FIVE ESTUARIES OFFSHORE WIND FARM

PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

VOLUME 3, CHAPTER 9: AIRBORNE NOISE AND VIBRATION

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GLOSSARY OF TERMS.

Term	Definition
Array Areas	The areas where the WTGs will be located.
Cable Works TCC	TCC associated with cable works.
DCO	An order made under the Planning Act 2008 granting development consent for a NSIP from the Secretary of State for Business, Energy and Industrial Strategy.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact in question with the sensitivity of the receptor in question, in accordance with defined significance criteria.
ES	The documents that collate the processes and results of the EIA.
European sites	Sites designated for nature conservation under the Habitats Directive and Birds Directive, as defined in regulation 8 of the Conservation of Habitats and Species Regulations 2017 and regulation 18 of the Conservation of Offshore Marine Habitats and Species Regulations 2017. These include candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas.
The Environmental Protection Act 1990	The Environmental Protection Act 1990 is an Act of the Parliament, the fundamental structure and authority for waste management and control of emissions into the environment.
Evidence Plan	A voluntary consultation process with specialist stakeholders to agree the approach to the Environmental Impact Assessment.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial, resulting from the activities associated with the construction, operation and maintenance, or decommissioning of the project.
Habitats Regulations	The Conservation of Habitats and Species Regulations 2010.
Landfall	The landfall denotes the location where the offshore export cables are brought ashore and jointed to the onshore cable circuits in TJBs.

Term	Definition
Maximum Design Scenario	The maximum design parameters of the combined project assets that result in the greatest potential for change in relation to each impact assessed.
Mitigation	Mitigation measures are commitments made by the project to reduce and/or eliminate the potential for significant effects to arise as a result of the project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts through the assessment process.
Noise Policy Statement for England	The noise policy statement for England (NPSE) sets out the government's overall policy on noise.
Noise Sensitive Receptor	Noise Sensitive Receptors (NSRs) are defined as receptors which are potentially sensitive to noise and vibration
Noise and Vibration Management Plan	A Noise Management Plan is to put in place reasonable measures to reduce the impact of noise associated with the development.
Onshore ECC	At PEIR, the Onshore ECC is the wider cable corridor within which the typically 60 m cable route is located. The Onshore ECC is typically approximately 200m to 250 m wide, however some areas require a wider corridor (such as where trenchless crossing may take place).
OnSS	Where the power supplied from the wind farm is adjusted (including voltage, power quality and power factor as required) to meet the UK System-Operator Transmission-Owner Code for supply to the National Grid substation.
OnSS Access Zone	The area which will contain the final OnSS access route (both construction and operational)
OnSS Construction Zone	The area in which the final OnSS TCC footprint will be located.
OnSS Zone	The area in which the final OnSS footprint will be located.
PEIR	The PEIR is written in the style of a draft ES and forms the basis of statutory consultation. Following that consultation, the PEIR documentation will be updated into the final ES that will accompany the application for the DCO.
RLB	The area within which development will be carried out including all works, access routes, TCCs, visibility splays and discharge points.
SSSI	A geological or biological conservation designation denoting a nationally protected area in the UK.

Term	Definition
SAC	Area of protected habitats and species as defined in the European Union's Habitat Directive (92/43/EEC).
SPA	A designated area for birds under the European Union Directive on the Conservation of Wild Birds (2009/147/EC).
Sound Power Level	The Sound Power Level is a measure of the acoustic energy emitted from a source of noise independent of the acoustic environment it is in, expressed in decibels.
Sound Pressure Level	The Sound Pressure Level is the result of one or more sound sources that is transferred into a specific acoustic environment and measured at a specific location, expressed in decibels.
TJB	An underground unit where the offshore cable joins the onshore cable.
United Kingdom Accreditation Service	The United Kingdom Accreditation Service is national accreditation body recognised by the British government to assess the competence of organisations that provide certification, testing, inspection and calibration services.

DEFINITION OF ACRONYMS

Term	Definition
AAWT	Annual Average Weekday Traffic
AQTAG09	Air Quality Technical Advisory Group 09
BNL	Basic Noise Level
BPM	Best Practicable Means
CoPA	Control of Pollution Act 1974
CRTN	Calculation of Road Traffic Noise
DCO	Development Consent Order
DRMB	Design Manual for Roads and Bridges
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EPA	The Environmental Protection Act 1990
ES	Environmental Statement
ETG	Expert Topic Group
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
IEMA	Institute of Environmental Management and Assessment
LSE	Likely Significant Effects
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
NPPF	The National Planning Policy Framework
NSPE	Noise Policy Statement for England
NSR	Noise Sensitive Receptor
NVMP	Noise and Vibration Management Plan
PEIR	Preliminary Environmental Information Report
PINS	The Planning Inspectorate
SAC	Special Area of Conservation
SoS	Secretary of State
SWL	Sound Power Level
TCC	Temporary Construction Compound
TDLP	Tendring District Local Plan

Term	Definition
TJB	Transition Joint Bay
UKAS	United Kingdom Accreditation Service
VE	Five Estuaries Offshore Wind Farm
VE OWFL	Five Estuaries Offshore Wind Farm Limited
VSR	Vibration Sensitive Receptor

9 AIRBORNE NOISE AND VIBRATION

9.1 INTRODUCTION

9.1.1 This Chapter of Preliminary Environmental Information Report (PEIR) considers the potential for the construction and operation of the onshore elements of the proposed Five Estuaries Offshore Wind Farm (VE) to impact upon the airborne noise and vibration environment at the nearby sensitive receptors to the project, providing a worst case as noise and vibration impacts diminish with increasing distance. This Chapter describes the scope, relevant legislation, assessment methodology, and the baseline conditions existing at the site and its surroundings. It considers any potential significant environmental effects the proposed development would have on this baseline environment; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been employed. Cumulative noise and/or vibration effects with other proposed developments that may also have an impact on the sensitive receptors close to the VE are also considered.

9.1.2 The Chapter is complemented with the following technical annexes:

- Volume 5, Annex 9.1: Baseline Survey Details
- Volume 5, Annex 9.2: Construction Plant.

9.1.3 This Chapter has been informed by the following PEIR chapters:

- Volume 3, Chapter 1: Onshore Project Description; and
- Volume 3, Chapter 8: Traffic and Transport.

9.2 STATUTORY AND POLICY CONTEXT

LEGISLATION

9.2.1 In England, there are two legislative instruments which address the effects of environmental noise with regard to construction noise and vibration and nuisance. The Environmental Protection Act 1990 (EPA) and the Control of Pollution Act 1974 (CoPA).

9.2.2 The EPA provides a requirement for Local Authorities to investigate noise from industrial, trade or business premises, or vehicles, machinery or equipment in the street, and to determine if the noise is detrimental to health or constitutes a statutory nuisance. If the Local Authority determines that noise is detrimental to health or constitutes a statutory nuisance, the EPA gives the Local Authority the power to issue an abatement notice that requires the person responsible for producing the noise to prevent the noise from occurring.

9.2.3 The CoPA provides two means of controlling construction noise and vibration. Section 60 provides the Local Authority with the power to impose, at any time, operating conditions on the development site. Section 61 allows the developer to negotiate a set of operating procedures with the Local Authority prior to commencement of site works.

9.2.4 The assessment work completed in this Chapter will inform the Planning Inspectorate (PINS), Secretary of State (SoS) and Local Authority as to benchmark baseline sound levels and construction sound levels which may be referred to in a Section 60 or 61 application, if applicable.

NATIONAL POLICY

NATIONAL POLICY STATEMENTS

9.2.5 The assessment of the potential Airborne Noise and Vibration impacts of the onshore elements of VE has been made with reference to the UK Government's National Policy Statements (NPSs). Key policies for Airborne Noise and Vibration are listed in Table 9.1.

9.2.6 NPSs set out policies or circumstances that the UK Government considers should be taken into account in decisions on Nationally Significant Infrastructure Projects (NSIPs).

9.2.7 Those relevant to VE are:

- Overarching NPS for Energy (EN-1) (DECC 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC 2011c).

9.2.8 In addition to the current NPS, draft NPSs were consulted on between September and November 2021. The draft NPSs have been reviewed to determine the emerging expectations and changes from previous iterations of the NPSs. This includes the Draft Overarching NPS EN-1 (DECC, 2021a), EN-3 (DECC, 2021b) and EN-5 (DECC, 2021c).

9.2.9 A more detailed assessment is referenced below starting Paragraph 9.2.24.

NATIONAL PLANNING POLICY FRAMEWORK

9.2.10 The National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing and Communities, updated 2021) is the primary source of national planning guidance in England. Whilst the NPPF is not directly applicable to NSIPs, as Government policy it may be considered relevant and important.

9.2.11 The general aims for planning policy with regards to noise include:

- avoiding significant effects;
- minimising other impacts arising from new development and protecting identified areas of tranquillity; and
- recognising that this should be balanced against the need for business to operate without unreasonable restrictions being imposed.

NOISE POLICY STATEMENT FOR ENGLAND

9.2.12 The policies outlined in the NPPF is consistent with, and refers to, general Government policy on noise as set out in the Noise Policy Statement for England (NPSE).

9.2.13 The vision and aims of the NPSE are set out on pages 3 and 4 of that document. However, when considering these visions and aims it is important to note the specific advice of the NPSE that it should be interpreted "*within the context of Government policy on sustainable development*".

9.2.14 The guiding principles of sustainable development are set out clearly in paragraph 1.8 of the NPSE as relating not only to personal wellbeing but also to:

- ensuring a strong, healthy and just society in all respects by meeting the diverse needs of all;
- being guided by sound science;
- understanding the limits of the planet's resources;
- maintaining a sustainable economy; and
- promoting good governance.

9.2.15 In the Explanatory Note to the NPSE, paragraph 2.4 states:

"By describing clear policy vision and aims the NPSE provides the necessary clarity and direction to enable decisions to be made regarding what is an acceptable noise burden to place on society."

9.2.16 The Explanatory Note therefore embodies a clear expectation that there will often be a 'noise burden' as a consequence of development. It is one of the underlying principles of the NPSE that any such noise effects should not be considered in isolation but should rather be evaluated alongside the overall planning merits of the development being considered. Therefore, any identified adverse effects of noise should not be allowed to preclude development in their own right, but only if deemed to be unacceptable when assessed within the wider planning context of the development.

9.2.17 The NPSE also advises that noise impacts should be assessed based on adverse and significant adverse effect. The NPSE does not provide any specific guidance on assessment methods or noise limits. However, the concepts summarised in Table 9.1 are introduced and can be applied when considering the significance of noise impacts.

Table 9.1: Observed Effect Level.

EFFECT LEVEL	DESCRIPTION
No Observed Effect Level (NOEL)	This is the noise level below which no effect can be detected. In simple terms, below this level of noise, there is no detectable effect on health and quality of life due to the noise being assessed.
Lowest Observed Adverse Effect Level (LOAEL)	This is the level of noise above which adverse effects on health and quality of life can be detected.
Significant Observed Adverse Effect Level (SOAEL)	This is the level of noise above which significant adverse effects on health and quality of life occur.

PLANNING PRACTICE GUIDANCE

9.2.18 Planning Practice Guidance (PPG) provides greater details in relation to the relevance of noise to the planning process following the introduction of the NPPF and NPSE.

9.2.19 The PPG states that the following should be considered by local authorities:

'- whether or not a significant adverse effect is occurring or likely to occur;

- whether or not an adverse effect is occurring or likely to occur; and

- whether or not a good standard of amenity can be achieved.

In line with the Explanatory note of the noise policy statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.'

9.2.20 The PPG provides further guidance on each of the various observed effect levels set out in the NPSE. This is summarised in Table 9.2 below.

Table 9.2: Observed Effects

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

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

9.2.21 It is important to note that no specific noise parameters are defined; and no target noise levels are provided in PPG, it is the role of the acoustic consultant, as Competent Expert, to define the specific thresholds for assessment.

9.2.22 When considering appropriate thresholds guidance can be taken from PPG under the heading 'What factors influence whether noise could be a Concern?'. PPG refers to the subjective nature of noise, stating that there is no simple relationship between noise levels and the impact on those affected. This depends on how various factors combine in particular situations, including:

'the source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day - this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;…

for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise; …

the spectral content of the noise (i.e. whether or not the noise contained particular high or low frequency content) and the general character of the noise (i.e. whether or not the noise contains particular tonal characteristics or other particular features).'

NATIONAL POLICY STATEMENTS

9.2.23 The Overarching NSP for Energy (EN-1) gives general policy guidance in relation to energy infrastructure projects. With specific regard to the assessment of noise impacts, EN-1 (current version and revised (draft) version) gives the following recommendations:

"Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. Further information on assessment of particular noise sources may be contained in the technology-specific NPSs. In particular, for renewables (EN-3) and electricity networks (EN-5) there is assessment guidance for specific features of those technologies. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies."

9.2.24 EN-1 advises that operational noise should be assessed using the principles of the relevant British Standard, and Footnote 137 of EN-1 (footnote 125 of revised (draft) version of EN-1) lists British Standard BS 4142, BS 6472 and BS 8233 as an example. Similarly, footnote 138 of EN-1 (footnote 126 of revised (draft) version of EN-1) references British Standard BS 5228 as a relevant standard for the assessment of noise from construction and decommissioning noise. These British Standards are discussed in more detail in the following section.

9.2.25 As referenced in EN-1 (current version and revised (draft) version), the National Policy Statement for Electricity Networks Infrastructure (EN-5) provides planning policy advice specific to the development of electrical infrastructure projects. EN-5 sets out specialised assessment procedures that are applicable to overhead transmission lines. However, since the cable route that is to be considered as part of the proposed development is entirely underground, this advice is not relevant to the assessment presented in this Chapter. EN-5 also makes reference to the assessment of operational noise from substation equipment (paragraph 2.9.7), and refers to BS 4142 as a standard method of assessment of noise (paragraph 2.9.8).

9.2.26 Details of the policies of relevance to this assessment are provided in Table 9.3 together with an indication of where each requirement is addressed.

9.2.27 Table 9.3 also presents key details of relevant saved local planning policy with regard to noise and vibration; however, the NPS remain the principal policy against which the proposed development will be assessed.

TENDRING DISTRICT LOCAL PLAN

9.2.28 The Tendring District Local Plan (TDLP) 2013-2033 comprises two sections: Section 1 which was adopted 26 January 2021 and is shared with neighbouring authorities Braintree and Colchester; and Section 2 which was adopted 25 January 2022.

9.2.29 There are no specific noise policies set out in the TDLP; however, noise is referenced within Policy SP7 (Section 1): Place Shaping Principles and Policy SPL3 (Section 2): Sustainable Design.

9.2.30 Policy SP7 states:

"All new development must meet high standards of urban and architectural design. Development frameworks, masterplans, design codes, and other design guidance documents will be prepared in consultation with stakeholders where they are needed to support this objective.

All new development should reflect the following place shaping principles, where applicable:

> *….*

> *Protect the amenity of existing and future residents and users with regard to noise, vibration, smell, loss of light, overbearing and overlooking."*

9.2.31 Part C: Impacts and Compatibility of Policy SPL3 states:

"New development (including changes of use) should be compatible with surrounding uses and minimise any adverse environmental impacts. The following criteria must be met:

a. ….

b. the development, including any additional road traffic arising, will not have unacceptable levels of pollution on: air, land, water (including ground water), amenity, health or safety through noise, smell, dust, light, heat, vibration, fumes or other forms of pollution or nuisance;…"

9.2.32 Relevant legislation and policy are outlined in Table 9.3.

Table 9.3: Summary of Policy Context

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
EPA	Part III of the EPA provides powers for Local Authorities to issue abatement notices where a statutory nuisance exists.	Statutory nuisance cannot be assessed at this stage of the development; therefore, is not considered further in this Chapter. The control of significant effects would be expected to minimise the risk of nuisance.
CoPA	Sections 60 and 61 of Part III of the CoPA provide powers to Local Authorities for controlling noise from construction activities.	Construction noise impacts are considered in Section 9.10.

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
NPSE, Overarching Noise Policy Vision	Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.	The significance of construction and operational noise has been assessed in Sections 9.10 and 9.11 and where appropriate mitigation specified to control the management of noise.
NPSE, Noise Policy Aims	Avoid noise having significant adverse impacts on health and quality of life and mitigate and minimise adverse impacts.	The assessment defines the relevant thresholds for SOAEL in Section 9.5 which are used to assess significance of effect in Sections 9.10 and 9.11.
EN-1 Paragraph 5.11.4	The following should be included in the noise assessment: a description of the noise generating aspects of the proposal, including identification of the type of noise impacts; identification of the Noise Sensitive Receptors (NSRs); description of the existing noise environment; prediction of how the noise environment will be affected (during the construction and operational phases); and mitigation measures.	The assessment has considered all the aspects identified as shown in Sections 0 to 9.11.20.
EN-1 Paragraph 5.11.6	Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance, for example BS4142. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies, for example BS5228.	The assessment has been undertaken in accordance with the principles in the relevant British Standards as outlined in Paragraphs 9.4.16 to 9.4.34.

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
EN-1 Paragraph 5.11.8	The project should demonstrate good design through the selection of the quietest plant available. Measures should be taken to minimise noise, such as landscaping, bunds or noise barriers.	The siting of the substation has taken into account the locations of the nearest sensitive receptors. The measures adopted to avoid and mitigate effects are set out in Section 0, Paragraph 9.10.13 and 9.11.17.
EN-1 Paragraph 5.11.9	The proposal should avoid and mitigate adverse impacts on health and quality of life from noise and if possible, contribute to improvements in the above.	The measures adopted to avoid and mitigate effects are set out in Section 0, Paragraph 9.10.13 and 9.11.17.
Local Policy SP7	To protect the amenity of existing residents with regard to noise and vibration.	Construction and operational noise have been assessed in Sections 9.10 and 9.11.
Local Policy SPL3	Any noise from a new development, including any additional road traffic, is to be acceptable.	Construction and operational noise has been assessed in Sections 9.10 and 9.11 against criteria representing best practice acceptable levels.

STANDARDS AND GUIDANCE

9.2.33 A summary of the relevant British Standards and guidance utilised within this Chapter is given below.

BRITISH STANDARDS 5228:2009 + A1:2014 PART 1: NOISE

9.2.34 BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise, sets out a methodology for predicting noise levels arising from a wide variety of construction and related activities and contains tables of sound power levels generated by a wide variety of mobile and fixed plant equipment.

9.2.35 Compliance with BS5228-1:2009+A1:2014 is expected as a minimum standard when assessing the impact of construction noise upon the existing noise environment at nearby sensitive receptors.

9.2.36 Noise levels generated by construction operations and experienced at local receptors will depend upon a number of variables, the most significant of which are likely to be:

- the amount of noise generated by plant and equipment being used at the development site, generally expressed as a sound power level;
- the periods of operation of the plant at the development site, known as the “on-time”;

- the distance between the noise source and the receptor, known as the "stand-off";
- the attenuation due to ground absorption or barrier screening effects; and
- reflections of noise due to the presence of hard vertical faces such as walls.

9.2.37 BS5228-1:2009+A1:2014 gives several examples of acceptable noise limits for construction or demolition noise. For this assessment, as baseline noise data is available, it is proposed that the ABC method will be used to determine the threshold value at the receptor locations.

9.2.38 Under the ABC method, a threshold value noise level is determined by establishing the existing ambient noise level at each location. This measured ambient noise level is then rounded to the nearest whole 5 dB(A) and the threshold noise value for each receptor is then established from Table E.1 of BS5228-1:2009+A1:2014. This threshold value is the $L_{Aeq,T}$ noise level that should not be exceeded at the receptor location by operations at the site.

9.2.39 If the threshold value is exceeded, then the effect of construction noise upon nearby receptors may be significant. BS5228-1:2009+A1:2014 states that the significance of the effect will depend upon *"other project-specific factors, such as the number of receptors affected and the duration and character of the impact."* Professional judgement will be used to determine whether an effect is considered to be significant, and commentary explaining the reasons for this judgement will be provided. In accordance with this method, the threshold noise levels for a potentially significant effect are as detailed in Table 9.4.

Table 9.4: Construction Noise BS5228-1 Example Threshold Values.

Assessment category and threshold value period	Threshold value, dB L_{Aeq}		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (2300-0700)	45	50	55
Evening and weekends [D)]	55	60	65
Daytime (0700-1900) and Saturday (0700-1300)	65	70	75

9.2.40 The notes for Table 9.4 are as follows:

- NOTE 1: A significant effect has been deemed to occur if the total LAeq noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.
- NOTE 2: If the ambient noise level exceeds the threshold values given in the Table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total LAeq noise level for the period increases by more than 3 dB due to construction activity.
- NOTE 3: Applied to residential receptors only.
- A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

- B) Category B: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.
- C) Category C: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.
- D) 19.01-23.00 weekdays, 13.01-23.00 Saturdays and 07.01-23.00 Sundays.

9.2.41 Note that the thresholds in Table 9.4 above are considered to be noise level limits externally at the closest noise sensitive window. They are not considered as internal noise levels.

9.2.42 The impact of construction noise, arising from VE, upon residential receptors will be determined with reference to BS5228:2009+A1:2014 Part 1.

BRITISH STANDARD 5228:2009 + A1:2014 PART 2: VIBRATION

9.2.43 BS5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/ operations generate significant vibration levels.

9.2.44 The majority of people are known to be very sensitive to vibration, the threshold of perception being typically in the peak particle velocity (PPV) range of between 0.14 mm/s and 0.30 mm/s. Vibration levels above these values can cause disturbance. BS5228-2:2009+A1:2014 provides guidance on the effects of vibration shown in Table 9.5.

Table 9.5: Risk of Complaint from Vibration Levels.

Vibration Level, mm/s	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30	Vibration might be just perceptible in residential environments.
1.00	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10.00	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

9.2.45 High vibration levels generally arise from ‘heavy’ construction works such as piling, deep excavation, dynamic ground compaction or drilling.

9.2.46 Annex E of BS 5228-2:2009+A1:2014 contains empirical formulae derived by Hiller and Crabb (2000) from field measurements relating to resultant peak particle velocity (PPV), with a number of other parameters for vibratory compaction, dynamic compaction, percussive and vibratory piling, the vibration of stone columns and tunnel boring operations. These prediction equations are based on the energy approach. Use of these empirical formulae enables resultant PPV to be predicted and for some activities (vibratory compaction, vibratory piling and vibrated stone columns) they can provide an indicator of the probability of these levels of PPV being exceeded.

9.2.47 The empirical equations for predicting construction-related vibration provide estimates in terms of PPV. Therefore, the consequences of predicted levels in terms of human perception and disturbance can be established through direct comparison with the BS 5228-2:2009+1A:2014 guidance vibration levels shown in Table 9.5.

BS4142:2014+A1:2019

9.2.48 BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound is intended to be used to assess the potential adverse impact of sound, of an industrial and/ or commercial nature, at nearby sensitive receptor locations within the context of the existing sound environment.

9.2.49 Where the specific sound contains tonality, impulsivity and/ or other sound characteristics, corrections should be applied depending on the perceptibility. For tonality, a correction of either 0, 2, 4 or 6 dB should be added; for impulsivity, a correction of either 0, 3, 6 or 9 dB should be added and if the sound contains specific sound features which are neither tonal nor impulsive a penalty of 3 dB should be added.

9.2.50 In addition, if the sound contains identifiable operational and non-operational periods that are readily distinguishable against the existing sound environment, a further correction of 3 dB may be applied.

9.2.51 The assessment of impacts contained in BS4142:2014+A1:2019 is undertaken by comparing the sound rating level, i.e. the specific sound level of the source plus any character corrections, to the measured representative background sound level immediately outside the sensitive receptor location. Consideration is then given to the context of the existing sound environment at the sensitive receptor location to assess the potential impact.

9.2.52 Once an initial estimate of the impact is determined, by subtracting the measured background sound level from the rating sound level, BS4142:2014+A1:2019 states that the following should be considered:

- typically, the greater the difference, the greater the magnitude of the impact;
- a difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and

- the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. It is an indication that the specific sound source has a low impact when the rating level does not exceed the background sound level, depending on the context.

9.2.53 BS4142:2014+A1:2019 outlines guidance for the consideration of the context of the potential impact, including consideration of the existing residual sound levels, location and/ or absolute sound levels. BS4142:2014+A1:2019 notes that:

"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

9.2.54 The impact of operational noise from the substation noise upon residential receptors will be determined with reference to BS4142:2014+A1:2019.

WORLD HEALTH ORGANISATION

9.2.55 The World Health Organisation 2018 Environmental Noise Guidelines for the European Region, published in 2018, do not cover industrial noise. However, the previous 1999 Community Noise Guidelines (CNG) remain valid for industrial noise, i.e. *"… all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid"*.

9.2.56 The 1999 guidelines are therefore still valid when referring to external daytime (07:00 – 23:00 hours) ambient noise level limits. This document sets out guideline values for noise levels for different environments. For outdoor living areas during the daytime a value of 50 dB $L_{Aeq,\ 16hour}$ is described as 'moderate annoyance' and 55 dB $L_{Aeq,16hour}$ as 'serious annoyance'. During the night-time (23:00 – 07:00 hours) a level of 45 dB $L_{Aeq,8hour}$, as experienced outside an open bedroom window, is described as the guideline value when sleep disturbance starts to occur.

9.2.57 The 2018 guidelines also "complement" the Night Noise Guidelines from 2009.

9.2.58 The Night Noise Guidelines define effect thresholds or 'lowest observed adverse health effect levels' for both immediate physiological reactions during sleep and long-term adverse health effects. The Guidelines state:

- An $L_{night,outside}$ level of less than 30 dB(A): No effects expected to occur, equivalent to NOEL for night noise.
- An $L_{night,outside}$ level of 40 dB(A): Adverse effects start to occur. $L_{night,outside}$ 40 dB is equivalent to the LOAEL for night noise.
- An $L_{night,outside}$ level of 55 dB(A): Adverse effects such as sleep disturbance are likely and occur frequently.

GUIDELINES FOR ENVIRONMENTAL NOISE IMPACT ASSESSMENT

9.2.59 The Institute of Environmental Management and Assessment (IEMA) 'Guidelines for Environmental Noise Impact Assessment', Version 1.2 published in November 2014, addresses the key principles of a noise impact assessment and are applicable to "all development proposals where noise effects are likely to occur" and "are relevant to all types of projects, regardless of size".

9.2.60 The guidelines provide specific support on how noise impact assessments fit within the Environmental Impact Assessment (EIA) process but can also apply to developments which do not require an EIA. They cover:

- how to scope a noise assessment;
- issues to be considered when defining the baseline noise environment;
- prediction of changes in noise levels as a result of implementing development proposals; and
- definition and evaluation of the significance of the effect of changes in noise levels.

9.2.61 Table 7-14 of the guidelines refers to impacts from change in sound levels, reproduced below in Table 9.6. The source of the table is the HS2 Phase 1 Environmental Statement, and it is important to understand that it may not necessarily be appropriate to equally transpose over to other development schemes. This is discussed further in paragraph 9.5.15.

Table 9.6: IEMA Impact from Change in Sound Level Criteria.

Long term impact classification	Short term impact classification	Sound level change, dB $L_{Aeq,T}$
Negligible	Negligible	≥ 0 dB and < 1 dB
	Minor	≥ 1 dB and < 3 dB
Minor	Moderate	≥ 3 dB and < 5 dB
Moderate	Major	≥ 5 dB and < 10 dB
Major		≥ 10 dB

CALCULATION OF ROAD TRAFFIC NOISE

9.2.62 The former Department of Transport and Welsh Office memorandum Calculation of Road Traffic Noise (CRTN) published in 1988 sets out standard methods and procedures to predict and measure road traffic noise. These procedures were primarily intended to enable entitlement under the Noise Insulation Regulations to be determined, but they also provide guidance appropriate to the calculation of traffic noise for more general applications, for example the haul route under assessment in this Chapter.

9.2.63 Road traffic noise is predicted and measured in terms of a statistical measure, equivalent to the 10th percentile. Termed the L_{A10}, this measure of noise is equivalent to the noise level exceeded for 10% of the measurement period. Most legislation that refers to road traffic noise uses this noise index over an 18-hour period, from 06:00 hours to 00:00 hours.

9.2.64 The CRTN prediction method applies a correction if the flow of traffic on a section of road is low, less than 4,000 vehicles per 18-hour period, and is not reliable if the flow is less than 1,000 vehicles per 18-hours.

9.2.65 The Design Manual for Roads and Bridges (DMRB) was originally published by the Department for Transport and sets out procedures for undertaking the design of road schemes. LA 111: 2019 sets out a methodology for assessing the impacts of noise and vibration. This methodology is generally applied to the assessment of new road schemes or schemes that result in changes in traffic flows on existing road links.

9.2.66 LA 111 advises that LOAEL and SOAEL for construction noise shall be established in accordance with Table 3.12 of the document. This separates the definition of the effect levels into the BS5228 assessment periods (see Table 9.4) and defines LOAEL as the existing baseline L_{Aeq} noise levels and SOAEL as the BS5228 Category threshold values. The magnitude of construction noise is defined in LA 111 in Table 3.16, reproduced in Table 9.7. LA 111 further advises that the study area limited to 300 m from construction activity is normally sufficient for assessing significant effects.

Table 9.7: LA 111 Magnitude of impact and construction noise descriptions

Magnitude of impact	Construction noise level
Major	Above or equal to SOAEL +5 dB
Moderate	Above or equal to SOAEL and below SOAEL +5 dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

9.2.67 For construction traffic, LA 111 compares the Basic Noise Level (BNL) increases, as calculated using CRTN, for roads within the construction traffic study area. The magnitude of impact of construction traffic is set out in Table 3.17 of LA 111, reproduced in Table 9.8.

Table 9.8: LA 111 Magnitude of impact for construction traffic noise

Magnitude of impact	Increase in BNL of closest public road used for construction traffic (dB)
Major	Greater than or equal to 5
Moderate	Greater than or equal to 3 and less than 5
Minor	Greater than or equal to 1 and less than 3
Negligible	Less than 1

EVIDENCE AND USAGE OF LOAEL, SOAEL ETC.

9.2.68 Department for Environment, Food, and Rural Affairs (Defra) published a report in October 2014 setting out a review of the evidence and usage of observed effect level terminology (LOAEL, SOAEL, etc.).

9.2.69 When considering effect levels for all types of construction noise, this document provides a summary of the criteria used in the assessment of historic major development, including HS1, HS2, the Forth Replacement Crossing and the Thames Tideway Tunnel. Whilst these developments are not identical to VE, there are similarities: they are all major developments, HS1 and HS2 will involve a long linear construction over a long period but only remaining in one location for a short period, development will be passing villages and larger settlements. The criteria sets the threshold of LOAEL for construction noise to that of BS 5228 Category A (see Table 9.4) and SOAEL to Category C, unless the ambient noise already exceeds Category C and SOAEL is then equal to the ambient noise level.

9.3 CONSULTATION

9.3.1 Consultation with regards to the scope of the Noise and Vibration assessment was outlined within the Scoping Report (GoBe, 2021) and has been undertaken through the VE Evidence Plan (Noise and Vibration Expert Topic Group (ETG)) process, comprising discussion with Essex County Council and Tendring District Council.

9.3.2 A Scoping Opinion for VE was sought from the Planning Inspectorate (PINS), which included responses to the proposed assessment methodology for further consideration.

9.3.3 In addition, Essex County Council and Tendring District Council were consulted over the general approach to the assessment and the baseline noise survey. The consultation took place through July 2022 to August 2022 and all points raised were agreed between all parties.

9.3.4 Consultation has also been undertaken through an Expert Topic Group (ETG) meeting that took place on 3 November 2022.

9.3.5 Table 9.9 provides a summary of consultation comments received to date relating to Noise and Vibration, and associated responses.

Table 9.9: Summary of consultation relating to Noise and Vibration.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
November 2021 PINS Scoping Opinion	The Inspectorate agrees that offshore airborne noise impacts during all phases of the Proposed Development are unlikely to result in significant effects and can be scoped out of further assessment in the ES.	Offshore airborne construction, operational and decommissioning noise impacts have not been included within this Chapter.
November 2021 PINS Scoping Opinion	Due to the location of the substation not being known at the scoping stage the Inspectorate was not able to agree to scope out vibration impacts arising from its operation. The ES should include an assessment of these matters or the information demonstrating agreement with relevant stakeholders and the absence of Likely Significant Effects (LSE)	Further consultation was carried out on this matter with Essex County Council in a letter dated 28 July 2022. Their response (outlined further below in this table) supersedes PINS Scoping Opinion on this matter.
November 2021 PINS Scoping Opinion	The Inspectorate agrees that operational noise and vibration from the underground cable within the Export Cable Corridor (ECC) can be scoped out of further assessment, subject to agreement with the relevant Environmental Health Officer.	The letter dated 28 July 2022 to Essex County Council scopes out operational noise and vibration from the ECC. Response received back 1 August 2022 agreed with this approach. Operational noise and vibration impacts from the ECC have not been included within this Chapter.
November 2021 PINS Scoping Opinion	Construction, operation and decommissioning of the offshore extent of the export cable route (offshore ECC) and the array areas on the nearest onshore NSRs can be scoped out of further assessment in the ES.	Noise and vibration from the construction, operation and decommissioning of the offshore ECC and the array areas impacts have not been included within this Chapter.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
November 2021 PINS Scoping Opinion	The Inspectorate agrees that transboundary noise and vibration impacts can be scoped out of further assessment.	Transboundary noise and vibration impacts have not been included within this Chapter.
November 2021 PINS Scoping Opinion	The ES should explain any assumptions used in the construction noise assessment. This should include the types of vehicles and plant to be used during the construction phase. Where this is not known then the ES should explain how the noise levels have been derived. The ES should include an assessment based on the 'worst case' for receptors, i.e. that within the application boundary the vehicles and plant are at the closest possible point to a receptor.	Paragraphs 9.4.17 to 9.4.30 and Section 9.10 describe the construction noise and vibration assessment method and Volume 5, Annex 9.2: Construction Plant sets out the assumptions for plant sound power levels which are summarised in Table 9.27, Table 9.29 and Table 9.31.
November 2021 PINS Scoping Opinion	The onshore search area for construction traffic noise does not encompass the full extent of the potential construction traffic routes. The final noise study area and identification of NSRs should be informed by the expected construction traffic routes.	Paragraphs 9.4.26 to 9.4.29 describes the construction traffic noise assessment method and area.
28 July 2022 Consultation letter to Essex County Council	Construction, operational and decommissioning noise from the array upon shoreline receptors can be scoped out.	Construction, operational and decommissioning noise impacts from the array have not been included within this Chapter.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
28 July 2022 Consultation letter to Essex County Council	Operational noise and vibration of the underground cable situated within the ECC can be scoped out.	Operational noise and vibration impacts of the cable within the ECC have not been include within this Chapter.
28 July 2022 Consultation letter to Essex County Council	Construction, operational and decommissioning noise from the offshore ECC upon shoreline receptors can be scoped out.	Construction, operational and decommissioning noise impacts from the offshore ECC have not been included within this Chapter.
28 July 2022 Consultation letter to Essex County Council	Transboundary noise impacts can be scoped out.	Transboundary noise impacts have not been included within this Chapter.
28 July 2022 Consultation letter to Essex County Council	There would be no LSE relating to noise and vibration arising from the operation of the Landfall[1]. The assessment is to consider construction and decommissioning impacts only.	Operational noise and vibration impacts of the Landfall have not been included within this Chapter. Paragraphs 9.10.4 to 9.10.25 assesses the construction noise and vibration impacts of the Landfall.
28 July 2022 Consultation letter to Essex County Council	No background noise surveys would typically be required along the ECC route. Localised noise surveys may be appropriate to supplement the assessment as required.	Background noise surveys did not include locations along the ECC route. Paragraphs 9.5.4 and 9.5.5 sets out the criteria of the construction noise assessment.

[1] Landfall area of the Proposed Development is where the offshore export cables are brought ashore and jointed to the onshore export cables in Transition Joint Bays (TJBs).

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
28 July 2022 Consultation letter to Essex County Council	The exact location of the onshore substation (OnSS) and construction compound may not be known and could be anywhere within the designated OnSS search areas. Construction and operational noise assessment of the OnSS and construction noise assessment of the construction compound is to assume worst case distance (shortest) to NSRs.	Paragraphs 9.4.17 to 9.4.24 and 9.10.45 to 0 set out the approach to the assessment of construction noise from the OnSS and the construction compound. Paragraphs 9.4.31 to 9.4.34 and 9.11.1 to 9.11.10 sets out the method for assessment of operational noise from the substation.
28 July 2022 Consultation letter to Essex County Council	Vibration occurring during the operation of the OnSS would be of low magnitude and receptors would be sufficient distance that there would be no LSE. Operational vibration impacts can of the OnSS can be scoped out.	Operational vibration impacts of the OnSS have not been included within this Chapter.
28 July 2022 Consultation letter to Essex County Council	Construction noise impacts are to be calculated in accordance with BS 5228-1 and where the distance exceeds the validity of BS 588-1, ISO 9613-2 is to be used. Predictions are to be made at fixed distances from construction activity.	Paragraphs 9.4.17 to 9.4.20 details the prediction method for construction noise.
28 July 2022 Consultation letter to Essex County Council	Assessment of construction noise impacts is to be in accordance with BS 5228-1 ABC method. Where no background noise data is available to inform NSR category, the most stringent category A is to be assumed.	Paragraph 9.5.5 details the method for the assessment of construction noise in the absence of baseline noise data.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
28 July 2022 Consultation letter to Essex County Council	Construction vibration impacts and assessment are to be in accordance with BS 5228-2. Construction vibration assessment will be limited to Horizontal Directional Drilling (HDD) and piling activities only.	Paragraphs 9.4.24, 9.4.25, 9.10.20, 9.10.23, 9.10.36 and 9.10.49 detail the method for the assessment of construction vibration.
28 July 2022 Consultation letter to Essex County Council	Decommissioning noise and vibration will not be assessed separately and the results of the construction noise and vibration assessment will be used to provide as a worst case for the decommissioning phase.	Decommissioning noise and vibration impacts of the Proposed Development have not been included within this Chapter
28 July 2022 Consultation letter to Essex County Council	The only operational impacts that need to be assessed are those associated with the noise from the OnSS. BS4142 and baseline noise survey data are to be used to assess these impacts.	Paragraphs 9.4.31 to 9.4.34 and Section 9.11 details the method for the assessment of operational noise impact from the OnSS.
4 August 2022 Consultation meeting with Essex County Council.	Essex County Council advised of North Falls Offshore Wind Farm (OWF) baseline noise survey and consideration of using the data to inform VE baseline.	Paragraphs 9.4.15 and Section 9.7 details the method for determining the baseline noise climate and how data has been acquired.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
12 August 2022 Non-statutory consultation letter from Essex County Council.	Noise is raised in general terms. A detailed Construction Management Plan (CMP) in accordance with BS5228 is requested. The noise assessment is to consider operational and construction noise. As part of a Waste Infrastructure Impact Assessment noise impacts upon the proposed development is to be considered.	Insufficient information is available at this stage to detail a CMP. Sections 9.10 and 9.11 assess construction and operational noise impact from the proposed development upon the existing environment. The proposed development is not noise sensitive, so impacts upon it do not need to be assessed.
30 August 2022 Consultation letter to Essex County Council	North Falls OWF noise survey data will be used to inform the baseline for VE. A further noise survey, concentrated around OnSS search area SSA East will be required to supplement these data.	Section 9.7 details the baseline noise survey and locations where measurements were taken.
3 November 2022 ETG meeting	Overview of assessment method, study area, assessment criteria and baseline conditions were provided.	Paragraphs 9.4.16 to 9.4.36 details the assessment method, Paragraphs 9.4.3 to 9.4.14 details the study area, Section 9.5 sets the assessment criteria and baseline conditions are summarised in Section 9.7.

9.4 SCOPE AND METHODOLOGY

SCOPE OF THE ASSESSMENT

IMPACTS SCOPED IN FOR ASSESSMENT

9.4.1 The impacts that have been scoped into this assessment are summarised in Table 9.10.

Table 9.10: Impacts scoped in for assessment.

Topic	Impact	Description of impact to be assessed
Construction	Impact 1	Noise and vibration during the construction of the Landfall
	Impact 2	Noise and vibration during the construction of the ECC
	Impact 3	Noise and vibration during the construction of the OnSS
	Impact 4	Noise from construction vehicles using the road network
Operation	Impact 5	Noise during the operation of the OnSS

IMPACTS SCOPED OUT OF ASSESSMENT

9.4.2 On the basis of the baseline environment and the project description outlined in Volume 3, Chapter 1: Onshore Project Description and in accordance with the Scoping Opinion (PINS, 2021) and consultation summarised in Table 9.9, a number of impacts have been scoped out (see Table 9.9), as summarised in Table 9.11.

Table 9.11: Impacts scoped out of assessment.

Topic	Impact	Description of impact to be assessed
Construction	Impact 1	Noise and vibration during the construction of the offshore wind farm array
	Impact 2	Noise and vibration during the construction of the offshore ECC
	Impact 3	Transboundary noise and vibration impact during construction of any part of the Proposed Development
	Impact 4	Noise and vibration during the decommissioning of the Proposed Development
	Impact 5	Vibration impacts from HGV and construction traffic

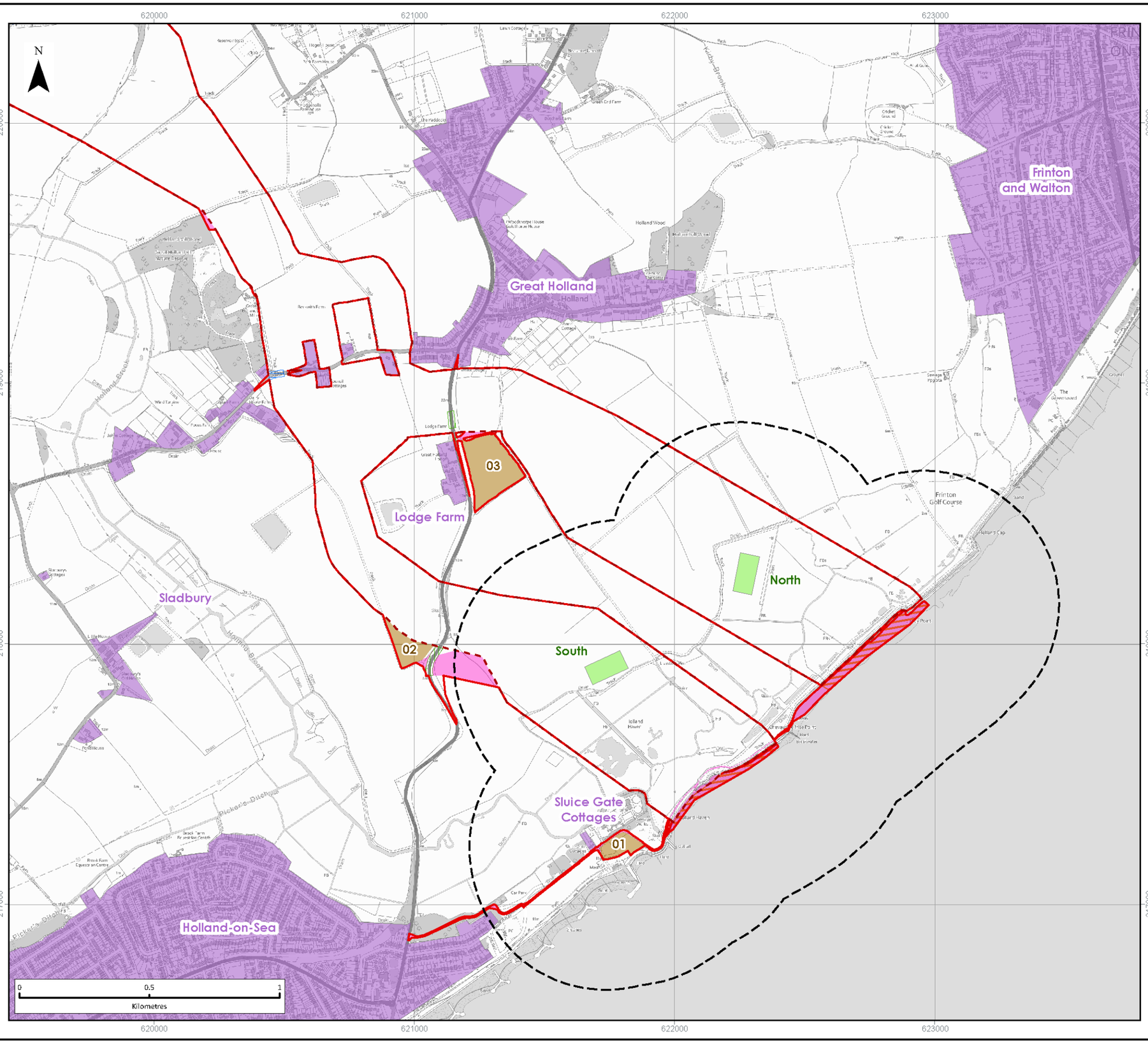
Topic	Impact	Description of impact to be assessed
Operation	Impact 6	Noise and vibration impacts during the operation of the offshore wind farm array
	Impact 7	Noise and vibration impacts during the operation of the offshore ECC
	Impact 8	Noise and vibration impacts during the operation of the ECC
	Impact 9	Noise and vibration impacts during the operation of the Landfall
	Impact 10	Vibration impacts during the operation of the OnSS
	Impact 11	Transboundary noise and vibration impact during the operation of any part of the Proposed Development

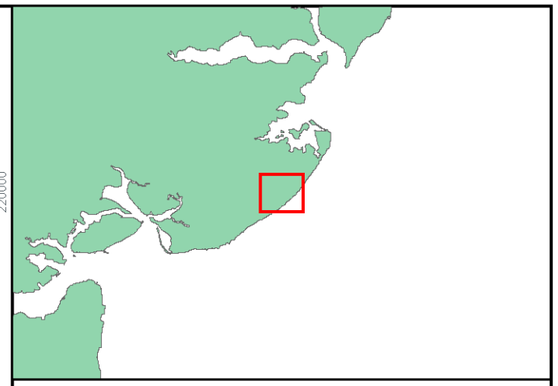
STUDY AREA

9.4.3 The study area for the Noise and Vibration assessments has been divided into three separate areas as set out below and discussed in more detail in the subsequent sections:

- the Landfall;
- the ECC; and
- the OnSS.

9.4.4 Figure 9.1and Figure 9.2 illustrate the study areas for the Landfall and OnSS.





LEGEND

- Onshore Red Line Boundary
- Onshore Export Cable Corridor
- Temporary Construction Compounds
- Works Access Required
- Haul Road Crossings
- Haul Road Access
- Beach Compound Zone
- Indicative Landfall HDD Location
- Beach Compound Zone, Indicative Landfall HDD Location and TCC 500 m Buffer
- Noise Sensitive Receptor Location

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Landfall Study Area

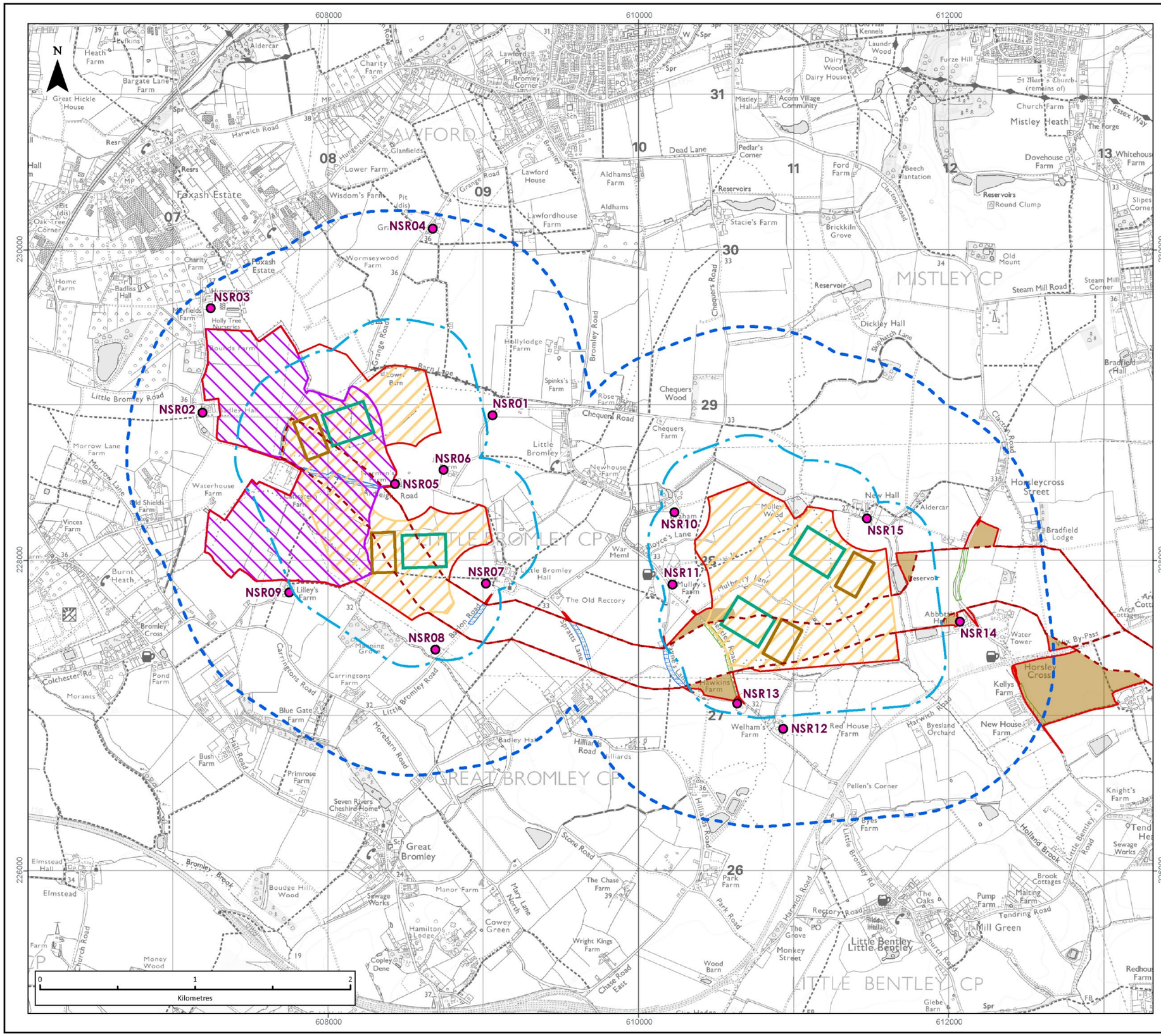
VER	DATE	REMARKS	Drawn	Checked
1	21/02/2023	PEIR Submission	JO	JS

DRAWING NUMBER:

FIGURE 9.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:15,000	A3	OSGB 1936	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM



LEGEND

- Onshore Red Line Boundary
- Onshore Export Cable Corridor
- Onshore Substation Areas of Search
- National Grid Area of Search
- Temporary Construction Compounds
- Works Access Required
- Haul Road Crossings
- Haul Road Access
- Onshore Substation Areas of Search 300 m Buffer (Construction Noise & Vibration Study Area)
- Onshore Substation Areas of Search 500 m Buffer (Operational Noise Study Area)
- Substation Construction Compound (Indicative)
- Substation Operational Boundary (Indicative)
- Noise Sensitive Receptor

Note:
Additional locations included for assessment purposes for Noise and Vibration Chapter.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Onshore Substation (OnSS) Study Area

VER	DATE	REMARKS	Drawn	Checked
1	23/02/2023	PEIR Submission	DB	JS

DRAWING NUMBER:

FIGURE 9.2

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:25,000	A3	OSGB 1936	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM

THE LANDFALL

9.4.5 The landfall denotes the location where the offshore export cables are brought ashore and jointed to the onshore export cables in the Transition Joint Bays (TJBs). There is a clear overlap in the offshore and onshore study area at the intertidal area of the Landfall, as described in the onshore project description in Volume 3, Chapter 1: Onshore Project Description.

Landfall construction activities will take place in three potential locations, as highlighted on Figure 9.1. These areas are:

- Beach operation Temporary Construction Compound (TCC) off Manor Way;
- Landfall HDD compound; and
- Beach compound.

9.4.6 Further information regarding these areas is available in Volume 5, Annex 9.2**:** Construction Dust Assessment Methodology. At the current PEIR stage of the development there are two potential locations for the Landfall HDD compound which reflect the two possible cable route 'legs', as shown in Figure 9.1. Furthermore, as the beach compound will be located at the beach end of the cable route, it also has two potential locations, as indicated in Figure 9.1. The TJBs are located in the Landfall HDD compound areas.

9.4.7 The Noise and Vibration study area for the landfall extends from the Mean High Water Spring (MHWS) to an area approximately 500 m back from the coastline between Holland-on-Sea and Frinton-on-Sea. It also includes dwellings at greater distance away situated on The Esplanade, Haven Avenue and Manor Way, Holland-on-Sea; and dwellings on Second Avenue, Third Avenue and Fourth Avenue between Holland Road and Esplanade, Frinton-on-Sea, as the nearest settlements to the Landfall.

9.4.8 A distance of 500 m and beyond to the above receptors is greater than 300 m advised in LA 111 for construction noise. The reason for this is that there are no NSRs within 300 m of the Landfall.

THE ECC

9.4.9 The ECC connects the Landfall to the OnSS at Little Bromley. The main cable route will have a length of approximately 20 km and will be installed using a standard trenching technique. In some sections the use of trenchless crossing techniques such as HDD will be required to cross obstacles, e.g. roads and rivers. References to HDD within this Chapter, also include other trenchless crossing techniques.

9.4.10 The Noise and Vibration study area for the ECC extends from the TJB to the of the substation zone. It follows the route of the ECC and includes the nearest noise-sensitive receptors that are within 300 m of the ECC. This distance aligns with the guidance in LA 111.

9.4.11 The study area for the ECC also includes the locations of the TCCs and allows for HDD compounds where required.

THE ONSS

9.4.12 The OnSS will be located in one of the substation search areas (SSA), referred to as SSA East and SSA West. SSA West has an area of just over 100 ha and is situated east of the existing Lawford substation near the junction of Little Bromley Road, Ardleigh Road and Grange Road. SSA East has an area of approximately 120 hectares and is situated north of the section of the A120 that runs between Little Bentley and Horsley Cross.

9.4.13 At the current PEIR stage of the development, four potential locations for the OnSS have been identified, as highlighted in Figure 9.2: two in SSA East and two in SSA West. This is specific for the noise assessment to give a better representation of the impacts which could occur anywhere within the SSA's. The assessment assumes that the construction of the OnSS may take place in any one of these four locations and activities will be limited to OnSS location and the corresponding construction compound. Similarly, operational noise impacts have been considered for each of the four locations separately on the assumption that the OnSS would be located in one of the areas highlighted. This will be refined for the ES stage once an OnSS location has been confirmed.

9.4.14 The study area for the OnSS will differ during construction and operation due to the nature of noise and the guidance and assessment methods applied. For both phases of development, the study area will extend to the nearest NSR in the general directions of the north, south, east and west of the substation zone. During the construction phase, the distance from the search areas will be limited to 300 m, as advised in LA 111. During the operation assessment the distance from the search areas will be extended to 1 km, as beyond this distance operational noise from a typical substation is low.

DATA SOURCES

9.4.15 It was agreed with Essex County Council and Tendring District Council that data from the baseline noise surveys undertaken for North Fall offshore wind farm would be used to establish the existing noise environment, supplemented with further baseline noise surveys in areas not already covered. The complete set of survey data covers the areas around the Landfall and OnSS representative of nearest NSRs for the daytime and night-time periods. Further information on the baseline noise surveys is provided in Section 9.7.

ASSESSMENT METHODOLOGY

9.4.16 The Noise and Vibration assessment methodologies were discussed with Essex County Council and Tendring District Council in correspondence and a meeting throughout July and August 2022, as set out in Section 9.3.3, and during the ETG meeting on 3 November 2022. The assessment methodologies, set out in the following sections, have been agreed.

CONSTRUCTION NOISE AND VIBRATION

9.4.17 On site construction noise and vibration assessments have been undertaken for the Landfall (Impact 1), the ECC (Impact 2) and the OnSS (Impact 3). The assessments have been undertaken in conjunction with BS5228:2009+A1:2014, Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1 Noise and Part 2 Vibration.

9.4.18 Construction noise limits have been set at the identified NSRs in conjunction with the measured baseline levels, where present, and the ABC Method contained in BS5228:2009+A1:2014.

9.4.19 For the Landfall and OnSS, where construction activity will be contained within a fixed area during the entire period, construction noise levels have been predicted at the identified NSRs using the BS5228:2009+A1:2014, Part 1 calculation method and assessed against the specified limits.

9.4.20 For the ECC, construction activity will move through the 20 km length and will be transient. The route will pass many NSR; therefore, construction noise levels have been calculated for set distances back from the ECC. Calculations and assessment of impacts have been carried out using BS5228:2009+A1:2014, Part 1.

9.4.21 The assessments include consideration of noise from the construction activities, including the use of plant and machinery, at each of the Landfall, ECC and OnSS areas. In addition, HDD activities for the Landfall and ECC have been included for areas identified where it will be required to take place.

9.4.22 Vibration impacts from the majority of the construction plant and techniques would have no LSE due to the distance between the closest receptor and the activities and that ground level plant does not generate significant levels of vibration.

9.4.23 Vibration impacts from the following construction activities have been considered, as those that have the potential to generate higher levels of vibration:

- the HDD operations at the Landfall and at various locations along the ECC; and
- piling associated with the sheet piled inter-tidal exit pit and OnSS foundations.

9.4.24 The potential vibration impacts of these working methods have been predicted at the closest vibration sensitive receptors (VSRs) to each construction activity using the BS5228:2009+A1:2014, Part 2 calculation method and assessed against the specified limits.

9.4.25 Whilst the majority of construction activities will be carried out during daytime, there is the possibility that some activities associated with the Landfall and ECC require HDD which may need to be carried out at night to ensure that a continuous operation can be completed. Depending on the situation, it may not be possible to complete a single bore solely within daytime hours as once a bore has been started, it is not possible to stop until it is completed.

CONSTRUCTION TRAFFIC

9.4.26 Changes in road traffic noise resulting from construction vehicles using the local road network have been assessed (Impact 4) in accordance with the Design Manual for Roads and Bridges (DMRB). The assessment undertaken includes all roads where it is anticipated that at least a 10% change in the total number of vehicles will occur, which equates to approximately 0.5 dB(A).

9.4.27 For each link, the Basic Noise Level (BNL) has been established for the "With Construction Traffic" and "Without Construction Traffic" scenarios. The BNL is the $L_{A10, T}$ dB noise level at 10 m from the kerb of the road assessed, prior to any correction for road surface, gradient, percentage of Heavy Goods Vehicles (HGVs), screening and angle of view. With the exception of the correction for the percentage of HGVs, the other corrections would not alter between the two traffic flow scenarios. Therefore, when considering a change in noise level between two traffic flow scenarios on an unaltered section of road, only the BNL with HGV correction for the different scenarios needs to be compared.

9.4.28 The HGV corrected BNL results for each link have been tabulated and the impact and significance determined. For any road links where the flow of traffic is less than the validity of the calculation of 1,000 vehicles over an 18-hour period, as discussed in section 9.2.65, the haul route calculation method provided in BS5228-1 has been used to determine the noise from construction vehicles.

9.4.29 It is noted that DMRB has since been superseded by LA 111 – Noise and Vibration; however, as the calculations associated with the assessment are being undertaken in conjunction with CRTN and the impact significance contained within LA 111 is identical to the one contained within DMRB, this method remains valid.

9.4.30 Where adverse impacts have been identified, specific mitigation measures, a suite of measures, or further design refinement have been proposed for consideration. It is anticipated that following provision of this PEIR and prior to submission of the ES, design refinement and/or mitigation options can be applied to reduce any adverse impact to a level that is not significant.

OPERATIONAL NOISE

9.4.31 As discussed in paragraph 9.4.13, the OnSS could be located in one of four potential locations, situated in the two SSAs. For each of the four potential locations, noise generated by the OnSS has been predicted at the nearest NSRs using noise modelling software which employs the methodology in ISO 9613-2:1996. Predicted noise levels have been assessed in accordance with BS4142:2014+A1:2019, whereby sound levels associated with the operation of the OnSS are compared to measured representative daytime and night-time background sound levels at the closest receptors.

9.4.32 In accordance with the method described in BS4142:2014+A1:2019 corrections, based on subjective opinion, for the potential acoustic features has also been included. These are corrections for tonal, impulsive and / or intermittent characteristics that have the potential to lead to increased awareness of a sound. An essential part of the BS4142:2014+A1:2019 assessment is to consider the context of the development in the surrounding area, which has been taken into account using the baseline noise survey data, guidance from the WHO and 2014 IEMA guidelines.

9.4.33 The results of the assessment have been used to determine whether noise levels generated by the operation of the substation would lead to adverse impacts at the nearest NSRs.

9.4.34 The assessment indicates whether additional mitigation is required to reduce any identified impacts. As with construction noise, where adverse impacts have been identified, mitigation measures are detailed. It is expected that design refinement and/or mitigation options can be applied to the design presented within the ES to reduce the impact to a level that is not significant.

CUMULATIVE IMPACT ASSESSMENT

9.4.35 There are a number of potential developments that may contribute to a cumulative noise impact during the construction and operational phases. The timings and locations of construction works for all projects, including VE, will be dependent on many factors and may not coincide such that any one NSR is exposed to construction noise from more than one development at any one time. A worst case cumulative scenario has been assumed whereby adjacent projects will be under construction at the same time.

9.4.36 The following developments have been considered in the cumulative impact assessment:

- Consented battery storage site west of Lawford substation (planning reference 21/02070/FUL), cumulative construction and operational impacts with OnSS considered;
- Proposed National Grid substation on land adjacent to existing Lawford substation, SSA West, cumulative construction and operational impacts with OnSS considered;
- Proposed North Falls onshore substation;
- Proposed North Falls onshore export cable corridor; and
- Proposed North Falls Landfall.

9.5 ASSESSMENT CRITERIA AND ASSIGNMENT OF SIGNIFICANCE

9.5.1 The assessment criteria for the construction and operational noise and vibration impacts and the resulting effect significance is dependent on two main factors: the sensitivity of the receptor location and the impact magnitude. These are discussed in full below.

SENSITIVITY OF THE ENVIRONMENT

9.5.2 The sensitivity of the environment is defined in Table 9.12. These apply equally to the assessment of noise and vibration impacts and have been based on professional judgement.

Table 9.12: Sensitivity of the environment.

Receptor sensitivity/ importance	Definition / Reason
High	Noise may be detrimental to vulnerable receptors, such as rooms within hospitals that require high level of focus (e.g. operating theatre) or care for vulnerable groups of people (e.g. high dependency unit) or care homes at night; or The structural integrity of the building is unsound and exposure to vibration would result in permanent structural damage.
Medium	Noise may cause disturbance and a level of protection is required, but a level of tolerance is expected. Example receptors include at all times of the day: dwellings and hospital wards and daytime only receptors including education facilities and care homes. The structural integrity of the building is limited and sub-standard. Exposure to high levels of vibration may cause structural damage which would otherwise not in a standard building.
Low	Leisure and sports facilities including public parks and non-noise-producing employment such as offices. Noise and vibration may be heard or felt but are unlikely to result in any change in behaviour.
Negligible	All other areas including industrial and agricultural. Noise and vibration is unlikely to have any effect.

IMPACT MAGNITUDE

9.5.3 The magnitude of impact will vary depending on the nature of the source of noise or vibration experienced. Each of the relevant different sources of noise and vibration, that would arise as a result of the Proposed Development, are discussed below and the magnitude of impact quantified. The values specified for the various magnitudes of impact have been derived from guidance documentation or standards relevant to nature of the source, as discussed below.

CONSTRUCTION NOISE IMPACT MAGNITUDE

9.5.4 The impact of construction noise upon NSRs will be determined with reference to the ABC method presented in BS5228, LA 111 and Defra 2014 report: Evidence of Usage of LOAEL and SOAEL. It would not be possible to directly apply the LA 111 construction noise impact magnitudes summarised in Table 9.8, as this would require the existing baseline L_{Aeq} noise levels to be measured during the BS5228 periods.

9.5.5 The Defra 2014 report sets LOAEL to be equal to BS5228 Category A and SOAEL to Category C. In the absence of existing baseline noise level throughout the construction noise study area, it is assumed that the nearest NSRs are within Category A. The impact of construction noise upon existing residential receptors is as detailed in Table 9.13.

Table 9.13: Construction noise impact magnitude.

Magnitude	Definition
High	Threshold value exceeded by more than 5 dB
Medium	Threshold value exceeded by more than 3 dB and up to 5 dB
Low	Threshold value exceeded by up to 3 dB
Negligible	Threshold value not exceeded

CONSTRUCTION TRAFFIC NOISE IMPACT MAGNITUDE

9.5.6 The impact of the change in road traffic noise level, as a result of construction vehicles, will be determined with reference to the classification of magnitude of impacts presented in the LA 111 and is shown in Table 9.14.

Table 9.14: Construction traffic noise impact magnitude.

Magnitude	Definition
High	Change in HGV corrected BNL of 5 dB or greater
Medium	Change in HGV corrected BNL of at least 3 dB and less than 5 dB
Low	Change in HGV corrected BNL of at least 1 dB and less than 3 dB
Negligible	Change in HGV corrected BNL of less than 1 dB

9.5.7 For any road links where construction traffic noise has been calculated using the haul route method of BS5228-1, the magnitude of impact is determined using Table 9.13.

CONSTRUCTION VIBRATION IMPACT MAGNITUDE

9.5.8 The impact of construction vibration will be determined with reference to BS5228-2:2009+A1:2014 using the values set out in Table 9.15 and should be applied equally during the daytime and night-time.

Table 9.15: Construction vibration impact magnitude.

Magnitude	Definition
High	Construction vibration levels of 10.0 mm/s PPV or greater
Medium	Construction vibration levels of at least 1.0 mm/s and less than 10.0 mm/s PPV
Low	Construction vibration levels greater than 0.3 mm/s and less than 1.0 mm/s PPV
Negligible	Construction vibration levels up to 0.3 mm/s PPV

OPERATIONAL NOISE IMPACT MAGNITUDE

9.5.9 The impact of operational noise from the substation upon existing NSRs has been determined with reference to BS4142:2014+A1:2019, by subtracting the measured background sound level from the rating sound level and considering the context in which the sound occurs. The margin by which the rating level exceeds the existing background sound provides an initial estimate of the impact, as described in paragraph 9.2.53, which then needs to be modified due to the context.

9.5.10 An important factor when considering the context is the absolute level of sound, where it is stated in BS4142:2014+A1:2019 that "*Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*" The standard offers no guidance about what background and rating levels are considered low; however, the 1997 version of the standard stated that background sound levels below around 30 dB L_{A90}, and rating levels below around 35 dB L_{ArTr}, were considered very low and therefore outside the scope of the assessment method. The Association of Noise Consultants produced guidance on the application of BS 4142 (BS 4142:2014+A1:2019 Technical Note, Association of Noise Consultants, March 2020) which states that "*similar values"* [i.e. background sound levels below around 30 dB L_{A90}, and rating levels below around 35 dB L_{ArTr}] *would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate.*".

9.5.11 When considering the absolute levels of sound and the likely impact it may have on people, many factors should be taken into account, such as the characteristics of the sound and the time of day it is experienced. As set out in paragraph 9.2.57, when considering industrial noise during the daytime, the 1999 WHO CNG can provide further advice. This guidance document is supplemented by the 2009 WHO NNG for the night-time period. These documents can be used to set appropriate values for the effect level categories defined in the NPSE and PPG.

9.5.12 In setting appropriate values for effect levels from operational noise the above has been considered. During the daytime, the threshold of LOAEL for a steady, anonymous noise, can be regarded as the guideline value for moderate annoyance of 50 dB $L_{Aeq,\ 16hour}$, set in the WHO CNG. This does, however, significantly exceed the low rating level of 35 dB L_{ArTr}, set out in paragraph 9.5.10, and therefore, should not simply be used as an acceptable threshold for industrial noise, even if the sound is steady and anonymous. Instead, consideration can be given to the value of the rating level in the context of the LOAEL and levels of existing ambient noise. This is discussed further in paragraph 9.5.14.

9.5.13 For the night-time period advice is available from the WHO NNG, where no observed effects on sleep can be found when exposed to noise level of 30 dB $L_{night,\ outside}$, or below. Furthermore, there is no evidence that biological effects observed at levels below 40 dB $L_{night,outside}$ are harmful to health. At levels above 55 dB $L_{night,outside}$, the NNG detailed that adverse health effects occur frequently and there is limited evidence that the cardio-vascular system is coming under stress. Therefore, when considering the context of the absolute level of sound during the night-time the following effect levels can be used:

- 30 dB $L_{night,\ outside}$ – NOEL

- 40 dB $L_{night, outside}$ – LOAEL; and
- 55 dB $L_{night, outside}$ – SOAEL.

9.5.14 Another important factor, when considering the context, is the change in sound level that a proposed development would have upon the existing environment. If there is no or very little change in the long-term sound levels, then the IEMA 2014 guidelines advises there to be negligible impact. The sound generated by the OnSS using the L_{Aeq} noise parameter (specific sound level) at the NSR can be logarithmically added to the existing measured L_{Aeq} (residual sound level) to determine a revised absolute sound level.

9.5.15 It is noted in paragraph 9.2.62 that the impact criteria set out in the IEMA 2014 guidelines when considering a change in sound level should be relevant to the development and the nature of sound generated. When considering the context of noise from a proposed onshore substation for an offshore wind farm, in accordance with BS4142:2014+A1:2019, previous noise assessments[2] have applied the criteria as set out in Table 9.6.

9.5.16 Table 9.16 summarises factors considered when determining the operational noise impact magnitude.

Table 9.16: Operational noise impact magnitude.

Magnitude	Excess of rating level over background sound level	Rating level threshold Night-time (2300 to 0700)	Sound level change
High	≥10 dB	>55 dB	≥10 dB
Medium	>5 to <10 dB	>40 to ≤55 dB	≥5 to <10 dB
Low	>0 to ≤5 dB	>30 to ≤40 dB	≥3 to <5 dB
Negligible	≤0 dB	≤30 dB	<3 dB

SIGNIFICANCE OF EFFECT

9.5.17 Sensitivity of the receptor and magnitude of impact have then been considered collectively to determine the potential effect and its significance.

9.5.18 Table 9.17 is used as a guide to determine the level of effect. 'Major' and 'moderate' effects are considered to be 'significant' in terms of the EIA Regulations.

[2] Chapter 23 – Noise and Vibration. Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects. Document no C282-RH-Z-GA-00061, dated August 2022. EN010109; and Volume 3, Chapter 10 – Noise and Vibration. Awel Y Mor Offshore Wind Farm. Dated April 2022. EN010112.

9.5.19 It is considered that the VE project would not lead to any beneficial noise and vibration effects; therefore, this has not been considered within Table 9.17.

9.5.20 Assessment of the level of effect is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive, formulaic tool.

9.5.21 In addition, based on professional judgement, short-term is defined as less than one-month, medium-term is defined as one month to two years, and long-term is defined as greater than two years.

Table 9.17: Matrix to determine effect significance.

			Sensitivity			
			High	Medium	Low	Negligible
Magnitude	Negative	High	Major	Major	Moderate	Minor
		Medium	Major	Moderate	Minor	Negligible
		Low	Moderate	Minor	Minor	Negligible
	Neutral	Negligible	Minor	Negligible	Negligible	Negligible

Note: shaded cells are defined as significant with regards to the EIA Regulations 2017[3].

9.6 UNCERTAINTY AND TECHNICAL DIFFICULTIES ENCOUNTERED

9.6.1 The main uncertainties and technical difficulties encountered during the completion of the Noise and Vibration assessment are outlined below. For the purposes of this Chapter, they have been divided into:

- Baseline Survey;
- Construction Noise and Vibration Assessment; and
- Operational Noise Assessment of the Substation.

BASELINE SURVEY

9.6.2 As advised in BS 4142:2014+A1:2019, areas of uncertainty associated with measurements of sound include:

- the complexity and level of variability of the residual acoustic environment;
- the location(s) selected for taking the measurements;

[3] The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

- the number of measurements taken;
- the measurement time intervals;
- the range of times when the measurements have been taken;
- the range of suitable weather conditions during which measurements have been taken;
- the measurement method and variability between different practitioners in the way the method is applied;
- the level of rounding of each measurement recorded; and
- the instrumentation used.

9.6.3 With reference to the above, the measurement uncertainty was minimised during the baseline sound survey as follows:

- baseline sound measurements were taken at positions representative of the NSRs near to the Landfall and OnSS;
- where reasonably practicable, the measurement positions were located away from reflecting surfaces, sources of environmental noise and mature leafy vegetation;
- longer-term measurements were undertaken that included daytime and night-time periods for typical midweek and weekend periods;
- a weather station was installed for the duration of the surveys so any unsuitable weather conditions could be identified and these periods excluded from the monitoring results; and
- the instrumentation was suitable according to BS EN 61672-1.

CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

9.6.4 Construction noise and vibration predictions are based on the anticipated programme and construction methods. It has been necessary to make assumptions with the advice of the design team regarding some aspects of the construction process. These are considered to be precautionary and reflect the level of information that is typically available at this stage in the development of the proposed development. Further information on the anticipated construction programme is provided in Volume 3, Chapter 1: Onshore Project Description.

OPERATIONAL NOISE FROM THE SUBSTATION

9.6.5 There is uncertainty associated with the calculation of sound from the onshore substation due to its layout and location. At this stage, prior to further environmental assessments that will be undertaken between drafting of the PEIR and ES, four indicative substation locations have been identified within the search areas. For each of these potential locations, an indicative substation layout has been modelled and the noise levels calculated at the relevant noise sensitive receptors. This manages the uncertainty of the OnSS location; however, only one substation location will be utilised; therefore, not all impacts reported would occur.

9.7 EXISTING ENVIRONMENT

9.7.1 The existing environment has been determined with a combination of a baseline sound survey, which was undertaken in September 2022, and baseline sound data measured for the North Falls OWF during July 2022. A summary of the relevant information is set out below.

9.7.2 During all surveys undertaken, the sound level meters were calibrated prior to, and upon completion of, measurements being carried out. No significant drift in readings was observed. The calibration chain is traceable via the United Kingdom Accreditation Service (UKAS) to National Standards held at the National Physical Laboratory.

9.7.3 At all monitoring locations, the microphone was placed 1.5 m above the ground in free-field conditions, i.e., at least 3.5 m from the nearest vertical, reflecting surface, with the following noise level indices being recorded continuously every 15-minutes:

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period; and
- L_{A90}: The A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe background noise; and

9.7.4 For the purposes of this Chapter, the baseline environment has been divided into two separate areas:

- the Landfall; and
- the OnSS.

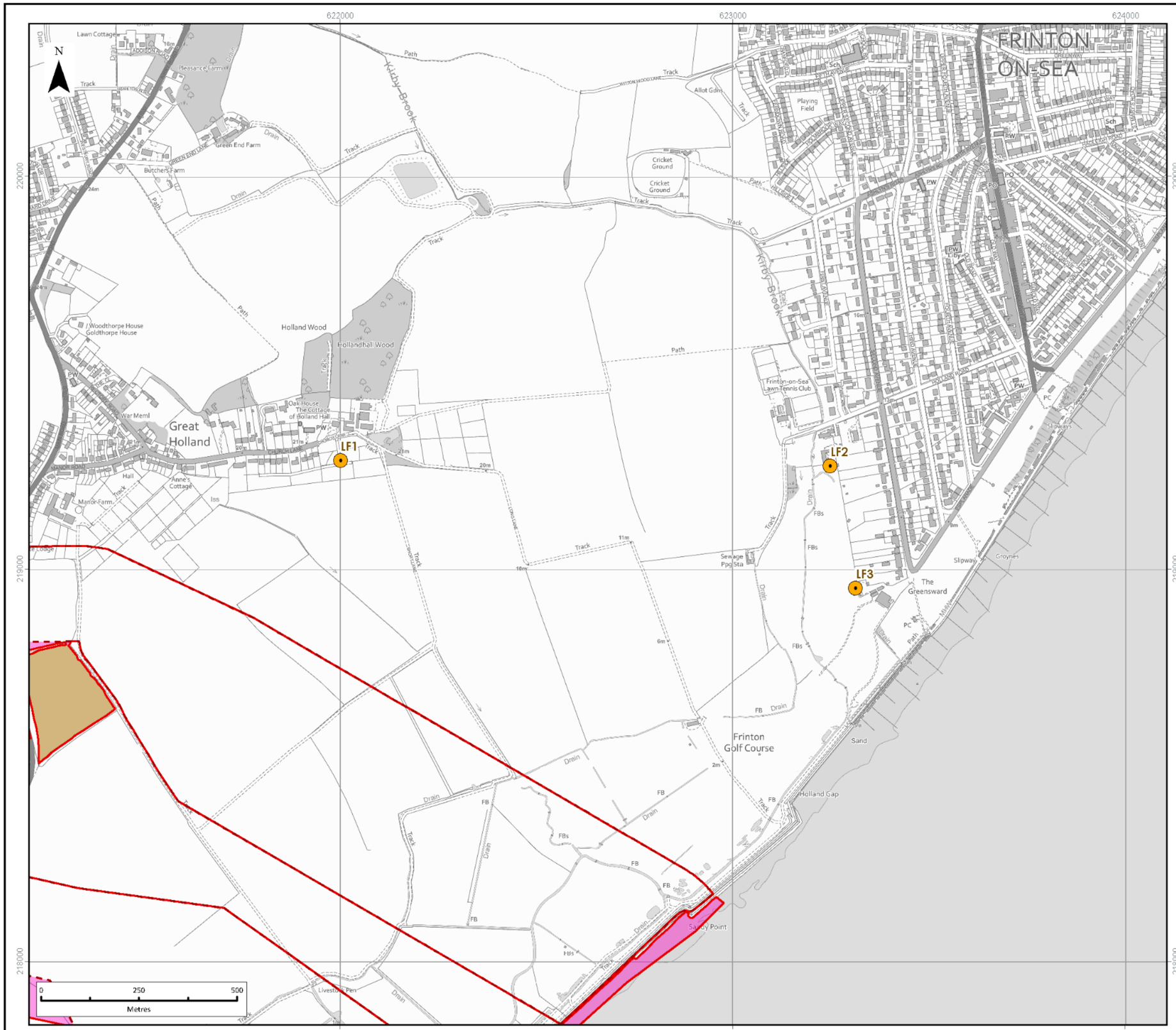
LANDFALL

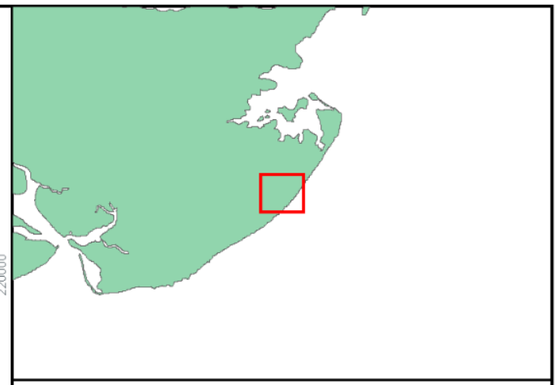
9.7.5 The local environment in the vicinity of the Landfall can be characterised as a rural environment between the towns of Frinton-on-Sea and Holland-on-Sea. The Landfall is located adjacent to Frinton Golf Club and agricultural land beyond. North east of the Landfall is Frinton Golf Clubhouse and dwelling of Frinton-on-Sea. To the south west of the Landfall is the water treatment works with two adjacent dwellings, Sluice Gate Cottages, and the settlement of Holland-on-Sea beyond. HDD will be required at the Landfall site.

9.7.6 The soundscape of the Landfall area can be characterised as one of natural sound, such as the sea breaking, birdsong and wind disturbed vegetation, other contributions came from distant road traffic and golfing activity. As you move away from the shore toward Great Holland, contributions from the sea diminish and noise from agricultural activity becomes more prevalent.

MONITORING LOCATIONS

9.7.7 Baseline sound levels were measured at three representative locations around the Landfall area, as described in Table 9.18 and illustrated in Figure 9.3. Measurement commenced approximately midday Thursday 7 July 2022 and completed 24 hours later on Friday 8 July 2022.





LEGEND

- Onshore Red Line Boundary
- Onshore Export Cable Corridor
- Temporary Construction Compounds
- Works Access Required
- Landfall Baseline Noise Survey Location

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Landfall Baseline Noise Survey Locations

VER	DATE	REMARKS	Drawn	Checked
1	21/02/2023	PEIR Submission	DB	JS

DRAWING NUMBER:

FIGURE 9.3

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:10,000	A3	OSGB 1936	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2022 09 PIER\Chapters\Noise\05356.00010.0187.0 Landfall Baseline Noise Survey Locations.mxd

Table 9.18: Landfall Noise Monitoring Locations

ID	Description	Easting	Northing
LF1	To the east of dwellings off Church Lane, Great Holland, approximately 1.6 km north of Landfall.	622002	219278
LF2	Finton Golf Course, north east of number 1 green and south of dwellings on Linkside.	623253	219263
LF3	Frinton Golf Course, adjacent to the carpark and to the rear of the gardens of dwellings on Second Avenue.	623316	218954

9.7.8 Weather conditions during the survey were monitored using a Davis weather station and were dry with a light breeze of less than 3 m/s. The temperature was in the mid 20's Celsius during the daytime, dropping to 10°C overnight. The weather conditions were suitable for measuring environmental sound.

9.7.9 The measurements were carried out utilising the equipment listed in Table 9.19. Field calibrations were undertaken using a Rion NC-75 1 kHz calibrator, serial number 35084983 that was laboratory calibrated on 31 May 2022.

Table 9.19: Noise Monitoring Equipment - Landfall

ID	Equipment	Serial Number	Calibrated
LF1	Rion NL-52 Class 1 sound level meter	864983	30/09/2020
LF2	Rion NL-52 Class 1 sound level meter	864982	30/09/2020
LF3	Rion NL-52 Class 1 sound level meter	898320	26/10/2021

SURVEY RESULTS

9.7.10 A summary of the overall survey results is included in Table 9.20 and are shown in full in Volume 5, Annex 9.1: Baseline Survey Details.

9.7.11 The $L_{Aeq,T}$ levels presented are the logarithmic average for this parameter in each period. These data will be used to inform the construction noise assessment for the Landfall and as such, has been divided into day (07:00 to 19:00 hours), evening (19:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) periods to be consistent with BS5228:2009+A1:2014.

9.7.12 It was evident from the data that noise levels saw a sharp increase during the night-time period, around 04:00 hours. This is common in spring and early summer due to the dawn chorus. As it would not be representative for the night-time of the year as a whole, the night-time data excluded any measurements between 04:00 and 07:00 hours.

Table 9.20: Summary of Baseline Sound Survey – Landfall, dB

Parameter	Period	LF1	LF2	LF3
L_{Aeq}	Day (07:00 to 19:00)	48	43	50
	Evening (19:00 to 23:00)	41	41	41
	Night (23:00 to 07:00)	28	34	35

9.7.13 To determine the BS5228-1:2009+A1:2014 assessment category using the example threshold values given in Table 9.4, the measured L_{Aeq} levels are rounded to the nearest 5 dB and compared to the values of Category A. During all periods the L_{Aeq}, when rounded to the nearest 5 dB, remains below the threshold values for Category A. Therefore, construction noise impacts at the NSRs nearest to the Landfall are to be assessed against Category A.

ONSHORE SUBSTATION

9.7.14 Currently there are two possible large search areas being considered for the location of the OnSS, as shown in Figure 9.4. These are referenced as SSA West which are west of Little Bromley and SSA East which is east of Little Bromley. Each of the search areas has two indicative locations for the siting of the OnSS which have been used in the assessment. The local environment in the vicinity of the OnSS search areas can be characterised as a rural environment around the village of Little Bromley.

9.7.15 SSA West is just over 100 ha and is surrounded by agricultural land with isolated farmhouses and dwellings in all directions. A minimum set back distance of 250 m from any existing dwelling has been applied to all search areas, so all NSRs are at least this distance away from the OnSS. The settlement of Little Bromley is approximately 700 m east of SSA West at the closest point, increasing to approximately 2 km. Immediately west of the search area is Lawford substation.

9.7.16 Search area SSA East is approximately 120 ha and situated around 2 km to the east of SSA West. The surrounding environment is comparable to that of SSA West, with the exception of the A120 located approximately 300 m to the south east and no existing substation. SSA East is approximately 600 m from the village of Little Bromley at its closest point, increasing to 2 km.

9.7.17 The soundscape of the OnSS area can be characterised as one of a mix of natural sounds: birdsong and wind disturbed vegetation, and anthropogenic sounds: distant road traffic, aircraft and remote agricultural activity. Road traffic noise was more dominant for locations around SSA East that were also adjacent to the A120.

MONITORING LOCATIONS

9.7.18 Baseline sound levels were measured at a total of 11 representative locations around the two OnSS search areas, as described in Table 9.21 and illustrated in Figure 9.4. Measurements took place during two periods: between Thursday 7 July 2022 and Wednesday 20 July 2022 at five locations around SSA West; and between Monday 26 September 2022 and Monday 3 October 2022 at two further locations near SSA West and four locations around SSA East. A minimum of seven day's data was recorded at each location.

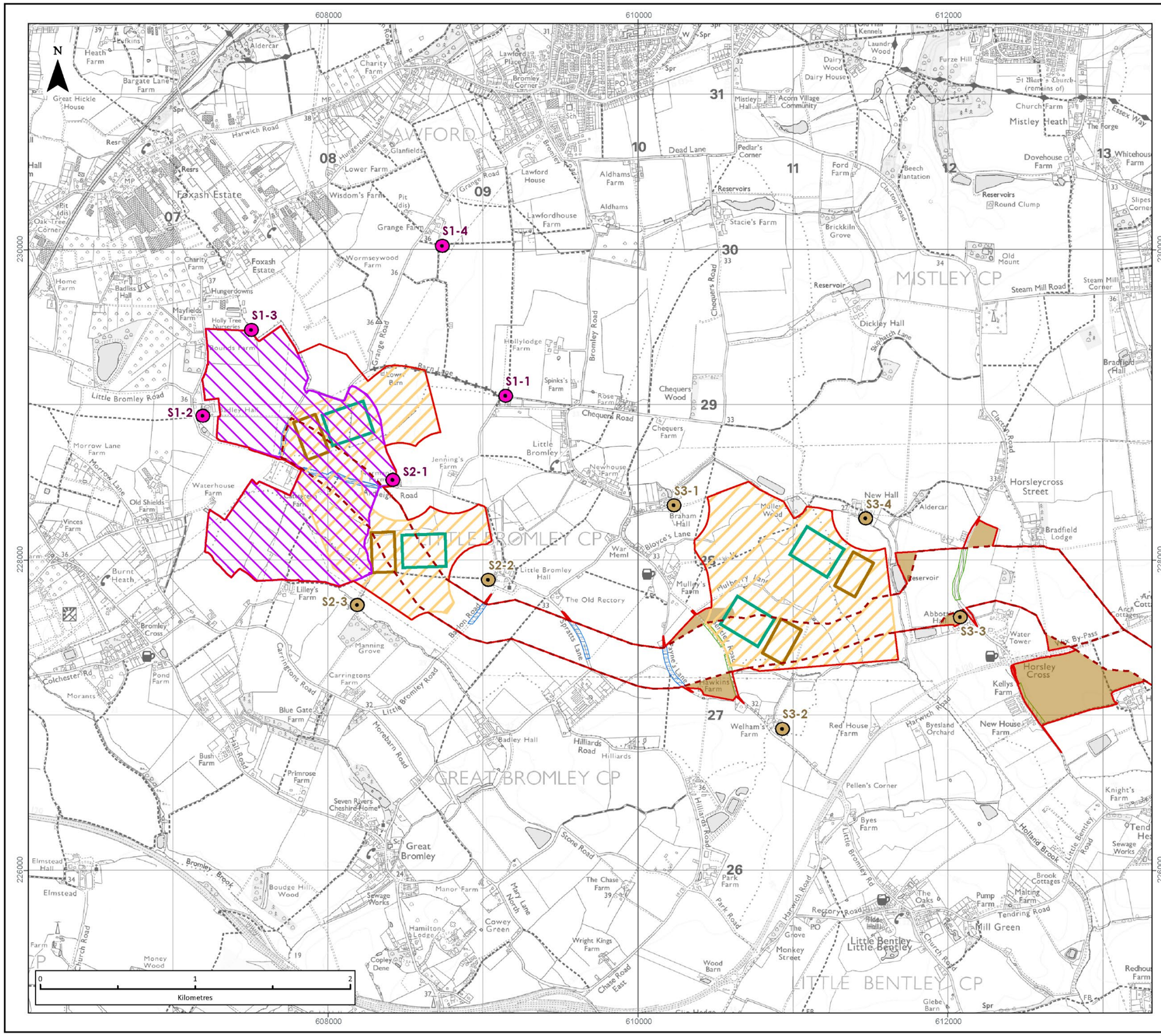
Table 9.21: OnSS Noise Monitoring Locations

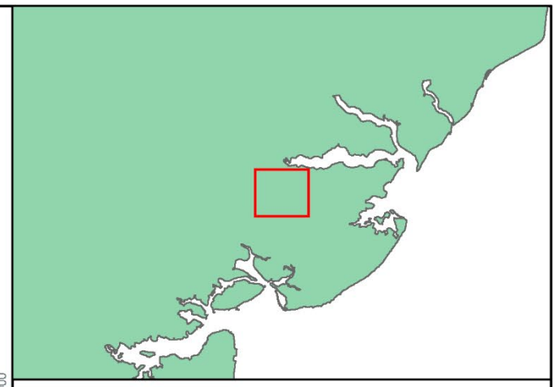
ID	Description	Measurement dates	Easting	Northing
S1-1	Hollywell Farm	7 – 19 July 2022	609148	229057
S1-2	Badley Hall	7 – 19 July 2022	607190	228928
S1-3	Mayfields Farm	8 – 20 July 2022	607494	229514
S1-4	Grange Farm	8 – 20 July 2022	608736	230032
S2-1	Normans Farm	7 – 19 July 2022	608423	228518
S2-2	Hall Farm barn conversion	26 Sept – 3 Oct 2022	609034	227876
S2-3	Fields between Lilleys Farm and Barlon House	26 Sept – 3 Oct 2022	608189	227712
S3-1	Branham Hall	26 Sept – 3 Oct 2022	610235	228356
S3-2	Welhams Farm	26 Sept – 3 Oct 2022	610934	226915
S3-3	Abbots Hall	26 Sept – 3 Oct 2022	612083	227632
S3-4	New Hall	26 Sept – 3 Oct 2022	611472	228270

9.7.19 Weather conditions during both the OnSS surveys were monitored using a Davis weather station, situated at S2-1 during July and S3-1 for the September measurements.

9.7.20 Weather conditions during July remained dry with wind speeds typically below 5m/s and temperatures ranging between 10°C and 37°C.

9.7.21 Weather conditions during the second survey at the end of September included some spells of rain, wind speeds less than 5m/s and temperatures ranging from 2°C to 20°C. Any periods where rainfall was noted, including a period of 30 minute after the rain stopped, have been excluded from the data as it is likely that noise levels would be elevated. Furthermore, the temperature remained at 3°C or greater for the entire survey, with the exception of Thursday 29 September 2022 when it fell between 2.3°C and 2.9°C between 0630 and 0815 hours. This period was excluded from the data as environmental sound can increase due to the risk of a temperature inversion occurring.





LEGEND

- Onshore Red Line Boundary
- Onshore Export Cable Corridor
- National Grid Area of Search
- Onshore Substation Areas of Search
- Temporary Construction Compounds
- Haul Road Crossings
- Haul Road Access
- Substation Construction Compound (Indicative)
- Substation Operational Boundary (Indicative)
- Onshore Substation Baseline Noise Survey Location (Bow Acoustics)
- Onshore Substation Baseline Noise Survey Location (RHDHV)

Note:
Additional locations included for assessment purposes for Noise and Vibration Chapter.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Onshore Substation (OnSS)
Baseline Noise Survey Locations

VER	DATE	REMARKS	Drawn	Checked
1	23/02/2023	PEIR Submission	DB	JS

DRAWING NUMBER:

FIGURE 9.4

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:25,000	A3	OSGB 1936	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

9.7.22 The weather conditions for all included data were suitable for the measurement of environmental sound.

9.7.23 The measurements were carried out utilising the equipment listed in Table 9.22. Field calibrations during the first survey that took place in July 2022 were undertaken using a Rion NC-74 1 kHz calibrator, serial number 01020506 that was laboratory calibrated on 5 August 2021. Field calibrations during the second survey that took place in September and October 2022 were undertaken using a Rion NC-75 1 kHz calibrator, serial number 35292145 that was laboratory calibrated on 14 April 2022.

Table 9.22: Noise Monitoring Equipment - OnSS

ID	Equipment	Serial Number	Calibrated
S1-1	Norsonic 140 Class 1 sound level meter	1403342	01/07/2021
S1-2	Norsonic 140 Class 1 sound level meter	1405219	06/07/2021
S1-3	Rion NL-52 Class 1 sound level meter	864982	30/09/2020
S1-4	Rion NL-52 Class 1 sound level meter	864983	30/09/2020
S2-1	Norsonic 140 Class 1 sound level meter	1406177	23/07/2020
S2-2	Rion NL-52 Class 1 sound level meter	586907	28/07/2022
S2-3	Rion NL-52 Class 1 sound level meter	586905	20/05/2022
S3-1	Rion NL-52 Class 1 sound level meter	620864	22/09/2022
S3-2	Rion NL-52 Class 1 sound level meter	610193	09/02/2022
S3-3	Rion NL-52 Class 1 sound level meter	1143558	11/01/2022
S3-4	Rion NL-52 Class 1 sound level meter	620867	10/05/2022

SURVEY RESULTS

9.7.24 A summary of the overall survey results is included in Table 9.23 and are shown in full in Volume 5, Annex 9.1: Baseline Survey Details.

9.7.25 The $L_{Aeq,T}$ levels presented are the logarithmic average for this parameter in each period. These data will be used to inform the construction noise assessment for the Landfall and as such, has been divided into periods to be consistent with BS5228:2009+A1:2014:

- day and Saturday mornings – 07:00 to 19:00 hours weekdays and 07:00 to 13:00 hours Saturdays;
- evening and weekends - 19:00 to 23:00 hours weekdays, 13:00 to 23:00 hours Saturdays and 07:00 to 23:00 hours Sundays; and
- night-time - 23:00 to 07:00 hours.

9.7.26 The background noise levels, described by the L_{A90}, and residual sound level, using the L_{Aeq} parameter, are used in the assessment of operational noise from the OnSS. The statistical distribution of the L_{A90} levels were reviewed and a representative value was selected for the overall daytime (07:00 to 23:00 hours) and the night-time (23:00 to 07:00 hours). This approach is consistent with the method described in BS4142:2014+A1:2019.

9.7.27 It was evident from the data measured in July that noise levels saw a sharp increase during the night-time period, around 04:00 hours. This is common in spring and early summer due to the dawn chorus. As it would not be representative for the night-time of the year as a whole, the night-time data excluded any measurements between 04:00 and 07:00 hours.

9.7.28 It is understood that the harvesting took place during the first survey in July. Local farmers have advised that harvesting activity, which includes combine harvesters and tractors with trailers active constantly on adjacent fields and roads, typically started around 11:00 hours and would not continue beyond 22:00 hours, 7-days a week. Data during these periods has been used with caution, and is discussed further in Paragraph 9.7.32.

9.7.29 An increase in noise level within the early morning hours was also observed during the second survey to start around 05:00 to 06:00 hours, it was however, not as pronounced as the dawn chorus in the July data. This increase observed in September / October, is considered to be typical of the diurnal pattern of noise and no time-specific exclusions were applied to these data.

Table 9.23: Summary of Baseline Sound Survey – OnSS, dB

Para-meter	Period	S1-1	S1-2	S1-3	S1-4	S2-1	S2-2	S2-3	S3-1	S3-2	S3-3	S3-4
L_{Aeq}	Day	41	47	45	44	44	46	46	53	49	54	46
	Evening	38	44	42	39	38	40	43	51	50	49	39
	Night	32	35	36	35	34	38	37	44	40	45	35
L_{A90}	Daytime	29	32	34	30	26	29	28	34	33	39	29
	Night	21	25	24	22	23	26	24	28	26	29	23

9.7.30 To determine the BS5228-1:2009+A1:2014 assessment category using the example threshold values given in Table 9.4, the measured L_{Aeq} levels are rounded to the nearest 5 dB and compared to the values of Category A. During the day and evening periods the L_{Aeq}, when rounded to the nearest 5 dB, remains below the threshold values for Category A. The same is true for the night, with the exception of two locations: S3-1; and S3-3, where the L_{Aeq} is equal to the threshold values of Category A, when rounded to the nearest 5 dB. The resultant construction noise categories for the NSRs around the OnSS are summarised in Table 9.24.

Table 9.24: Construction Noise Assessment Categories – OnSS

Period	S1-1	S1-2	S1-3	S1-4	S2-1	S2-2	S2-3	S3-1	S3-2	S3-3	S3-4
Day	A	A	A	A	A	A	A	A	A	A	A
Evening	A	A	A	A	A	A	A	A	A	A	A
Night	A	A	A	A	A	A	A	B	A	B	A

9.7.31 The L_{A90} levels presented in Table 9.23 are the representative background sound levels against which an initial estimate of the operational noise impacts from the substation have been determined, as described in Paragraph 9.5.9. Further consideration is then given to the context of development in the surrounding area using the L_{Aeq} levels as discussed in Paragraphs 9.5.10 to 9.5.16.

9.7.32 When considering the potential impact harvesting or other a-typical daytime activities may have had on the measured levels, consideration is given to the assessment methods. For the case of construction noise, all receptor locations are within Category A during the BS5228-1:2009+A1:2014 daytime and Saturday; and evening and weekend periods. This is the most stringent category and therefore, a worst case will be assessed.

EVOLUTION OF THE BASELINE

9.7.33 The baseline noise conditions are not expected to evolve significantly between now and the point of impact over the project lifetime.

9.7.34 The other proposed developments in the area, as listed in Paragraph 9.4.36, which are considered within the cumulative assessment for operational noise, would have the potential to slightly elevate the existing baseline in the immediate locality of that development. None of these developments, would however, have a significant impact on the measured baseline sound levels due to their distance away.

9.8 KEY PARAMETERS FOR ASSESSMENT

9.8.1 The maximum design scenarios (MDS) identified in Table 9.25 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the project description (Volume 3, Chapter 1: Onshore Project Description). Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project design envelope to that assessed here be taken forward in the final design scheme.

Table 9.25: Maximum design scenario for the project alone.

Potential effect	Maximum adverse scenario assessed	Justification
Construction		
General: applies to Impact 1, Impact 2, and Impact 3.	Assumed all plant used in each construction activity to be operating in the same location at the same time. Resultant noise level for each activity compared and the noisiest selected.	Construction activities at the closest approach will result in greater noise impacts.
	Receptor height of 4 m adopted for all calculations and periods.	Representative of a first floor window height. Noise levels will be higher than ground floor.
	Evening and night-time assessment undertaken for construction operations that are continuous and unable to stop.	More stringent noise criteria apply during the evening and night periods.
Impact 1: Noise and vibration impacts during construction of the Landfall.	Assessment assumes that impact piling will be required to construct a sheet piled intertidal exit pit at MHWS.	Impact piling is likely to generate relatively high levels of noise and vibration compared to other types of construction methods.
	Two HDD take place for VE at the same time and both at the minimum distance.	Two simultaneous construction activities will result in higher noise levels.
Impact 2: Noise and vibration impacts during the construction of the ECC.	Noise assessment assumes that construction activity from noisiest phase is located at the extremity of the cable corridor or TCC.	Construction activities at the extremity of the cable corridor or TCC will result in greater noise impacts.
Impact 3: Noise and vibration impacts during the construction of the OnSS.	The construction noise and vibration assessments assume that impact piling will be required to construct substation the foundations.	Impact piling is likely to generate relatively high levels of noise and vibration compared to other types of foundation construction methods.

Potential effect	Maximum adverse scenario assessed	Justification
Impact 4: Noise impacts from construction vehicles using the road network.	Construction HGV and worker peak traffic are combined for the peak month of construction vehicular activity.	The values presented will result in the highest noise impact which would occur during the busiest month for each link.
	Roads with an existing traffic flow below the CRTN low flow threshold will be assessed using the BS5228-1 haul route method.	Construction traffic noise assessed in the absence of any contribution to the overall noise level from any existing vehicles.
Operation		
Impact 5: Noise impacts during the operation of the OnSS.	All the plant associated with the substation is operating 100% of the time.	Results in predictions of highest possible noise levels.
Cumulative		
Cumulative noise impacts during the construction of the Landfall	Qualitative consideration given to the simultaneous construction activity of North Falls OWF landfall together with VE Landfall.	North Falls OWF planning application has not yet been submitted, therefore it is not possible to quantitively asses impacts from this development, until details of their noise assessment are available. Cumulative impacts should be fully considered by North Falls OWF.
Cumulative noise impacts during the construction of the ECC	Qualitative consideration given to the simultaneous construction activity of North Falls OWF ECC together with VE ECC.	
Cumulative noise impacts during the construction of the OnSS	It is assumed that construction of OnSS would coincide with the construction of the consented battery storage site, the proposed National Grid substation and proposed North Falls OWF substation.	Maximum possible construction activity assumed to be taking place at the same time. In reality fewer activities will be present and construction noise likely to be lower than assessed.

Potential effect	Maximum adverse scenario assessed	Justification
Cumulative noise impacts during the operation of the OnSS.	OnSS operating together with the consented battery storage site, proposed National Grid substation and proposed North Falls substation.	The assessment of cumulative operational noise. The planning applications and noise assessments for North Falls OWF or the National Grid EACN substation have not yet been submitted, therefore it is not possible to quantitively asses impacts from these developments.

9.9 EMBEDDED MITIGATION

9.9.1 The embedded mitigation contained in Table 9.26 are mitigation measures or commitments that have been identified and adopted as part of the evolution of the project design of relevance to noise and vibration, these include project design measures, compliance with elements of good practice and use of standard protocols. General mitigation measures, which would apply to all parts of the project, are set out first. Thereafter mitigation measures that would apply specifically to noise and vibration issues associated with the Landfall, onshore ECC and OnSS, are described separately. The subsequent assessment stage of the EIA is based on the 'mitigated' design with the embedded mitigation incorporated.

Table 9.26: Embedded mitigation relating to Noise and Vibration.

Project phase	Mitigation measures embedded into the project design
General	
Project design	Careful routing of the onshore cable route and positioning of the landfall. OnSS and TCC to avoid key areas of sensitivity. 250 m buffer distance applied between the OnSS and any dwelling.
Construction	
All construction aspects	All construction work will be undertaken in accordance with the measures outlined in the draft Code of Construction Practice (CoCP).
Operation	
Operational noise from the substation	Substation sited at a location to avoid key areas of sensitivity.

9.10 ENVIRONMENTAL ASSESSMENT: CONSTRUCTION PHASE

9.10.1 A development of this nature has the potential to generate noise and vibration during the construction phases. However, disruption due to construction-related noise and vibration is a localised phenomenon and is both temporary and intermittent in nature. The techniques available to predict the likely noise and vibration effects from construction sites are necessarily based on detailed information on the type and number of plant being used, their location within the site and the length of time they are in operation.

9.10.2 During the construction of the VE, noise from construction activities will inevitably be generated and will, during certain phases of construction, be audible at residential receptors in the vicinity of construction activities. The purpose of this section of the Chapter is therefore to:

- quantify the likely levels of construction noise that can be expected at the nearest residential receptor locations to construction works;
- provide comment as to the magnitude of the potential construction noise impacts, the resulting level of effect and whether this is significant in EIA terms; and
- where relevant, identify those impacts that would require specific mitigation measures for the potential noise effects to be reduced to a level considered acceptable.

9.10.3 Details of the construction works are described in Volume 3, Chapter 1: Onshore Project Description. A detailed list of indicative construction plant, operational noise levels and associated on-times for all the construction activities/operations have been provided; the full list of plant is included within Volume 5, Annex 9.2: Onshore Airborne Noise Construction Sound Power Details.

IMPACT 1: NOISE AND VIRBATION IMPACTS DURING THE CONSTRUCTION OF THE LANDFALL.

9.10.4 The construction activities associated with the Landfall are listed in Table 9.27 together with the total sound power levels, taking into account the number of plant and on-times, as detailed in Volume 5, Annex 9.2: Construction Plant.

Table 9.27: Landfall construction activities and sound power levels.

Activity	Combined Sound Power Level, dB L_{WA}
+Construction of the Landfall TCC (if required).	122
#Landfall TCC operations.	109
Removal of Landfall TCC.	121
Construction of the Landfall HDD compound.	122
Excavation of entry pits.	119

Activity	Combined Sound Power Level, dB L_{WA}
+#HDD operations or suitable alternative trenchless techniques.	116
+#Excavation of Transition Joint Bays (TJB).	119
+#Construction of TJB.	114
Pull-in of offshore export cables from offshore.	114
Trench excavation.	121
Trench backfilling.	121
Trench reinstatement.	121
Jointing of onshore and offshore cables.	115
Roof and backfill over TJBs.	120
HDD compound removal.	121
Construction of beach compound.	108
#Excavation of inter-tidal exit pit.	115
Excavation on the beach of open trench.	108
Pull-in export cable from offshore and backfilling beach trench.	108

9.10.5 Construction activity prefaced with a symbol ('+', or '#') in Table 9.27 have the potential to occur simultaneously with all other activities marked with the matching symbol.

9.10.6 A Landfall TCC may be required, and its location is identified adjacent to the promenade and an existing yard at the eastern end of Manor Way using existing public access to this area. It is assumed that the existing yard will be used for Landfall TCC operations.

At the current PEIR stage of the development, the ECC route has not been finalised. For the Landfall area this means that the location of the HDD compound and associated operations and the beach compound and associated operations may each take place in one of two potential areas, as highlighted in Figure 9.1.

9.10.7 Calculations assume the MDS set out in Table 9.25 and include embedded mitigation measures detailed in Table 9.26. The predicted noise levels from each of the Landfall construction operations are shown in Table 9.28 together with the NSR exposed to the highest level of noise during that operation. The final two construction activities in Table 9.28 correspond to the activities that are discussed in Paragraph 0 which have the potential to occur simultaneously.

9.10.8 The southern landfall option would place construction activity closer to NSRs than the northern landfall option. All NSRs within the landfall study area reside within the same construction category, as discussed below; therefore, greatest noise impacts would occur at NSRs closest to the construction works. Consequently, all calculations assume construction activity will take place within the area of the southern cable route as a worst case. Additional consideration has been given to the northern cable route only when the significance of effect would be different.

9.10.9 The NSRs around the Landfall are within BS5228-1:2009+A1:2014 Category A, as discussed in Paragraph 0, with the threshold values set out in Table 9.4, which have been included in Table 9.28. For the case of all Landfall construction activity, the closest NRSs are Sluice Gate Cottages; therefore the predicted noise levels set out in Table 9.28 represent this location. Other, more distance receptors would be exposed to lower levels of construction noise. The construction noise impact magnitude given in Table 9.13 has been applied to determine the significance of effect, together with Table 9.17 and Table 9.12, where residential receptors are of medium sensitivity.

9.10.10 Within the Landfall area the majority of the construction activities will take place during the daytime and Saturday morning, reflected in Table 9.28 as 'Day'. Two construction activities require continuous operation, or are reliant on tide times and as such may occur during the evenings and weekends or the night-time. All construction periods are defined in Table 9.4 and follow BS5228-1:2009+A1:2014. These activities are HDD and the piling associated with the excavation of the exit pit.

9.10.11 It can be seen from Table 9.28 that if a Landfall TCC is required adjacent to the promenade at the eastern end of Manor Way opposite Sluice Gate Cottages, there would be a temporary high magnitude of impact during its construction and removal, including the case of any other simultaneous construction activities. For medium sensitivity receptors, this would give rise to a **major adverse** level of effect at the two properties during the daytime. This effect is considered significant in terms of the 2017 EIA regulations.

9.10.12 Similarly, if HDD operations or piling associated with the excavation of the intertidal exit pit continue throughout the night-time there would be a temporary high magnitude of impact for medium sensitivity receptors, giving rise to a **major adverse** level of effect at the two properties of Sluice Gate Cottages during the night-time. It is noted that this assumes two simultaneous drills taking place, should only one HDD occur during any one night-time period the magnitude of impact reduces to medium, which gives rise to a **moderate adverse** level of effect. These effects (major and moderate) are considered significant in terms of the 2017 EIA regulations.

9.10.13 A number of mitigation options can be employed, as appropriate, for the construction and removal of the TCC and night-time piling and HDD operations. These include, but are not limited to, one or a combination of the following: the selection of quieter equipment, relocating noisier plant at greater distances from the NSRs, the use of a noise barrier around the perimeter of the works, localised acoustic screening around noisy plant, the use of an enclosure, alternative piling methods such as continuous flight auger, vibro displacement or rotary bored during the night.

9.10.14 With the selection of an appropriate form of mitigation, discussed above, or suitable equivalent, BS5228-1:2009+A1:2014 advises that 5 dB attenuation would be provided by a barrier that results in the top of the plant being just visible at the NSR, and 10 dB attenuation if the barrier completely hides the plant. Reductions of at least 10 dB would be achieved if an enclosure or quieter plant or alternative techniques are employed. It is therefore achievable to apply a degree of mitigation commensurate to the reduction required. With such mitigation in place, it would ensure that there would be no greater than a low impact magnitude, which would be of **minor residual effect**.

9.10.15 All other construction activity would be of minor or negligible magnitude of impact, which upon medium sensitive receptors would be of **minor effect** or **negligible effect**, which are not significant in terms of the 2017 EIA regulations.

9.10.16 Noise levels from all construction activities at more distant receptors, such as the dwellings located in Frinton-on-Sea and Holland-on-Sea, are predicted to be below the threshold value and would be of negligible magnitude of impact. A negligible impact upon medium sensitive receptors would be of **negligible effect** and not significant in terms of the 2017 EIA regulations.

Table 9.28: Landfall construction noise.

Construction Activity	Predicted noise level (dB L_{Aeq})	Period	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect (significance)
Construction of Landfall TCC.	73	Day	65	+8	High	Major (Significant)
Landfall TCC operations.	66	Day	65	+1	Low	Minor (not Significant)
Removal of Landfall TCC.	72	Day	65	+7	High	Major (Significant)
Construction of the Landfall HDD compound.	50	Day	65	-15	Negligible	Negligible (not Significant)
Excavation of entry pits.	53	Day	65	-12	Negligible	Negligible (not Significant)
HDD operations (assuming two simultaneous drills).	53	Day	65	-12	Negligible	Negligible (not Significant)
		Evening	55	-2	Negligible	Negligible (not Significant)
		Night	45	+8	High	Major (Significant)
Excavation of TJB.	53	Day	65	-12	Negligible	Negligible (not Significant)
Construction of TJB.	46	Day	65	-19	Negligible	Negligible (not Significant)
Pull-in of offshore export cables	46	Day	65	-19	Negligible	Negligible (not Significant)
Trench excavation.	53	Day	65	-12	Negligible	Negligible (not Significant)
Trench backfilling.	53	Day	65	-12	Negligible	Negligible (not Significant)

Construction Activity	Predicted noise level (dB L_{Aeq})	Period	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect (significance)
Trench reinstatement.	53	Day	65	-12	Negligible	Negligible (not Significant)
Jointing of onshore and offshore cables.	47	Day	65	-18	Negligible	Negligible (not Significant)
Roof and backfill over TJBs.	52	Day	65	-13	Negligible	Negligible (not Significant)
HDD compound removal.	55	Day	65	-10	Negligible	Negligible (not Significant)
Construction of beach compound.	47	Day	65	-18	Negligible	Negligible (not Significant)
Excavation of inter-tidal exit pit.	54	Day	65	-11	Negligible	Negligible (not Significant)
		Evening	55	-1	Negligible	Negligible (not Significant)
		Night	45	+9	High	Major (Significant)
Excavation on the beach of open trench.	47	Day	65	-18	Negligible	Negligible (not Significant)
Pull-in export cable and backfilling beach trench.	47	Day	65	-18	Negligible	Negligible (not Significant)

Construction Activity	Predicted noise level (dB L_{Aeq})	Period	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect (significance)
Landfall TCC construction + HDD operations + excavation and construction of TJBs.	73	Day	65	+8	High	Major (Significant)
TCC operations + HDD operations + excavation and construction of TJBs + excavation of inter-tidal pit.	67	Day	65	+2	Low	Minor (not Significant)

9.10.17 If the northern leg of the cable route is adopted in the Landfall study area, the distance between the nearest NSR and the majority of construction activities increases. The nearest NSRs remain the dwellings at Sluice Gate Cottages. Whilst the noise impact reduces for all activities listed in Table 9.28 by 6 dB, except the first three, the only impact magnitude that would change would be HDD operations during the night. This reduces to a low impact which is of **minor effect** and not significant in terms of the 2017 EIA regulations. Therefore, the mitigation discussed in Paragraph 9.10.13 would not be required.

9.10.18 The exact location of HDD within the Landfall, is not known, but will be within the red line boundary and between one of the HDD compounds and the beach compounds. Therefore, the closest any drilling work could be to a sensitive receptor would be approximately 300 m if the southern leg of the cable route is adopted.

9.10.19 Depending on the progress rates and techniques employed, vibration effects due to drilling are relatively short-lived, in addition, levels of vibration are found to decrease rapidly with distance.

9.10.20 Predictions of ground-borne vibration due to drilling works have been completed in accordance with the empirical prediction method given in Table E.1 of BS5228-2:2009+A1:2014 Part 2 Vibration. At the shortest distance between Landfall HDD and a receptor of 300 m, the vibration levels generated would be 0.1 mm/s.

9.10.21 A level of vibration of such magnitude would be negligible, as per Table 9.15, impacting upon medium sensitive receptors would result in a **negligible effect** and not significant in terms of the 2017 EIA regulations.

9.10.22 The other potential source of vibration associated with the Landfall construction is the piling of the sheet piled intertidal exit pit, which is potentially required during the construction of the Landfall HDD exit pit.

9.10.23 BS5228-2:2009+A1:2014 Part 2 Vibration provides further guidance for the prediction of an upper estimate of vibration from piling operations which is based on the energy per blow or cycle (determined by the type of piler and ram weight), the distance of the receptor from piling and generalised soil conditions. The formulae provided in Table E.1 in Annex E of BS BS5228-2:2009+A1:2014 Part 2 have been used to calculate ground-borne vibration levels from percussive piling at the shortest possible distance between Landfall piling and a receptor of approximately 330 m, assuming the beach compound is located in the southern cable route option.

9.10.24 During the worst case of a pile being driven to refusal and a hammer energy of the maximum permissible by the calculation parameters of 85 kJ per cycle, the vibration levels generated would be less than 0.8 mm/s, which is of low impact magnitude. Such an impact upon medium sensitive receptors would result in a **minor effect** and not significant in terms of the 2017 EIA regulations.

9.10.25 It should be noted that the prediction method used to calculate ground-borne vibration from percussive piling has a parameter range of up to 111 m distance, which is less than the nearest receptor of 330 m. Therefore, a degree of caution is advised.

IMPACT 2: NOISE AND VIBRATION IMPACTS DURING THE CONSTRUCTION OF THE ECC

9.10.26 The construction activities associated with the ECC are listed in Table 9.29 together with the total sound power levels, taking into account the number of plant and on-times, as detailed in Volume 5, Annex 9.2: Onshore Airborne Noise Construction Sound Power Details.

Table 9.29: ECC construction activities and sound power levels.

Activity	Combined Sound Power Level, dB L_{WA}
Temporary haul route installation along sections of route.	122
Site access point establishment.	122
+HDD / trenchless duct installation.	116
#Trench excavation.	121
Trench backfilling.	121
Trench reinstatement.	121
+Excavation of joint bays.	119
+Construction of joint bays.	114
Cable jointing.	114
Roof and backfill over joint bays.	121
Removal of haul roads, fencing and ground reinstatement.	121
+#Construction of TCC.	122
Removal of TCC	121

9.10.27 Construction activity prefaced with a symbol ('+' or '#') in Table 9.29 have the potential to occur simultaneously with all other activities marked with the matching symbol.

9.10.28 Calculations assume the MDS set out in Table 9.25 and include embedded mitigation measures detailed in Table 9.26. The noise levels from each of the ECC construction activities have been calculated and the minimum distances between each activity and a NSR have been determined such that the impact magnitude would be negligible, low, medium or high. Table 9.30 summarises the minimum distances for each impact magnitude threshold.

9.10.29 Where two or more construction activities are noted to have the same sound power level in Table 9.29, they share the same row in Table 9.30 as the minimum distances to impact thresholds are the same for each activity. The final two rows in Table 9.30 correspond to the activities discussed in Paragraph 0 which have the potential to occur simultaneously.

Table 9.30: ECC construction noise.

Construction Activity	Period	Negligible	Low	Medium	High
Temporary haul road installation / site access point establishment / construction of TCC	Day	>210 m	156 – 210 m	127 – 155 m	≤126 m
HDD / trenchless duct installation	Day	>113 m	84 – 113 m	69 – 83 m	≤68 m
	Evening	>318 m	235 – 318 m	191 – 234 m	≤190 m
	Night	>900 m	661 – 900 m	537 – 660 m	≤536 m
Trench excavation / backfilling / reinstatement / removal of haul roads / removal of TCC / roof and backfill over joint bay	Day	>189 m	141 – 189 m	115 – 140 m	≤114 m
Excavation of joint bay	Day	>154 m	115 – 154 m	93 – 114 m	≤92 m
Construction of joint bay / cable jointing	Day	>91 m	69 – 91 m	56 – 68 m	≤55 m
HDD + excavate & construct joint bay + construct TCC	Day	>281 m	208 – 281 m	169 – 207 m	≤168 m
Trenching + Construct TCC	Day	>274 m	202 – 275 m	165 – 201 m	≤164 m

9.10.30 The majority of construction activities would take place within the ECC corridor and could occur along the length of corridor. The exception to this is HDD work and the construction of TCCs, where activity will be in limited areas. For ECC construction activities that could occur along the entire length of the corridor, the installation of temporary haul roads provides a worst case as it is the noisiest and the corresponding distances to impact thresholds are the greatest.

9.10.31 There is a potential for medium to high impacts from the installation of temporary haul roads upon dwellings within the specified distances in Table 9.30 from the ECC along:

- Manor Way, Holland-on-Sea due to the proposed haul road immediately north;
- B1032 Clacton Road, near Great Holland Lodge;
- Little Clacton Road, south of Great Holland;
- Thorpe Cross and in and around White Lodge Crescent;
- North of Thorpe le Soken around where Henderson Road meets the B1414 Landermere Road;
- Golden Lane near to the ECC;
- Junction of B1035 Thorpe Road / Swan Road / Tendring Road, Tendring (south of Beaumont); and
- Isolated dwellings along the corridor not close to the above roads.

9.10.32 The construction of TCC has the potential for medium to high impacts upon dwellings within the specified distances in Table 9.30 of the TCCs located near:

- B1032 Clacton Road;
- Thorpe Cross;
- B1035 Tendring Road;
- B1035 Thorpe Road;
- South of the A120;
- North of the A120 off Clacton Road; and
- Bentley Road.

9.10.33 HDD will be utilised along the ECC and at a number of crossing locations, such as major roads, the railway and rivers. Depending on the progress rates and techniques employed, noise and vibration effects due to drilling are relatively short-lived, in addition, levels of vibration are found to decrease rapidly with distance.

9.10.34 During the daytime, noise from HDD work has the potential for medium to high impacts upon dwellings within the specified distances in Table 9.30 of the crossing of:

- B1032 Clacton Road, Holland on Sea;
- Little Clacton Road;
- Thorpe Cross;
- Landermere Road; and
- The roads around the junction of B1035 Thorpe Road / Swan Road / Tendring Road, Tendring (south of Beaumont).

9.10.35 If HDD continues through the evening period noise from this activity has the potential for medium to high impacts upon dwellings within the specified distances in Table 9.30 of the above crossing, plus:

- A120; and
- B1035 Clacton Road, nr Horsley Cross.

9.10.36 If HDD continues throughout the night time, a medium or high impact would occur at a distance of 660 m or less.

9.10.37 The above potential medium to high impacts upon medium sensitive receptors would result in a **moderate** or **major effect** which would be significant in terms of the 2017 EIA regulations.

9.10.38 The exact number of dwellings exposed to medium to high impacts will vary greatly on where in the construction activity is taking place. In most cases it will be possible to reduce impacts to low or negligible by increasing the distance to the activity or by introducing temporary mitigation that is appropriate to the nature of the work being carried out. These include, but are not limited to, one or a combination of the following: the selection of quieter equipment, relocating noisier plant at greater distances from the NSRs, the use of a noise barrier around the perimeter of the works, localised acoustic screening around noisy plant, or the use of an enclosure quieter working methods or temporary screening. The reduced impacts would lead to a **minor residual effect** during the daytime and evenings, which would not be significant in terms of the EIA regulations.

9.10.39 If it is not possible to completely reduce night time HDD noise impacts to low or negligible at all crossings, careful consideration will be required to ensure that any crossing that would result in a medium or high impact can be completed before night time or involve further mitigation as required. This may be a combination of mitigation options, such as positioning the HDD as far as possible from the NSR, also locating any associated plant at a maximum distance, and installing localised screens around noisier plant.

9.10.40 Predictions of ground-borne vibration due to drilling works have been completed in accordance with the empirical prediction method given in Table E.1 of BS5228-2:2009+A1:2014 Part 2 Vibration.

9.10.41 Any vibration from HDD at a distance of at least 138 m would be less than 0.3 mm/s, which would be of negligible magnitude of impact. At a distance of 55 m from HDD a level of vibration of just under 1 mm/s is calculated, which would be of low impact magnitude. At a distance of just 10 m from HDD the vibration level would be 9 mm/s which is at the upper end of a medium magnitude of impact.

9.10.42 No dwellings are expected to be exposed to a high impact from HDD vibration, the following crossings have the potential to result in a medium impact, depending on the exact location of the drilling works:

- Little Clacton Road;
- Thorpe Cross;
- Landermere Road; and
- The roads around the junction of B1035 Thorpe Road / Swan Road / Tendring Road, Tendring (south of Beaumont).

9.10.43 A medium impact upon medium sensitive receptors would result in a **moderate effect**, which is significant in terms of the 2017 EIA regulations.

9.10.44 It will be possible to carry out the majority of HDD work and result in a low or negligible vibration impact at nearby sensitive receptors by selecting a crossing location that maximises the distance to any sensitive receptor. The reduced impacts would lead to a **minor residual effect**, which would not be significant in terms of the EIA regulations.

IMPACT 3: NOISE AND VIBRATION IMPACTS DURING THE CONSTRUCTION OF THE ONSS

9.10.45 The construction activities associated with the OnSS are listed in Table 9.31 together with the total sound power levels, taking into account the number of plant and on-times, as detailed in Volume 5, Annex 9.2: Onshore Airborne Noise Construction Sound Power Details.

Table 9.31: OnSS construction activities and sound power levels.

Activity	Combined Sound Power Level, dB L_{WA}
Site enabling works: site clearance, ground works and formation of site platform.	123
Access road construction.	116
Building foundation works.	119
Building fabrication and HV plant installation.	117
TCC construction.	122

9.10.46 Calculations assume the MDS set out in Table 9.25 and include embedded mitigation measures detailed in Table 9.26. The predicted noise levels from each of the OnSS construction operations are shown in Table 9.32 to Table 9.33 for substation search areas SSA West and SSA East respectively. The closest point to the substation and construction compound has been used in the calculations. For each of the search areas, two potential locations have been identified for the substation and construction compound, the one nearest to the receptor under consideration has been used.

9.10.47 Table 9.32 and Table 9.33 also show the BS5228-1:2009+A1:2014 construction noise threshold Categories, as presented in Table 9.24, which have been determined for the nearby NSRs based on the specified noise monitoring location (NML) given in Table 9.21. The threshold value against which the predicted construction noise is assessed is derived from Table 9.4. It is noted that OnSS construction activity would take place during the working day (including Saturday morning 07:00 to 13:00 hours) therefore, the thresholds reflect this period.

9.10.48 It can be seen from Table 9.32 and Table 9.33 that construction noise would not exceed the day threshold at any of the NSRs. Therefore, this would result in a negligible impact on medium sensitivity receptors, giving a **negligible effect**, which is not significant in terms of the 2017 EIA regulations.

Table 9.32: OnSS construction noise SSA West.

NSR (NML)	Construction Activity	Predicted noise level (dB L_{Aeq})	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect	Significance
Jubilee Villa (S1-1)	Site enabling works	54	65	-11	Negligible	Negligible	Not Significant
	Access road and carpark	47	65	-18	Negligible	Negligible	Not Significant
	Building foundation	49	65	-16	Negligible	Negligible	Not Significant
	Building & HV installation	47	65	-18	Negligible	Negligible	Not Significant
	TCC construction	50	65	-15	Negligible	Negligible	Not Significant
Badley Hall (S1-2)	Site enabling works	54	65	-11	Negligible	Negligible	Not Significant
	Access road and carpark	47	65	-18	Negligible	Negligible	Not Significant
	Building foundation	49	65	-16	Negligible	Negligible	Not Significant
	Building & HV installation	48	65	-17	Negligible	Negligible	Not Significant
	TCC construction	55	65	-10	Negligible	Negligible	Not Significant
Property at Holly Tree Nurseries (S1-3)	Site enabling works	51	65	-14	Negligible	Negligible	Not Significant
	Access road and carpark	44	65	-21	Negligible	Negligible	Not Significant
	Building foundation	46	65	-19	Negligible	Negligible	Not Significant
	Building & HV installation	44	65	-21	Negligible	Negligible	Not Significant
	TCC construction	51	65	-14	Negligible	Negligible	Not Significant

NSR (NML)	Construction Activity	Predicted noise level (dB L_{Aeq})	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect	Significance
Grange Farm (S1-4)	Site enabling works	50	65	-15	Negligible	Negligible	Not Significant
	Access road and carpark	43	65	-22	Negligible	Negligible	Not Significant
	Building foundation	45	65	-20	Negligible	Negligible	Not Significant
	Building & HV installation	43	65	-22	Negligible	Negligible	Not Significant
	TCC construction	47	65	-18	Negligible	Negligible	Not Significant
Mulberry Lodge (S2-1)	Site enabling works	58	65	-7	Negligible	Negligible	Not Significant
	Access road and carpark	51	65	-14	Negligible	Negligible	Not Significant
	Building foundation	54	65	-11	Negligible	Negligible	Not Significant
	Building & HV installation	52	65	-13	Negligible	Negligible	Not Significant
	TCC construction	53	65	-12	Negligible	Negligible	Not Significant
Normans Farm (S2-1)	Site enabling works	63	65	-2	Negligible	Negligible	Not Significant
	Access road and carpark	56	65	-9	Negligible	Negligible	Not Significant
	Building foundation	58	65	-7	Negligible	Negligible	Not Significant
	Building & HV installation	56	65	-9	Negligible	Negligible	Not Significant
	TCC construction	61	65	-4	Negligible	Negligible	Not Significant

NSR (NML)	Construction Activity	Predicted noise level (dB L_{Aeq})	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect	Significance
Hall Farm (S2-2)	Site enabling works	65	65	0	Negligible	Negligible	Not Significant
	Access road and carpark	58	65	-7	Negligible	Negligible	Not Significant
	Building foundation	60	65	-5	Negligible	Negligible	Not Significant
	Building & HV installation	58	65	-7	Negligible	Negligible	Not Significant
	TCC construction	56	65	-9	Negligible	Negligible	Not Significant
Barlon House (S2-3)	Site enabling works	57	65	-8	Negligible	Negligible	Not Significant
	Access road and carpark	50	65	-15	Negligible	Negligible	Not Significant
	Building foundation	53	65	-17	Negligible	Negligible	Not Significant
	Building & HV installation	51	65	-14	Negligible	Negligible	Not Significant
	TCC construction	56	65	-9	Negligible	Negligible	Not Significant
Lilleys Farm (S2-3)	Site enabling works	54	65	-11	Negligible	Negligible	Not Significant
	Access road and carpark	47	65	-18	Negligible	Negligible	Not Significant
	Building foundation	50	65	-15	Negligible	Negligible	Not Significant
	Building & HV installation	48	65	-17	Negligible	Negligible	Not Significant
	TCC construction	56	65	-9	Negligible	Negligible	Not Significant

Table 9.33: OnSS construction noise SSA East.

NSR (NML)	Construction Activity	Predicted noise level (dB L_{Aeq})	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect	Significance
Branham Hall (S3-1)	Site enabling works	54	65	-11	Negligible	Negligible	Not Significant
	Access road and carpark	47	65	-18	Negligible	Negligible	Not Significant
	Building foundation	50	65	-15	Negligible	Negligible	Not Significant
	Building & HV installation	48	65	-17	Negligible	Negligible	Not Significant
	TCC construction	50	65	-15	Negligible	Negligible	Not Significant
Mulleys Farm (S3-1)	Site enabling works	60	65	-5	Negligible	Negligible	Not Significant
	Access road and carpark	53	65	-12	Negligible	Negligible	Not Significant
	Building foundation	56	65	-9	Negligible	Negligible	Not Significant
	Building & HV installation	54	65	-11	Negligible	Negligible	Not Significant
	TCC construction	54	65	-11	Negligible	Negligible	Not Significant
Welhams Farm (S3-2)	Site enabling works	57	65	-8	Negligible	Negligible	Not Significant
	Access road and carpark	50	65	-15	Negligible	Negligible	Not Significant
	Building foundation	53	65	-12	Negligible	Negligible	Not Significant
	Building & HV installation	51	65	-14	Negligible	Negligible	Not Significant
	TCC construction	59	65	-6	Negligible	Negligible	Not Significant

NSR (NML)	Construction Activity	Predicted noise level (dB L_{Aeq})	Threshold (dB L_{Aeq})	Difference (dB)	Impact magnitude	Effect	Significance
Oakwood (S3-2)	Site enabling works	61	65	-4	Negligible	Negligible	Not Significant
	Access road and carpark	54	65	-11	Negligible	Negligible	Not Significant
	Building foundation	57	65	-8	Negligible	Negligible	Not Significant
	Building & HV installation	55	65	-10	Negligible	Negligible	Not Significant
	TCC construction	61	65	-4	Negligible	Negligible	Not Significant
Abbots Hall (S3-3)	Site enabling works	53	65	-12	Negligible	Negligible	Not Significant
	Access road and carpark	46	65	-19	Negligible	Negligible	Not Significant
	Building foundation	48	65	-17	Negligible	Negligible	Not Significant
	Building & HV installation	46	65	-19	Negligible	Negligible	Not Significant
	TCC construction	54	65	-11	Negligible	Negligible	Not Significant
New Hall (S3-4)	Site enabling works	65	65	0	Negligible	Negligible	Not Significant
	Access road and carpark	58	65	-7	Negligible	Negligible	Not Significant
	Building foundation	60	65	-5	Negligible	Negligible	Not Significant
	Building & HV installation	58	65	-7	Negligible	Negligible	Not Significant
	TCC construction	64	65	-1	Negligible	Negligible	Not Significant

9.10.49 In addition to construction noise, vibration would be generated if the substation building foundations require impact piling. The formulae provided in Table E.1 in Annex E of BS BS5228-2:2009+A1:2014 Part 2 have been used to calculate ground-borne vibration levels from percussive piling at the nearest receptor to a potential location for the OnSS building. The north eastern layout option at SSA East places the area of the substation approximately 275 m from New Hall dwelling.

9.10.50 During the worst case of a pile being driven to refusal at this shortest distance and a hammer energy of 85 kJ per cycle, the vibration levels generated are calculated to be 0.98 mm/s, which is of low impact magnitude. For the majority of piling the piles would not be driven to refusal and the calculated vibration level would be lower. A low impact upon medium sensitive receptors would result in a **minor effect** and not significant in terms of the 2017 EIA regulations.

9.10.51 It should be noted that the prediction method used to calculate ground-borne vibration from percussive piling has a parameter range of up to 111 m distance, which is less than the nearest receptor of 275 m. Therefore, a degree of caution is advised.

IMPACT 4: NOISE IMPACTS FROM CONSTRUCTION VEHICLES USING THE ROAD NETWORK

9.10.52 Construction traffic from the development proposals may temporarily alter noise levels near the affected local road network. A number of road links have been considered, as set out in paragraph 9.4.26, using the method described in paragraph 9.4.27 and paragraph 9.4.28.

9.10.53 Table 9.34 presents a summary of the road links assessed, the traffic data and the HGV corrected basic noise level. The impact magnitude of the change in BNL has been determined using Table 9.14.

9.10.54 Two road links provided were noted to have a level of flow that was below the validity of the calculation method; therefore, as specified in paragraph 9.4.28, the haul route calculation method provided in BS5528-1:2009+A1:2014 has been used to determine the likely noise from construction vehicles. Table 9.35 summarises these links and the calculated total noise from construction HGV and LDVs at a reference distance of 10 m. The impact magnitude has been determined using Table 9.13.

9.10.55 Construction traffic noise is predicted to have a negligible or low magnitude of impact at all roads assessed. Such impacts (negligible and low) upon medium sensitive receptors would result in a **minor effect** and not significant in terms of the 2017 EIA regulations.

Table 9.34: Construction traffic noise assessment – Change in BNL.

Road	Without construction traffic			With construction traffic			Change in BNL	Impact magnitude	Effect / Significance
	AAWT	% HGV	BNL	AAWT	% HGV	BNL			
A12 north of A120	16492	8.1%	75.0	17069	9.4%	75.4	0.4	Negligible	Minor / not significant
A12 south of A120	8857	9.3%	72.5	9434	11.6%	73.1	0.6	Negligible	Minor / not significant
A120 between A12 and A133	19448	11.1%	76.2	20604	13.1%	76.7	0.5	Negligible	Minor / not significant
A120 between the A133 and Harwich Road	6434	15.0%	69.8	6872	17.5%	70.5	0.6	Negligible	Minor / not significant
A120 between Bentley Road and B1035	6969	10.8%	69.5	7407	13.3%	70.2	0.7	Negligible	Minor / not significant
A120 east of B1035	15820	6.0%	72.1	15820	6.0%	72.1	0.0	Negligible	Minor / not significant
A133 between A120 & B1033 Colchester Road	13699	10.3%	74.6	14417	12.0%	75.0	0.5	Negligible	Minor / not significant
A133 between B1033 and B1027	25323	3.8%	76.1	25529	4.1%	76.2	0.1	Negligible	Minor / not significant
B1027 between A133 & B1032 Frinton / Clacton Rd	14242	1.4%	68.4	14448	2.0%	68.7	0.3	Negligible	Minor / not significant
B1032 Frinton / Clacton Road	7400	1.6%	65.6	7606	2.8%	66.2	0.5	Negligible	Minor / not significant

Road	Without construction traffic			With construction traffic			Change in BNL	Impact magnitude	Effect / Significance
	AAWT	% HGV	BNL	AAWT	% HGV	BNL			
B1033 Colchester Road between A133 and B1441 Weeley Bypass	18516	1.7%	69.7	19028	2.8%	70.2	0.5	Negligible	Minor / not significant
B1441 Weeley Bypass / Clacton Rd / Weeley Rd	6138	2.3%	69.7	6316	3.2%	70.0	0.3	Negligible	Minor / not significant
B1414 Harwich / Station Road	6246	1.8%	69.7	6424	2.7%	70.0	0.3	Negligible	Minor / not significant
B1033 Abbey St / Frinton Road / Thorpe Road	14178	1.0%	68.2	14356	1.4%	68.4	0.2	Negligible	Minor / not significant
B1033 Colchester Road between B1441 Weeley Bypass & Tendring Road	12234	1.8%	67.9	12568	3.0%	68.4	0.5	Negligible	Minor / not significant
Tendring Road	1897	2.2%	63.8	2231	9.0%	66.0	2.2	Low	Minor / not significant
Thorpe Road	2686	2.1%	65.8	2797	3.9%	66.4	0.6	Negligible	Minor / not significant
B1035 south of A120	6004	2.4%	69.6	6115	3.2%	69.9	0.2	Negligible	Minor / not significant
B1035 north of A120	8653	2.8%	71.3	8978	4.7%	71.8	0.5	Negligible	Minor / not significant
B1027 Frinton Road	8265	1.3%	66.0	8471	2.3%	66.5	0.5	Negligible	Minor / not significant

Road	Without construction traffic			With construction traffic			Change in BNL	Impact magnitude	Effect / Significance
	AAWT	% HGV	BNL	AAWT	% HGV	BNL			
B1029 Frating Road	2169	2.7%	60.1	2274	5.8%	61.4	1.3	Low	Minor / not significant

Table 9.35: Construction traffic noise assessment – BS5228 haul route.

Road	Construction traffic		Predicted noise level (dB L_{Aeq})	Threshold	Difference	Impact magnitude	Effect	Significance
	HGVs	LDVs						
Bentley Road	181	146	63	65	-2	Negligible	Minor	Not significant
Waterhouse Lane	150	60	62	65	-3	Negligible	Minor	Not significant

9.11 ENVIRONMENTAL ASSESSMENT: OPERATIONAL PHASE

IMPACT 5: NOISE IMPACTS DURING THE OPERATION OF THE ONSS

9.11.1 An assessment has been made in accordance with the guidance contained in BS4142:2014+A1:2019 to determine whether noise emissions associated with the operation of the proposed OnSS is likely to give rise to adverse impacts at the closest residential receptors.

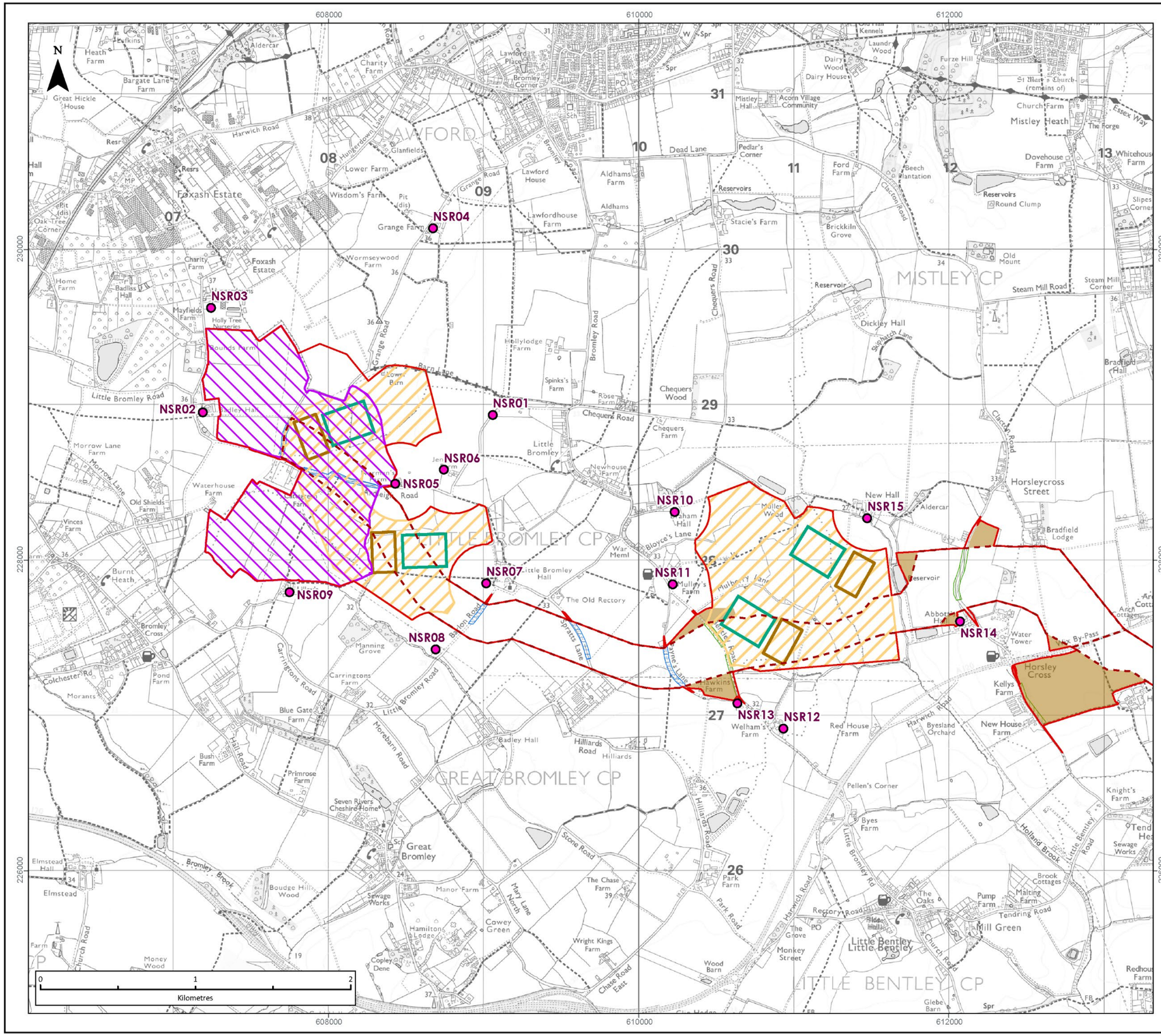
9.11.2 The OnSS may be located in one of two search areas: SSA West or SSA East. Each of the search areas have two indicative locations that the substation could be located within it. Giving a total of four locations for the OnSS, each of which have been considered in this assessment to give a good representation of the likely impacts, given the flexibility retained at PEIR stage.

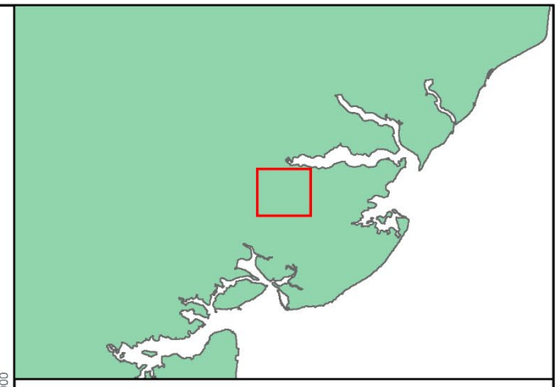
9.11.3 Noise levels from the OnSS have been predicted at the nearest residential receptors to each of the possible locations, as set out in Table 9.36 and shown in Figure 9.5.

Table 9.36: Receptor locations.

ID	Name	Easting	Northing
NSR01	Jubilee Villa	609060	228933
NSR02	Badley Hall	607192	228949
NSR03	Property at Holly Tree Nurseries	607243	229623
NSR04	Grange Farm	608676	230134
NSR05	Normans Farm	608432	228489
NSR06	Mulberry Lodge	608745	228580
NSR07	Hall Farm	609018	227851
NSR08	Barlon House	608692	227425
NSR09	Lilleys Farm	607749	227794
NSR10	Branham Hall	610232	228310
NSR11	Mulleys Farm	610221	227844
NSR12	Welhams Farm	610934	226916
NSR13	Oakwood	610637	227079
NSR14	Abbots Hall	612073	227606
NSR15	New Hall	611474	228269

9.11.4 The modelling has been undertaken on the basis of the type, quantity and size of plant that is likely to be required at a substation of the size in the application. It should, however, be noted that the final design of the substation has not been determined and so a maximum envelope has been assessed. In particular, there is the potential for two possible types of substations – Air Insulated (AIS) and Gas Insulated (GIS) to be utilised.





LEGEND

- Onshore Red Line Boundary
- Onshore Export Cable Corridor
- Onshore Substation Areas of Search
- National Grid Area of Search
- Temporary Construction Compounds
- Haul Road Crossings
- Haul Road Access
- Substation Construction Compound (Indicative)
- Substation Operational Boundary (Indicative)
- Noise Sensitive Receptor

Note:
Additional locations included for assessment purposes for Noise and Vibration Chapter.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Noise Sensitive Receptors (NSRs) Around the Onshore Substation (OnSS) Search Areas

VER	DATE	REMARKS	Drawn	Checked
1	23/02/2023	PEIR Submission	DB	JS

DRAWING NUMBER:

FIGURE 9.5

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:25,000	A3	OSGB 1936	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

9.11.5 In conjunction with the MDS shown in Table 9.25, the modelling has assumed that the AIS substation would be chosen, as this has the potential to generate higher noise levels as the substation equipment is not housed within a building.

9.11.6 The operational noise levels of the plant associated with the OnSS have been provided by VE OWFL and are shown in Table 9.37. Also included in the height that the source has been modelled at, which typically represents approximately 3/4 of the height of the plant.

Table 9.37: Operational plant associated with the OnSS.

Item of plant	Sound power level, dB L_{WA}	Quantity	Source height, m
Power transformers	95	2	5
Shunt reactors	92	9	5
Statcom	85	2	3
Harmonic Filter	85	3	9
Transformer coolers	93	2	1.5
Shunt reactor coolers	93	9	1.5
Statcom coolers	85	2	1.5

9.11.7 All sources have been modelled in their layout location based on AIS as point sources. The calculation follows the ISO 9613-2 methodology which accounts for the attenuation due to geometric spreading, atmospheric absorption, and barrier and ground effects. All attenuation calculations have been made on an octave band basis and therefore account for the sound frequency characteristics of the OnSS plant.

9.11.8 All noise level predictions have been undertaken using a receiver height of four metres above local ground level, soft ground (G=1) and an air absorption based on a temperature of 10°C and 70% relative humidity. A receiver height of four metres will be typical of first floor windows and result in slightly higher predicted noise levels than if a 1.2 to 1.5 metre receiver height were chosen in the ISO 9613 algorithm. There are no screening effects due to intervening ground at the site and therefore this element was excluded from the model; however, proposed buildings within the OnSS have been modelled which may provide some screening at some NSRs.

9.11.9 The calculated specific noise levels for each of the OnSS location options and all relevant factors to be considered when determining the operational noise impact are detailed in Table 9.38 to Table 9.41 for the daytime and Table 9.42 to Table 9.45 for the night-time. This approach is discussed further in paragraph 9.5.9 to paragraph 9.5.16 and summarised in Table 9.16. Note that when considering the change in existing sound level during the daytime, the evening period has been used as it represents the quietest period of the day and as such a worst case.

9.11.10 It has been assumed that the specific noise from the operation of the OnSS contains a tone that is just perceptible at each receiver location as a worst case. BS4142:2014+A1:2019 applies a +2 dB correction for tone that is just perceptible.

Table 9.38: Daytime OnSS operational noise assessment – SSA West northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR01	S1-1	32	+2	34	29	+5	38	39.1	+1.1
NSR02	S1-2	34	+2	36	32	+4	44	44.4	+0.4
NSR03	S1-3	33	+2	35	34	+1	42	42.5	+0.5
NSR04	S1-4	31	+2	33	30	+3	39	39.6	+0.6
NSR05	S2-1	41	+2	43	26	+17	38	42.4	+4.4
NSR06	S2-1	37	+2	39	26	+13	38	40.7	+2.7

Table 9.39: Daytime OnSS operational noise assessment – SSA West southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR05	S2-1	41	+2	43	26	+17	38	42.6	+4.6
NSR07	S2-2	40	+2	42	29	+13	40	42.8	+2.8
NSR08	S2-3	38	+2	40	28	+12	43	44.3	+1.3
NSR09	S2-3	35	+2	37	28	+9	43	43.7	+0.7

Table 9.40: Daytime OnSS operational noise assessment – SSA East, southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR10	S3-1	34	+2	36	34	+2	51	51.1	+0.1
NSR11	S3-1	40	+2	42	34	+8	51	51.3	+0.3
NSR12	S3-2	37	+2	39	33	+6	50	50.2	+0.2
NSR13	S3-2	40	+2	42	33	+9	50	50.4	+0.4
NSR14	S3-3	30	+2	32	39	-7	49	49.1	+0.1
NSR15	S3-4	34	+2	36	29	+7	39	40.2	+1.2

Table 9.41: Daytime OnSS operational noise assessment – SSA East, northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR10	S3-1	35	+2	37	34	+3	51	51.1	+0.1
NSR11	S3-1	35	+2	37	34	+3	51	51.1	+0.1
NSR12	S3-2	33	+2	35	33	+2	50	50.1	+0.1
NSR13	S3-2	34	+2	36	33	+3	50	50.1	+0.1
NSR14	S3-3	32	+2	34	39	-5	49	49.1	+0.1
NSR15	S3-4	42	+2	44	29	+15	39	43.8	+4.8

Table 9.42: Night-time OnSS operational noise assessment – SSA West northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR01	S1-1	32	+2	34	21	+13	32	35.2	+3.2
NSR02	S1-2	34	+2	36	25	+11	35	37.3	+2.3
NSR03	S1-3	33	+2	35	24	+11	36	37.7	+1.7
NSR04	S1-4	31	+2	33	22	+11	35	36.4	+1.4
NSR05	S2-1	41	+2	43	23	+20	34	41.4	+7.4
NSR06	S2-1	37	+2	39	23	+16	34	39.0	+5.0

Table 9.43: Night-time OnSS operational noise assessment – SSA West southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR05	S2-1	41	+2	43	23	+20	34	41.5	+7.5
NSR07	S2-2	40	+2	42	26	+16	38	41.9	+3.9
NSR08	S2-3	38	+2	40	24	+16	37	40.8	+3.8
NSR09	S2-3	35	+2	37	24	+13	37	39.2	+2.2

Table 9.44: Night-time OnSS operational noise assessment – SSA East, southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ – L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR10	S3-1	34	+2	36	28	+8	44	44.4	+0.4
NSR11	S3-1	40	+2	42	28	+14	44	45.4	+1.4
NSR12	S3-2	37	+2	39	26	+13	40	41.6	+1.6
NSR13	S3-2	40	+2	42	26	+16	40	43.0	+3.0
NSR14	S3-3	30	+2	32	29	+3	45	45.1	+0.1
NSR15	S3-4	34	+2	36	23	+13	35	37.6	+2.6

Table 9.45: Night-time OnSS operational noise assessment – SSA East, northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR10	S3-1	35	+2	37	28	+9	44	44.5	+0.5
NSR11	S3-1	35	+2	37	28	+9	44	44.5	+0.5
NSR12	S3-2	33	+2	35	26	+9	40	40.8	+0.8
NSR13	S3-2	34	+2	36	26	+10	40	40.9	+0.9
NSR14	S3-3	32	+2	34	29	+5	45	45.2	+0.2
NSR15	S3-4	42	+2	44	23	+21	35	42.9	+7.9

9.11.11 Reviewing SSA West northern option, it can be seen from Table 9.38 that during the daytime the initial estimate of impact, obtained from subtracting the rating level from the background sound level, is of low magnitude at NSR01 to NSR04 and high at NSR05 and NSR06. When considering the context of the development, the rating level at all locations is below the threshold of LOAEL discussed in the WHO CNG of 50 dB $L_{Aeq,\ 16hour}$, but above the 'very low' level that is described in BS4142:1997 to be 'about 35 dB' at NSR05 and NSR06. During the evening period of the daytime, the OnSS at this location would have a negligible change on the existing sound level at all locations, except NSR05, where it would be a low impact.

9.11.12 During the night-time period, it can be seen from Table 9.42 that the initial estimate of impact would be high at all NSRs with the OnSS located in the northern option of SSA West. However, as discussed in Paragraph 9.5.10 and 9.5.13, during the night-time the absolute levels can be more relevant than the difference between the rating level and background sound level. Comparing the rating levels set out in Table 9.42 with the night-time rating level thresholds detailed in Table 9.16, a low impact is observed at all NSRs except for NSR05, which would be exposed to a medium impact. Considering this further, with the likely change in existing sound level, a negligible impact is predicted at NSR02 to NSR04, a low impact at NSR01 and medium impact at NSR05 and NSR06.

9.11.13 When considering all the above factors relevant to the determination of impacts, should the OnSS be located within the northern area of SSA West, NSR01 to NSR04 would be exposed to a negligible to low impact and NSR05 and NSR06 a medium to high impact. Negligible and low impacts upon a medium sensitive receptor results in a **negligible** or **minor effect**, which is not significant. Medium to high impacts upon a medium sensitive receptor results in an **moderate** to **major effect**, which is a significant effect without any mitigation.

9.11.14 The initial estimate of impact for the OnSS located in the southern area of SSA West during the daytime, as set out in Table 9.39, is high at NSR05, NSR07 and NSR08 and medium at NSR09. When considering the context of the development, the rating level at all locations is below the threshold of LOAEL, but above the 'very low' level. During the evening period of the daytime, the OnSS at this location would have a negligible change in the existing sound level at all locations, except NSR05, where it would be a low impact. During the night-time Table 9.43 shows the initial estimate of impact to be high and the absolute rating level to be a medium impact at NSR05 and NSR07 and low impact at NSR08 and NSR09. The change in night-time sound level would result in a medium impact at NSR05, a low impact at NSR07 and NSR08 and a negligible impact at NSR09. On balance, the OnSS in this location would result in a medium to high impact at all NSRs, which is a **moderate** to **major effect** and considered significant in terms of the EIA Regulations 2017.

9.11.15 The initial estimate of impact for the OnSS located in the southern area of SSA East during the daytime, as set out in Table 9.40, is medium at NSR11 to NSR13 and NSR15, and negligible to low at the remaining NSRs. When considering the context of the development, the rating level at all locations is below the threshold of LOAEL, but above the 'very low' level at NSR11 to NSR13. During the evening period of the daytime, the OnSS at this location would have a negligible change in the existing sound level at all locations. During the night-time Table 9.44 shows the initial estimate of impact ranges from low to high and the absolute rating level to be a medium impact at NSR11 and NSR13 and low impact at all other NSRs. The change in night-time sound level would result in a low impact at NSR13, and a negligible impact at all other NSRs. On balance, the OnSS in this location would result in a medium impact at NSR11 to NSR13, which is a **moderate effect** and considered significant in terms of the EIA Regulations 2017. There would be a **negligible** to **low impact** at remaining NSRs which is not significant.

9.11.16 The initial estimate of impact for the OnSS located in the northern area of SSA East during the daytime, as set out in Table 9.41, is high at NSR15 and negligible to low at the remaining NSRs. When considering the context of the development, the rating level at all locations is below the threshold of LOAEL, but above the 'very low' level at NSR10, NSR11 and NSR15. During the evening period of the daytime, the OnSS at this location would have a low change in the existing sound level at NSR15 and negligible at all other NSRs. During the night-time Table 9.45 shows the initial estimate of impact at all NSRs to be medium to high and the absolute rating level to be a medium impact at NSR15 and a low impact at all other NSRs. The change in night-time sound level would result in a medium impact at NSR15, and a negligible impact at all other NSRs. On balance, the OnSS in this location would result in a medium to high impact at NSR15, which is a **moderate** to **major effect** and considered significant in terms of the EIA Regulations 2017. There would be a **negligible** to **low impact** at remaining NSRs which is not significant.

9.11.17 The exact location of the OnSS is not finalised at this stage of the development; however, the above considers four potential indicative locations within the SSAs. Each of the locations resulted in at least one NSR being exposed to a significant effect; therefore mitigation would be required.

9.11.18 A number of mitigation options are available that can be applied as appropriate. These include, but are not limited to, one or a combination of the following: electrical components with reduced sound power levels, enclosures or localised screening around selected noisy components, a noise barrier around some or all of the OnSS, repositioning the OnSS within the SSA to be further away from NSRs and using buildings and other structures within the OnSS to form a noise barrier.

9.11.19 The exact reduction offered by the mitigation will depend on what is applied and where. A nominal 10 dB can be assumed as a realistically achievable value; however, it is noted that for most locations much less or no mitigation would be necessary. The residual effects are summarised in Table 9.46 to Table 9.53.

Table 9.46: Daytime OnSS residual noise after mitigation – SSA West northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR01	S1-1	22	+2	24	29	-5	38	38.1	+0.1
NSR02	S1-2	24	+2	26	32	-6	44	44.0	0.0
NSR03	S1-3	23	+2	25	34	-9	42	42.1	+0.1
NSR04	S1-4	21	+2	23	30	-7	39	39.1	+0.1
NSR05	S2-1	31	+2	33	26	+7	38	38.7	+0.7
NSR06	S2-1	27	+2	29	26	+3	38	38.4	+0.4

Table 9.47: Daytime OnSS residual noise after mitigation – SSA West southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR05	S2-1	31	+2	33	26	+7	38	38.7	+0.7
NSR07	S2-2	30	+2	32	29	+3	40	40.4	+0.4
NSR08	S2-3	28	+2	30	28	+2	43	43.1	+0.1
NSR09	S2-3	25	+2	27	28	-1	43	43.1	+0.1

Table 9.48: Daytime OnSS residual noise after mitigation – SSA East, southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR10	S3-1	24	+2	26	34	-8	51	51.0	0.0
NSR11	S3-1	30	+2	32	34	-2	51	51.0	0.0
NSR12	S3-2	27	+2	29	33	-4	50	50.0	0.0
NSR13	S3-2	30	+2	32	33	-1	50	50.0	0.0
NSR14	S3-3	20	+2	22	39	-17	49	49.0	0.0
NSR15	S3-4	24	+2	26	29	-3	39	39.1	+0.1

Table 9.49: Daytime OnSS residual noise after mitigation – SSA East, northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Day dB L_{A90}	Difference $L_{Ar,Tr}$ – L_{A90}	Change in evening sound level, dB $L_{Aeq, 4hr}$		
							Existing	Revised	Change
NSR10	S3-1	25	+2	27	34	-7	51	51.0	0.0
NSR11	S3-1	25	+2	27	34	-7	51	51.0	0.0
NSR12	S3-2	23	+2	25	33	-8	50	50.0	0.0
NSR13	S3-2	24	+2	26	33	-7	50	50.0	0.0
NSR14	S3-3	22	+2	24	39	-15	49	49.0	0.0
NSR15	S3-4	32	+2	34	29	+5	39	39.8	+0.8

Table 9.50: Night-time OnSS residual noise after mitigation – SSA West northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR01	S1-1	22	+2	24	21	+3	32	32.5	+0.5
NSR02	S1-2	24	+2	26	25	+1	35	35.3	+0.3
NSR03	S1-3	23	+2	25	24	+1	36	36.2	+0.2
NSR04	S1-4	21	+2	23	22	+1	35	35.2	+0.2
NSR05	S2-1	31	+2	33	23	+10	34	35.6	+1.6
NSR06	S2-1	27	+2	29	23	+6	34	34.8	+0.8

Table 9.51: Night-time OnSS residual noise after mitigation – SSA West southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR05	S2-1	31	+2	33	23	+10	34	35.7	+1.7
NSR07	S2-2	30	+2	32	26	+6	38	38.6	+0.6
NSR08	S2-3	28	+2	30	24	+6	37	37.6	+0.6
NSR09	S2-3	25	+2	27	24	+3	37	37.3	+0.3

Table 9.52: Night-time OnSS residual noise after mitigation – SSA East, southern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR10	S3-1	24	+2	26	28	-2	44	44.0	0.0
NSR11	S3-1	30	+2	32	28	+4	44	44.2	+0.2
NSR12	S3-2	27	+2	29	26	+3	40	40.2	+0.2
NSR13	S3-2	30	+2	32	26	+6	40	40.4	+0.4
NSR14	S3-3	20	+2	22	29	-7	45	45.0	0.0
NSR15	S3-4	24	+2	26	23	+3	35	35.3	+0.3

Table 9.53: Night-time OnSS residual noise after mitigation – SSA East, northern option.

NSR	NML	Specific noise level (dB L_{Aeq})	Character correction	Rating Level (dB $L_{Ar,Tr}$)	Night dB L_{A90}	Difference $L_{Ar,Tr}$ - L_{A90}	Change in night sound level, dB $L_{Aeq, 8hr}$		
							Existing	Revised	Change
NSR10	S3-1	25	+2	27	28	-1	44	44.1	+0.1
NSR11	S3-1	25	+2	27	28	-1	44	44.1	+0.1
NSR12	S3-2	23	+2	25	26	-1	40	40.1	+0.1
NSR13	S3-2	24	+2	26	26	0	40	40.1	+0.1
NSR14	S3-3	22	+2	24	29	-5	45	45.0	0.0
NSR15	S3-4	32	+2	34	23	+11	35	36.8	+1.8

9.11.20 It can be seen that the highest residual rating level would be 34 dB $L_{Ar, Tr}$, which is very low and would be of low impact magnitude during the night-time. Furthermore, the change in sound level at all locations during the daytime and night-time would be negligible. Therefore, in the context of the development and surrounding area, a low residual impact would result after mitigation. A low impact upon a medium sensitive receptor results in a **minor residual effect**. This effect is considered not significant in terms of the 2017 EIA regulations.

9.12 ENVIRONMENTAL ASSESSMENT: CUMULATIVE EFFECTS

9.12.1 This cumulative impact assessment for noise and vibration has been undertaken in accordance with the methodology provided in Volume 1, Annex 3.1: Cumulative Effects Assessment Methodology.

9.12.2 The projects and plans selected as relevant to the assessment of impacts to noise and vibration are based upon an initial screening exercise undertaken on a long list. Each project, plan or activity has been considered and scoped in or out on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved. For the purposes of assessing the impact of the VE on noise and vibration in the region, the cumulative effect assessment technical note submitted through the EIA Evidence Plan and forming Volume 1, Annex 3.1: Cumulative Effects Assessment screened in a number of projects and plans as presented in Table 9.55. The Tier structure is described in Volume 1, Annex 3.1: Cumulative Effects Assessment, and outlined here in Table 9.54. The Tiers are listed in descending order of detail likely to be available, and correspondingly, certainty of effects arising.

Table 9.54: Description of Tiers of other developments considered for cumulative effect assessment.

Tiers	Development Stage
Tier 1	Projects under construction.
	Permitted applications, whether under the Planning Act 2008 or other regimes, but not yet implemented.
	Submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined.
Tier 2	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted.
	Projects under the Planning Act 2008 where a PEIR has been submitted for consultation.
Tier 3	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted.
	Identified in the relevant Development Plan (and emerging Development Plans with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited.
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/ approvals, where such development is reasonably likely to come forward.

Table 9.55: Projects considered within the Noise and Vibration cumulative effect assessment.

Development type	Project	Status	Data confidence assessment/ phase	Tier
Battery storage	21/020270/FUL Battery storage facility	Consented	High – data presented in noise assessment	Tier 1
Substation	National Grid substation	Not yet submitted	Low – no data available	Tier 3
Offshore wind farm	North Falls offshore wind farm	Not yet submitted	Low – no data available	Tier 3

9.12.3 For the cumulative projects that are not yet constructed there is a potential that construction activities could occur concurrently. Table 9.56 sets out the scenarios considered in the cumulative assessment.

Table 9.56: Cumulative MDS.

Impact	Scenario	Justification
Cumulative construction noise with Landfall	North Falls Landfall is being constructed at the same time as VE in the same area without infrastructure being shared.	This would result in the maximum possible cumulative construction noise impacts. If North Falls OWF construction activity does not occur concurrently with VE then no cumulative impacts would occur.
Cumulative construction noise with ECC	North Falls ECC is being constructed at the same time as VE in the same area without infrastructure being shared.	This would result in the maximum possible cumulative construction noise impacts. If North Falls OWF construction activity does not occur concurrently with VE then no cumulative impacts would occur.

Impact	Scenario	Justification
Cumulative construction noise with OnSS	The consented battery storage facility, proposed national grid substation and North Falls substation are all being constructed at the same time as VE OnSS.	Assumes maximum possible development consented and under construction concurrently. Consent applications have not yet been submitted for all cumulative developments, in which noise from VE should be assessed cumulatively.
Cumulative operational noise with OnSS	OnSS operating with battery storage facility, national grid substation and North Falls substation.	Assumes maximum possible development operating concurrently. Consent applications have not yet been submitted for all cumulative developments, in which noise from VE should be assessed cumulatively.

9.12.4 The assessment carried out for the impacts of construction traffic noise, summarised in Table 9.34 and Table 9.35 include traffic associated with the following developments:

- 21/02070/FUL, 50MW battery energy storage system on land adjacent to Lawford Grid Substation, Ardleigh Road Little Bromley Essex CO11 2QB;
- 20/00179/FUL, residential development to provide 50 dwellings at land at Oakwood Park; and
- 20/01130/FUL, residential development to provide 122 dwellings on land South of Centenary Way and west of Thorpe Road, Clacton on Sea Essex CO15 4QD.

9.12.5 Construction traffic data for the other developments listed in Table 9.55 is currently not available and therefore it was not possible to assess cumulatively.

CUMULATIVE CONSTRUCTION NOISE WITH LANDFALL

9.12.6 The construction of VE Landfall resulted in minor residual effect, as set out in paragraph 9.10.14 and paragraph 9.10.15. The majority of VE daytime and evening construction activity is calculated to be at below the BS5228-1:2009+A1:2014 threshold and adding another source of similar amount (North Falls OWF construction) would result in a maximum cumulative impact of low magnitude.

9.12.7 The only exceptions to this would be the construction activities associated with the VE TCC off Manor Way, night-time piling associated with the inter-tidal exit pit and night-time HDD in the southern leg of the cable route, where a low residual impacts are reported. It would not be possible to also locate the North Falls OWF TCC or carryout HDD as close to these receptors as the available ground would be used by VE. North Falls Landfall construction work is likely to be situated at a comparable distance to the northern cable route leg of VE, the impacts of which are discussed in Paragraph 9.10.17.

9.12.8 If the VE TCC was being constructed at the same time as the noisiest construction activity taking place within the North Falls OWF HDD compound, HDD compound removal, there would not be an increase in construction noise at Sluice Gate Cottages. This would result in a low cumulative impact which would be of **minor effect** and not significant in terms of the 2017 EIA regulations.

9.12.9 Two Landfall construction activities may continue through the evening and potentially night-time periods: HDD and piling associated with the inter-tidal exit pit. Construction works during these periods will be avoided wherever possible; however, in some circumstances it may necessary to complete a drill or pile. It is considered unlikely that both North Falls OWF and VE would both need to continue construction activities through these periods at the same time; however, such a worst case can be considered.

9.12.10 Mitigation was recommended for the two potential night-time operations in paragraph 9.10.13 that is likely to offer a reduction of 10 dB or more. This would result in residual construction noise levels of 43 dB and 44 dB for two simultaneous HDD and inter-tidal exit pit piling respectively. Therefore, the noisiest Landfall night-time construction activity would be the piling associated with the inter-tidal exit pit at 44 dB L_{Aeq} at Sluice Gate Cottages. If identical works were being carried out for North Falls at the same closest distance and time, the cumulative noise would be 47 dB L_{Aeq} at Sluice Gate Cottages. This would be a low impact during the night-time and the sensitivity of the receptor is medium; therefore, resulting in a **minor cumulative effect** and not significant in terms of the 2017 EIA regulations.

CUMULATIVE CONSTRUCTION NOISE WITH ECC

9.12.11 The construction of the ECC is predominantly linear and work will be transient as it progresses along the corridor. During this time receptors will be exposed to increased levels of construction noise and vibration which will soon reduce again as work passes through.

9.12.12 Paragraphs 9.10.26 to 9.10.44 set out these impacts for the construction of the ECC associated with VE which result in a minor residual effect. It is considered unlikely that North Falls OWF would be working in the same area as VE, and at the same time, for their onshore cable route without sharing any infrastructure.

9.12.13 If VE and North Falls OWF ECCs are in the same area and infrastructure is shared, noise from construction activities would not change from those assessed in paragraphs 9.10.26 to9.10.44.

9.12.14 If VE and North Falls OWF ECCs are not in the same corridor, construction activity would have to be occurring simultaneously and nearby to cumulatively contribute to the overall construction noise level. For example, the majority of ECC construction activity will be trench excavation and back filling, which Table 9.30 advises would have a low impact at a distance of between 141 m and 189 m. For this to cumulatively increase to a medium impact similar construction activity would have to occur within 190 m of the same receptor at the same time.

CUMULATIVE CONSTRUCTION NOISE WITH ONSS

9.12.15 No construction noise assessment was carried out for the consented battery storage facility; presumably due to the scale of the development, amount of construction required and the distance to the nearest sensitive receptors. Notwithstanding this, worst case assumptions can be made to allow for noise from its construction contributing to the cumulative level.

9.12.16 The cumulative developments are all potentially located to the west of SSA West. Therefore, a worst case for cumulative OnSS construction noise would occur if this search area was selected for the VE OnSS. Consequently, cumulative impacts associated with SSA East would be lower and are covered by this worst case.

9.12.17 No construction noise assessment data is available for any of the cumulative developments. Therefore, a simplified approach has been taken based on worst case assumptions of similar construction activity taking place at all sites. In addition, the location of the battery storage facility is known, but all other cumulative development is yet to be submitted to planning and exact positions are not available.

9.12.18 The nearest NSRs to SSA West and the cumulative developments are Badley Hall, and Lilleys Farm, where OnSS construction activities are predicted to produce noise levels at least 10 dB below and 9 dB below the BS5228-1:2009+A1:2014 threshold, as set out in Table 9.32. This is at least 12 dB below the point at which a medium magnitude of impact would occur (see Table 9.13).

9.12.19 Assuming a worst case: cumulative developments generate the maximum possible levels of construction noise at Lilleys Farm without resulting in a significant effect in their own right. This would result in a total construction noise of 68 dB from all other development and 56 dB from VE (Table 9.32). The cumulative effect of adding these two levels of noise totals 68 dB and therefore construction noise associated with the VE OnSS would not increase the overall cumulative construction noise level. Therefore, the maximum possible cumulative noise impact would be low which is of **minor effect** and is not significant in EIA terms.

CUMULATIVE OPERATIONAL NOISE WITH ONSS

9.12.20 As with cumulative construction noise, cumulative operational noise from the OnSS together with other developments set out in Table 9.55, will be at a highest if the OnSS is located in SSA West. Therefore, cumulative impacts associated with SSA East would be lower and are covered by this worst case.

9.12.21 The nearest NSR to SSA West and the cumulative developments are NSR02, Badley Hall and NSR09, Lilleys Farm. The residual OnSS operational noise is predicted to have a rating level of 26 dB $L_{Ar,Tr}$ at NSR02 (Table 9.46) and 27 dB $L_{Ar,Tr}$ at NSR09 (Table 9.47). In addition, operational noise from the VE OnSS has been calculated at Waterhouse Farm as the receptor considered in the proposed battery energy storage system (BESS). The residual OnSS operational noise at Waterhouse Farm is 26 dB $L_{Ar,Tr}$.

9.12.22 The BESS reported a rating level of 35 dB $L_{Ar, Tr}$ at Waterhouse Farm during the night when background levels were typically 32 dB L_{A90}. The addition of OnSS operational noise at 26 dB $L_{Ar, Tr}$ results in a total rating level of 36 dB $L_{Ar, Tr}$. The initial estimate of cumulative impact of these two developments would be low (Table 9.16) as the rating level would exceed the background by 4 dB. Further consideration needs to be given to the context and the absolute value of the rating level would also be of low impact. The existing sound level measured at Waterhouse Farm is noted to be typically 38 dB L_{Aeq} during the night-time hours in Appendix 5 of the noise assessment report for the BESS. The introduction of a total specific noise of 34 dB L_{Aeq} from the OnSS and BESS would alter the existing sound level by 2 dB, which is of negligible impact.

9.12.23 Until further details are available regarding the location of, and the rating level produced by, the other cumulative developments, it is not possible to quantify the likely total cumulative impacts.

9.13 INTER-RELATIONSHIPS

9.13.1 The inter-related effects assessment considers likely significant effects from multiple impacts and activities from the construction, operation and decommissioning of VE on the same receptor, or group of receptors. Such inter-related effects include both:

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

9.13.2 No project lifetime effects would occur at a receptor, as noise would dissipate once a phase of the project, e.g. construction, passes.

9.13.3 Receptor let effects concern the accumulation of impacts on a single receptor between Noise and Vibration and other environmental disciplines. It is considered likely that during the construction phase, human receptors impacted by noise and vibration are also likely to be affected by traffic and air quality impacts, which is considered in in Volume 3 Chapter 9: Traffic and Transport and in Volume 3 Chapter 11: Air Quality respectively. It is not anticipated that these inter-relationships will lead to any significant effects greater than the assessments presented for each discipline.

9.14 TRANSBOUNDARY EFFECTS

9.14.1 Transboundary noise and vibration effects from the construction, operation and decommissioning of VE have been scoped out as there are no likely significant effects. There are no noise and vibration transboundary effects.

9.15 SUMMARY OF EFFECTS

9.15.1 This assessment has considered the potential noise and vibration effects arising from onshore activities associated with VE. Consideration has been given to potential worst-case effects arising from onshore construction activities and the operation of the substation based upon available information. Worst-case parameters have been adopted to provide a robust assessment.

9.15.2 The approach undertaken was based upon the PINS Scoping Opinion (PINS, 2021), consultation carried out with Tendring District Council and Essex County Council and during the ETG meeting on 3 November 2022.

9.15.3 A summary of all significant effects is presented in Table 9.57. There are no significant residual effects after additional mitigation and the embedded mitigation set out in Section 0 and Table 9.26.

Table 9.57: Summary of effects for Noise and Vibration.

Description of Impact	Effect	Additional mitigation measures	Residual impact
Construction			
Landfall construction noise	Major adverse	Examples include: quieter equipment, relocation of plant, barriers, enclosures and alternative piling technique.	No significant adverse residual effects
Landfall construction vibration	Minor	Not Applicable – no additional mitigation required	No significant adverse residual effects
ECC construction noise	Major adverse	Careful positioning of route / drilling of crossings. Use of barriers, enclosures or quieter techniques where necessary	No significant adverse residual effects
ECC construction vibration	Moderate adverse	select drilling location that maximises distance to receptor.	No significant adverse residual effects
OnSS Construction noise	Negligible	Not Applicable – no additional mitigation required	No significant adverse residual effects
OnSS Construction vibration	Minor	Not Applicable – no additional mitigation required	No significant adverse residual effects
Construction vehicular noise	Minor	Not Applicable – no additional mitigation required	No significant adverse residual effects

Description of Impact	Effect	Additional mitigation measures	Residual impact
Operation			
OnSS operational noise	Major adverse	Examples include: quieter electrical components, enclosures, localised screening, noise barriers, or repositioning	No significant adverse residual effects
Cumulative effects			
Cumulative Landfall construction noise	Minor	Not Applicable – no additional mitigation required	No significant adverse residual effects
Cumulative ECC construction noise	Minor	Not Applicable – no additional mitigation required	No significant adverse residual effects
Cumulative OnSS construction noise	Minor	Not Applicable – no additional mitigation required	No significant adverse residual effects
Cumulative OnSS operational noise	Minor	Not Applicable – no additional mitigation required	No significant adverse residual effects

9.16 NEXT STEPS

9.16.1 The following steps will be undertaken to progress the Noise and Vibration assessment from PEIR stage to DCO Application stage:

- update the OnSS construction and operational noise assessment to reflect its finalised location / SSA;
- information on North Falls OWF substation and National Grid substation will be sourced, as far as is practical, to enable a detailed cumulative assessment to be carried out;
- efforts to work collaboratively with the North Falls OWF and National Grid project teams will continue to ensure an exchange of information; and
- In response to the refined corridor of the onshore ECC and associated HDD and construction compounds, the construction noise and vibration assessment will be updated and presented in the DCO Application.

9.17 REFERENCES

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FIVE ESTUARIES
OFFSHORE WIND FARM

PHONE 0333 880 5306
EMAIL fiveestuaries@rwe.com
WEBSITE www.fiveestuaries.co.uk
ADDRESS Five Estuaries Offshore Wind Farm Ltd
Windmill Hill Business Park
Whitehill Way, Swindon, SN5 6PB
COMPANY NO Registered in England and Wales
company number 12292474