitude for vibration generating activities which take place within 80m of the nearest sensitive receptors would be **Low**.

Significance of residual effect

25.9.4.10 For vibration generating activities which take place outside of 80m of the nearest sensitive receptors the residual impact magnitude is defined as **Negligible to Low** and the sensitivity of the receptors are classified as **High**. Therefore, there is direct, temporary, residual effect of **Negligible to Minor Adverse** significance, which is **Not Significant** in EIA terms.

25.9.4.11 For the vibration generating activities which take place within 80m of the nearest sensitive receptors, with the proposed mitigation measures in place, the residual impact magnitude would be **Low** and the sensitivity of the receptors are classified as **High**. Therefore, there is direct, temporary, residual effect of **Minor Adverse** significance, which is **Not Significant** in EIA terms.

25.9.4.12 After detailed design, and before the commencement of the construction period, a NVMP will be produced and agreed with the Local Authorities setting out the requirements for noise and vibration mitigation measures.

25.9.4.13 A summary of the residual effects arising from the construction stage of the Project are provided in **Table 25.18**.

25.10 Assessment of effects: O&M stage

25.10.1 Introduction

25.10.1.1 This Section provides an assessment of the effects for noise from the O&M of the onshore elements of the Project.

25.10.1.2 The assessment methodology set out in **Section 25.8** has been applied to assess effects to noise from the Project.

25.10.2 Operational site noise

Overview

25.10.2.1 The maximum assessment scenario relating to the onshore substations are presented in **Table 25.8**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 25.8.2**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 25.9** have been implemented as part of the Project.

25.10.2.2 An assessment of operational noise generated by the onshore substations has been undertaken using the prediction methodology within ISO 9613-2 and assessed in accordance with BS 4142. Details of the operational noise assessment, including a full listing of the plant assumptions, is provided in **Volume 3, Appendix 25.5**.

25.10.2.3 To predict the operational noise from the onshore substations, Datakustik CadnaA noise modelling software was utilised. The noise model incorporated proposed buildings and fixed plant associated with the fully enclosed and partially enclosed scenarios, residential dwellings and topographical data.

25.10.2.4 With the embedded environmental measures in place, the tonality from transformers will be minimised. As such, a +2dB penalty for low tonality has been applied for the BS 4142 assessment. No other corrections have been applied (i.e. impulsivity, intermittency or other sound characteristics). The rating level of an industrial or commercial sound source should, where practicable, achieve a level no greater than the representative background sound level, when predicted or measured in accordance with BS 4142. However, it is also necessary to consider the context and of relevance to this assessment are the absolute sound levels.

25.10.2.5 **Table 25.16** and **Table 25.17** presents a summary of the initial BS 4142 operational noise assessments for the fully enclosed and partially enclosed scenarios during the daytime and night-time periods respectively.

Table 25.16 Initial BS 4142 assessment for the daytime period, including embedded environmental measures

NSR	Specific sound level, dB $L_{Aeq,T}$	Acoustic feature correction, dB	Rating level, dB $L_{Ar,Tr}$	Daytime back-ground sound level, dB L_{A90}	Excess of daytime back-ground sound level, dB
Partially enclosed onshore substation scenario:					
NSR1 Hawthorn Cottage	34	+2	36	38	Does not exceed background.
NSR2 Howiemuir	35	+2	37	33	+4
NSR3 Denholm	32	+2	34	33	+1
NSR4 East Thunderton	32	+2	34	40	Does not exceed background.
Fully enclosed onshore substation scenario:					
NSR1 Hawthorn Cottage	25	+2	27	38	Does not exceed background.
NSR2 Howiemuir	32	+2	34	33	+1
NSR3 Denholm	31	+2	33	33	Does not exceed background.
NSR4 East Thunderton	25	+2	27	40	Does not exceed background.

Table 25.17 Initial BS 4142 assessment for the night-time period, including embedded environmental measures

NSR	Specific sound level, dB $L_{Aeq,T}$	Acoustic feature correction, dB	Rating level, dB $L_{Ar,Tr}$	Night-time back-ground sound level, dB L_{A90}	Excess of night-time back-ground sound level, dB
Partially enclosed substation scenario					
NSR1 Hawthorn Cottage	34	+2	36	33	+3

NSR	Specific sound level, dB $L_{Aeq,T}$	Acoustic feature correction, dB	Rating level, dB $L_{Ar,Tr}$	Night-time back-ground sound level, dB L_{A90}	Excess of night-time back-ground sound level, dB
NSR2 Howiemuir	35	+2	37	28	+9
NSR3 Denholm	32	+2	34	28	+6
NSR4 East Thunderton	32	+2	34	32	+2
Fully enclosed substation scenario					
NSR1 Hawthorn Cottage	25	+2	27	33	Does not exceed background.
NSR2 Howiemuir	32	+2	34	28	+6
NSR3 Denholm	31	+2	33	28	+5
NSR4 East Thunderton	25	+2	27	32	Does not exceed background.

25.10.2.6 The results of the initial daytime BS 4142 assessment, depending on context, indicates that, at worst, for the partially enclosed onshore substations scenario, the rating level would be +4dB above the background. For the fully enclosed onshore substations scenario the rating level would be +1dB above the background. This is an indication that the onshore substations could be approaching an adverse impact at the nearest NSRs of the Project.

25.10.2.7 The results for the initial night-time BS 4142 assessment, depending on context, indicates that, at worst, the rating level would be +9dB above background for the partially enclosed onshore substations scenario and +6dB above the background for the fully enclosed onshore substations scenario. This is an indication that the onshore substations could have an adverse impact at the nearest NSRs of the Project during the night.

25.10.2.8 As shown in **Table 25.7**, it can be seen that the measured backgrounds at NSR2 Howiemuir and NSR3 Denholm are low. Although it is a rural area, the ambient noise levels at NRSs typically range between 45 and 50 dB $L_{Aeq,15mins}$ during the daytime period and 42 and 49dB $L_{Aeq,15mins}$ during the night-time period. In the context of the location of the onshore substations a 35dB L_{ArTr} rating level is therefore considered to be a low magnitude of impact and an appropriate effect level for the LOAEL. The onshore substations will therefore be designed to meet this level.

25.10.2.9 In order to achieve a maximum rating level of 35dB $L_{Ar,Tr}$, an additional 2dB reduction is required in the partially outdoors scenario at the nearest NSR of Howiemuir. This may include the use of quieter plant than assessed or the use of low-noise modes on onshore plant that reduce tonality. **Volume 3, Appendix 25.5** presents further details on the combination of measures to achieve this.

25.10.2.10 The requirement for and extent of mitigation will be dependent upon the spatial arrangement of buildings, internal site layout and selection of equipment in the final design. Once a decision has been reached as to whether the onshore substations will be partially enclosed or fully enclosed, and detailed design and final plant selection information is available, it will be necessary to undertake an updated noise assessment to demonstrate that the final design meets the 35dB $L_{Ar,Tr}$ rating level requirement and would correspond to LOAEL.

25.10.2.11 In addition to the BS 4142 assessment, an NR curve assessment at the nearest case NSR of Howiemuir has been undertaken to address the requirements of Aberdeenshire Council. The results of the assessment indicated that with embedded environmental measures, both the partial outdoors and fully enclosed scenarios, meet the internal daytime and night-time noise criteria of the NR25 and NR20 respectively. These measures will be reviewed and refined following detailed design and will be secured through planning conditions and the Commitments Register (see **Table 25.9** reference M-183).

25.10.2.12 With embedded environmental measures, both the partially enclosed and fully enclosed scenarios, meet the internal daytime and night-time noise criteria requested by Aberdeenshire Council.

Sensitivity or value of receptor

25.10.2.13 The closest NSRs are existing dwellings and therefore have been identified to be of **High** sensitivity.

Magnitude of impact

25.10.2.14 The results of the onshore substations' noise assessment indicate, at worst, an impact magnitude of **Low** during the day and night, subject to the embedded noise mitigation described in this assessment.

Significance of residual effect

25.10.2.15 For residential receptors, the impact magnitude is, at worst, defined as **Low** and the sensitivity of the receptors are classified as **High**. While initial modelling for the partially enclosed onshore substations scenario indicates exceedances of background levels at night (up to +9dB), the onshore substations will be designed to meet a maximum rating level of 35dB $L_{Ar,Tr}$, which corresponds to the LOAEL and avoids SOAEL exceedance. This design commitment is secured through embedded mitigation measures, including Commitment M-183, which ensures compliance with NR25 (day) and NR20 (night) internal noise limits. The fully enclosed onshore substations scenario already meets background levels at all NSRs. Considering these factors, and the contextual interpretation permitted under BS 4142, the residual effect is considered to be **Minor Adverse**, which is **Not Significant** in EIA terms.

25.10.2.16 A summary of the residual effects arising from the O&M stage of the Project are provided in **Table 25.18**.

25.11 Assessment of effects: decommissioning stage

25.11.1.1 As per **Chapter 4: Project Description**, it is anticipated that the onshore export cables will be left in-situ with ends cuts, sealed and buried to minimise environmental effects associated with removal. The underground structures of the joint bays/transition joint bays, fibre optic cable junction boxes and link boxes will be removed only if it is feasible with minimal environmental disturbance or if their removal is required to return the land to its

current agricultural use. For this reason, the noise and vibration effect of decommissioning will be largely the same as the construction stage.

25.11.1.2 It is assumed that the majority of the activities associated with the decommissioning stage for the onshore substations will be similar to the activities associated with their construction. For this reason, the noise and vibration effect of decommissioning will be largely the same as construction stage.

25.11.1.3 As such, the effect of decommissioning will be represented by considering the construction stage activities and requiring no more mitigation than identified for construction stage, and with no higher residual effect. In summary, the impact magnitude would be **Negligible** to **Low** and the sensitivity of the receptors are classified as **High**. Therefore, there is direct, temporary, residual effect of **Negligible** to **Minor Adverse** significance, which is **Not Significant** in EIA terms.

25.11.1.4 A summary of the residual effects arising from the decommissioning stage of the Project are provided in **Table 25.18**.

25.12 Summary of effects

25.12.1.1 A summary of the effects arising from the construction, O&M and decommissioning stages of the Project in relation to onshore noise and vibration are summarised **Table 25.18**.

Table 25.18 Summary of effects during the construction, O&M and decommissioning stage of the Project on noise and vibration

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of effect	Significance of effects
Construction and decommissioning stage					
Residential Receptors	**High**	Site construction and decommissioning noise: Noise generation from construction and decommissioning activities associated with the Project.	M-063 M-090 M-184 M-212	**Negligible to Low**.	**Negligible** to **Minor Adverse** (**Not Significant**).
Residential Receptors along construction traffic routes	**High**	Construction traffic noise: Changes to road traffic noise due to traffic movements associated with the Project.	M-063 M-090 M-091 M-184	**Negligible**	**Negligible** (**Not Significant**).
Residential Receptors outside of 80m of vibration generating activities	**High**	Site construction vibration: Vibration generation from piling or compaction activities associated with the construction of the Project.	M-063 M-090 M-184	At worst, a **Negligible** to **Low** impact magnitude.	At worst a **Negligible** to **Minor Adverse impact** (**Not Significant**).
Residential Receptors within 80m of vibration generating activities				**Low** impact magnitude.	**Minor Adverse** (**Not Significant**).
O&M stage					
Residential Receptors	**High**	Operational site noise: Operational noise from the onshore substations.	M-183	At worst a **Low** impact magnitude at worst during the daytime and night-time period.	At worst a **Minor Adverse impact** (**Not Significant**).

25.13 Transboundary effects

25.13.1.1 Transboundary effects arise when impacts from a development with one European Economic Area (EEA) State affects the environment of another EEA State(s). A screening of transboundary effects has been carried out and is presented in Appendix 4B of the Scoping Report (MarramWind Ltd., 2023).

25.13.1.2 Based on the nature of planned works and the distance between the Project and other jurisdictions, there are not considered to be any transboundary effects on noise and vibration receptors from the Project.

25.14 Inter-related effects

25.14.1.1 A description and assessment of the likely inter-related effects arising from the Project on noise and vibration is provided in **Chapter 32: Inter-Related Effects**.

25.15 Assessment of cumulative effects

25.15.1.1 A description and assessment of the cumulative effects arising from the Project on noise and vibration is provided in **Chapter 33: Cumulative Effects Assessment**.

25.16 Summary of residual likely significant effects

25.16.1.1 There are no residual likely significant effects on noise and vibration receptors assessed in this EIA Report Chapter have been identified.

25.17 References

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25.18 Glossary of terms and abbreviations

25.18.1 Abbreviations

Acronym	Definition
BNL	Basic Noise Level
BS	British Standard
CEMP	Construction Environmental Management Plan
CRTN	Calculation of Road Traffic Noise
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
EEA	European Economic Area
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
ISO	International Standards Organisation
LOAEL	Lowest Observable Adverse Effect Level
NOEL	No Observed Effect Level
NPSE	Noise Policy Statement for England
NSR	Noise Sensitive Receptor
NVMP	Noise and Vibration Management Plan
O&M	Operation and Maintenance
PAN	Planning Advice Note
SOAEL	Significant Observable Adverse Effect Level
TAN	Technical Advice Note
TCC	Temporary Construction Compound

25.18.2 Glossary of terms

Term	Definition
Acoustic environment	Sound from all sources as modified by the environment.

Term	Definition
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.
Ambient sound level	The $L_{Aeq,T}$, of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background sound level	The underlying level of sound over a period, T, and is represented by $L_{A90,T}$, the level exceeded for 90% of the measurement interval T.
British Standard 5228-1	British Standard 5228-1:2009+A1:2014 Code of practice for noise vibration control on construction and open sites – Part 1: Noise
British Standard 4142	British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound
British Standard 82333	BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings
dB	A unit used to measure the intensity of a sound or the power level of an electrical signal by comparing it with a given level on a logarithmic scale.
Free-field level	Resulting level from a measurement that is undertaken away from the acoustic influence of a reflective façade (i.e., at least 3.5m away from any reflective source, not including the ground).
Frequency in Octave Bands	A range of frequencies where the upper frequency limit is twice that of the lower frequency limit. For example, the 1,000Hz octave band contains acoustic energy at all frequencies from 707 to 1,414Hz.
Frequency in One Third Octave Bands	Octave bands that are sub-divided into three parts, equal to 23% of the centre frequency. Used when octave analysis does not provide sufficient detail. Divides the audio spectrum into 33 or more equal parts where the cut-off frequencies have a ratio of 21 / 3, which is approximately 1.26. For example, a 1kHz third-octave band filter has a centre frequency of 1,000Hz with lower and upper frequencies of 891Hz and 1,112Hz, respectively.
Hertz	The number of waves per second. The unit of measurement for frequency of a sound wave.
Impact	Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact)
ISO 9613-2	International Standards Organisation (ISO) 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors. Part 2: Engineering method for the prediction of sound pressure levels outdoors
$L_{A10,18h}$	The $L_{A10,18h}$ is the A-weighted sound pressure level that is exceeded for 10% of an 18-hour measurement.
$L_{A90,T}$	The A-weighted sound pressure level that is exceeded for 90% of a given time interval, T. Known as the 'background sound level'.

Term	Definition
$L_{Aeq,T}$	The A-weighted equivalent continuous sound level. It is the notional continuous level that, over the defined time period, T, contains the same sound energy as the actual fluctuating sound that occurred over the same time period.
$L_{AFmax,T}$	The maximum recorded sound level within a given time period, T, measured using a fast time weighting.
$L_{AN,T}$	The level of A-weighted noise exceeded for N% of the measurement time T. Note that the time weighting (usually Fast) is sometimes included, denoted by 'F' (for example, $L_{AFN,T}$)
Mean (average)	The arithmetic average of a set of numbers, for example, add up the numbers and divide by the number of numbers.
Modal (average)	The mode is the number in a dataset that is repeated more often than any other number in the same set.
Noise	A term used to describe 'unwanted sound' or any sound that is undesired by the recipient.
Root Mean Square	Root Mean Square of a time-varying quantity is obtained by squaring the amplitude at each instant, obtaining the average of the squared values over the interval of interest, and then taking the Square Root of this average.
Sound	A term used to describe airborne waves that can be heard.
Sound level meter	Sound level meter is the instrument used for acoustic (sound that travels through air) measurements. It is commonly a hand-held instrument with a microphone. The diaphragm of the microphone responds to changes in air pressure caused by sound waves.
Sound pressure level (Lp)	Sound pressure level is the RMS value of the Instantaneous Sound Pressures measured over a specified period of time, measured in decibels (dB) to a given reference pressure level.
Specific sound level	An equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.
Time weighting	Time weightings determine how quickly the sound level meter responds to changes in sound pressure level. Fast time weighting: the sound level meter samples over a few discrete 125ms periods, with all parameters calculated from these 125ms measurements. For example, a 15-minute measurement period is actually 432,000 individual measurements. Slow time weighting: the sound level meter samples over several discrete 1 second periods, with all parameters calculated from these 1 second measurements.
Weighting network	An electronic filter in a sound level meter, which approximates, under defined conditions, the frequency response of the human ear. The A- weighting network is most commonly used.

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