East Anglia
Offshore Wind

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East Anglia THREE

Chapter 26

Noise and Vibration

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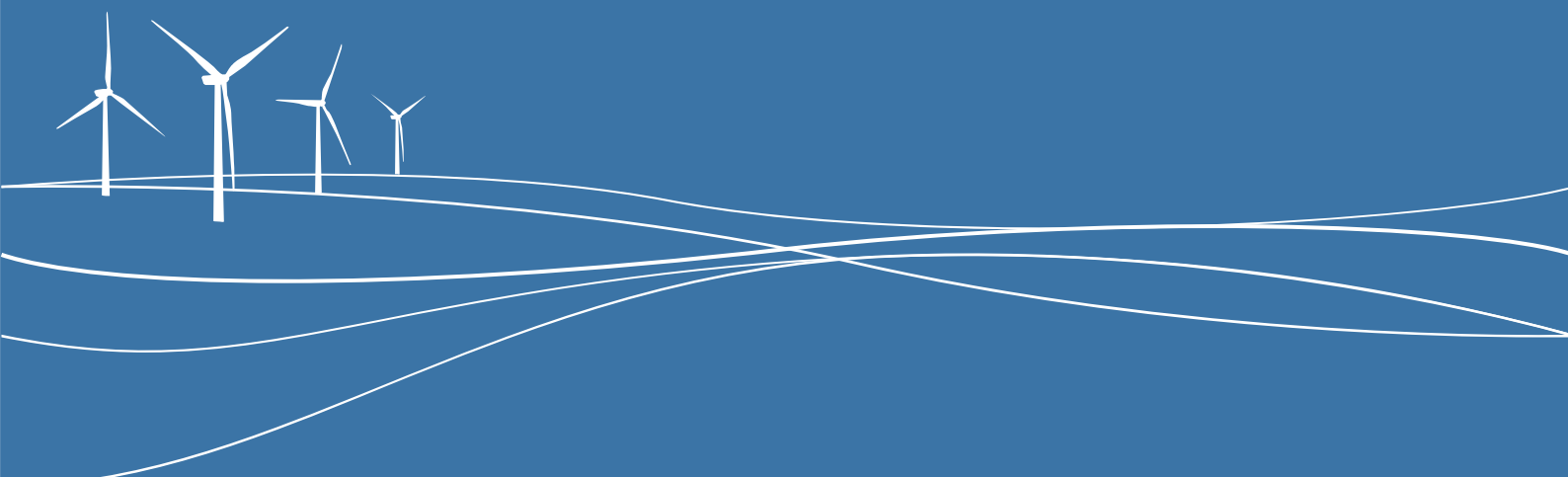

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Table of Contents

26 Noise and Vibration 1

26.1 Introduction 1

26.2 Consultation 1

26.3 Scope 4

26.3.1 Study Area 4

26.3.2 Worst Case 4

26.3.3 Embedded Mitigation 10

26.4 Assessment Methodology 12

26.4.1 Guidance 12

26.4.2 Data Sources 15

26.4.3 Impact Assessment Methodology 15

26.4.4 Prediction Methods 20

26.4.5 Sensitivity 30

26.4.6 Magnitude 30

26.4.7 Impact significance 32

26.4.8 Cumulative Impact Assessment 34

26.4.9 Transboundary Impact Assessment 34

26.5 Existing Environment 34

26.5.1 Noise Survey 34

26.5.2 Environmental Baseline 35

26.6 Potential Impacts 39

26.6.1 Potential Impacts During Construction 39

26.6.2 Potential Impacts During Operation 50

26.6.3 Potential Impacts During Decommissioning 52

26.7 Cumulative Impacts 53

26.8 Inter-relationships 58

26.9 Summary 59

26.10 References 64

Chapter 26 Noise and Vibration figures are presented in **Volume 2: Figures** and listed in the table below.

Figure number	Title
26.1	Study Area
26.2	Substation(s) Receptor Locations
26.3	Onshore Cable Route Construction Receptor Locations
26.4	Onshore Cable Route Construction Noise Buffer

Chapter 26 Noise and Vibration appendices are presented in **Volume 3: Appendices** and listed in the table below.

Appendix number	Title
26.1	East Anglia ONE Baseline Noise Survey

26 NOISE AND VIBRATION

26.1 Introduction

1. This chapter of the Environmental Statement (ES) assesses the potential airborne noise impacts of the proposed East Anglia THREE project during construction, operation and decommissioning.

2. This chapter is structured by the following sections: Consultation, Scope, Assessment Methods, Existing Environment, Potential Impacts, Cumulative Impacts, Inter-relationships, Summary, References and Appendices. Further, general information regarding the structure of this document is discussed in Chapter 1 Introduction. Further information regarding the approach taken towards impact assessment is discussed in Chapter 6 Environmental Impact Assessment Methodology.

3. This chapter includes assessment on traffic noise, with reference to Chapter 27 Traffic and Transport. Figures are provided in *Volume 2, Figures 26.1 to 26.4*.

26.2 Consultation

4. Since the East Anglia THREE site and offshore elements are situated a significant distance from land based receptors, the effect of both airborne construction noise and operational noise on land based receptors will be low due to the attenuation of noise over the large distances involved, and noise is extremely unlikely to result in significant onshore impacts. Therefore, the potential impact of airborne noise resulting from construction, operation and maintenance and decommissioning of the offshore elements of the proposed East Anglia THREE project have been scoped out of the Environmental Impact Assessment (EIA) (see Scoping Opinion, Planning Inspectorate 2012).

5. In addition, due to the large separation distance the potential cumulative and in-combination impacts of the offshore windfarm have also been scoped out of the EIA (see Scoping Opinion, Planning Inspectorate 2012).

6. Further consultation was undertaken on the Preliminary Environmental Information Report (PEIR) in summer 2014 and the section 42 Phase III consultation in summer 2015, there were no noise specific responses from the Phase III consultation.

7. Further consultation was held in 2015 directly with the Environmental Health Officer (EHO) from Mid-Suffolk District Council (MSDC) / Babergh District Council (BDC) with regard to the substation in particular.

8. Consultation undertaken is shown in *Table 26.1.*

Table 26.1 Consultation Responses

Consultee	Date /Document	Comment	Response / where addressed in the ES
Planning Inspectorate	December 2012, Scoping Opinion	Offshore construction and operational impacts could be scoped out for noise and vibration, with the exception of landfall activities and adjacent laying of export cables Onshore construction phase and operational phase impacts require assessment	Section 26.6 Section 26.6
Planning Inspectorate	December 2012, Scoping Opinion	Assessment of noise and vibration levels on the foreshore potentially effecting birds and fish	Chapter 11 Fish and Shellfish Ecology, Chapter 13 Offshore Ornithology and Chapter 24 Onshore Ornithology
Planning Inspectorate	December 2012, Scoping Opinion	Assessment of noise and vibration levels generated by construction traffic on public roads and access routes	Section 26.6
Suffolk County Council (SCC), Mid-Suffolk District Council (MSDC), Suffolk Coastal District Council (SCDC)	8th July 2014, PEIR Response	The local authorities consider that the measures contained in the OCoCP alongside appropriate conditions within the DCO (in the form used for EA ONE) will adequately control construction related noise impacts.	Noted Measures are contained with the OCoCP and conditions within the DCO which adequately control construction related noise impacts.
SCC, MSDC, SCDC	8th July 2014, PEIR Response	With respect to the assessment of HGV traffic noise the methodology adopted is acceptable which includes the use of *Table 26.11* for determining magnitudes of impact.	Noted
SCC, MSDC, SCDC	8th July 2014, PEIR Response	However, the presentation of traffic flow information in Chapter 27 Traffic and Transport is not clear. *Tables 27.12* and *27.13* do allow for cross checking with *Table 26.24* and there appears to be general correlation. However, the accuracy of the traffic noise assessment and HGV impacts is reliant on the traffic assessment being accepted as accurate. This is discussed further below.	The presentation of traffic flow information within Chapter 27 can now be found in *Table 27.12* and *Table 27.13*. According to best practice, traffic flow information for Chapter 27 Traffic and Access is presented as Average Annual Daily Traffic, and the traffic

Consultee	Date /Document	Comment	Response / where addressed in the ES
			flow information within this Chapter is presented as Annual Average Weekday Traffic.
SCC, MSDC, SCDC	8th July 2014, PEIR Response	Vibration caused by HGV traffic is discussed and the importance of maintaining good carriageway condition to ensure that potential is minimised. It is important that the proposal for a programme of mitigation works, as identified in paragraph 54, is carried forward and discussed with the highway engineers.	Noted
SCC, MSDC, SCDC	8th July 2014, PEIR Response	HGVs travelling along relatively narrow minor roads (as described in Scenario 1) would be expected to have a significant noise impact on nearby residents and also give rise to concerns relating to vibration damage. The extent of disturbance would be determined by exact numbers, distribution across the construction period and duration of the construction period which will need to be confirmed and assessed through the noise and vibration assessment.	Noted
SCC, MSDC, SCDC	8th July 2014, PEIR Response	The cumulative effect of EA ONE being followed by THREE and FOUR resulting in a relatively long term period of increased activity, albeit with quieter periods between each phase should be considered.	Noted. The cumulative assessment covers all projects, please refer to Section 26.7
SCC, MSDC, SCDC	8th July 2014, PEIR Response	Paragraph 150 onwards discusses the impact on Papermill Lane dwellings (at the northern end) and identifies a medium impact, due to the low baseline flows on Papermill Lane. Internal noise levels are considered to be acceptable on the basis of standard thermal double glazing and trickle vents being present. It is not clear whether it is assumed that the dwelling(s) would already have this arrangement in place or whether this is to be provided by way of mitigation? The assessment of noise reduction from outside to in is dependent on windows	The assessment has updated values based on the final traffic numbers. However, as Scenario 2 is no longer being considered therefore on this basis traffic increases would not exceed the 25% deemed necessary to trigger a further assessment. It is noted however, that Paper Mill Lane will remain the link likely to

Consultee	Date /Document	Comment	Response / where addressed in the ES
		being kept closed, which is not a realistic expectation.	experience the greatest increases in traffic (>10%). See Section 26.6.1.
MSDC, Babergh District Council (BDC)	7th August 2015	The local authorities confirmed that they were happy with the approach of the PEIR with regard to the assessment of operational noise and cumulative noise. The PEIR assumes that the introduction of a further substation would add 3dB to the predicted noise levels for East Anglia ONE and the introduction of a future substation would add an additional 2dB.	Noted
MSDC, BDC	25th September 2015	The local authorities confirmed they were in agreement with the proposed wording for the Development Consent Order (DCO) requirement, and it gives sufficient protection to any noise sensitive neighbour during the day and night.	Noted

26.3 Scope

26.3.1 Study Area

9. The spatial extent of the study area is determined by the predicted noise levels of the construction activities and operation of the substation(s) at noise sensitive receptors. Noise sensitive receptors are identified based on proximity to noise sources and sensitivity to additional noise. Predicted noise levels are compared to existing noise levels at these receptors. Therefore, a receptor close to the project works within an existing environment of high noise levels may not be as affected as a receptor within an existing environment of low noise levels which is more distant from the project works.

10. Human and heritage receptors are considered within this assessment. While the focus is on residential locations, consideration is also given to effects on leisure, educational and healthcare facilities and commercial premises where appropriate.

26.3.2 Worst Case

11. In considering the onshore noise impacts likely to arise from the construction, operation and decommissioning of the project, a conservative approach is taken to the identification and consideration of each of the impacts likely to arise. The predicted potential noise impacts and their associated worst case design parameters

which can be encompassed within the project's design envelope are presented in *Table 26.3* below and are taken from Chapter 5 Description of Development.

12. There are two approaches for the construction of the proposed East Anglia THREE project:

- Single Phase - a single phase (up to 1200MW installed in a single construction period); or
- Two Phased - two phases of up to 600MW each, with the start date of each phase of works separated by no more than 18 months).

13. Ducts (including all horizontal directional drilling (HDD) operations) for the onshore cables for the proposed East Anglia THREE project will be installed during the construction of East Anglia ONE.

14. Therefore, under the Single Phase approach, for construction of the proposed East Anglia THREE project the following works would be required:

- If the short duct method if used at the landfall, a ramp would be required to access the beach;
- Creation of one transition bay compound near to the landfall location;
- Installation of one transition bay compound to connect the offshore shore export cables and the onshore export cables;
- Installation of up to two jointing bays (assuming up to two cables are jointed in each bay) at up to 62 locations along the cable route;
- Creation of one jointing bay construction compound at up to 62 locations along the onshore cable route, each with a hardstanding area of 775m^2 within a compound of 3,740m^2.
- Construction Consolidation Sites (CCS) – seven sites covering an aggregated area of up to 37.71ha;
- Access via existing roads and tracks and therefore haul road is required only where joints are placed in remote areas. A maximum of 18.05km of 5.5m width haul road is required. Temporary track matting may be required if ground conditions are very poor;
- Transport to site, cable pulling and jointing at up to 124 (each with 2 cables so 248 joints) jointing bays;

- Installation of up to 248 kiosks for cable maintenance; and
- Up to 300m of open trenching for cables from the end of pre-installed ducts to the substation(s);
- One substation within a 3.04ha compound;
- Up to 235m of open trenching for cables from the substation(s) to ducts pre-installed by National Grid; and
- Reinstatement of land.

15. Under a Two Phased approach the following works would be required:

- If the short duct method if used at the landfall, a ramp would be required to access the beach;
- Creation of two transition bay compounds (one during each Phase) near to the landfall location;
- Installation up to two transition bay compounds (one during each Phase) each to house up to two joints between the offshore export cables and the onshore export cables;
- Creation of two jointing bay construction compounds (one during each Phase) at up to 62 locations along the onshore cable route;
- Installation of up to two jointing bays (assuming two cables are jointed in each bay in each in Phase 1 and two jointed in each bay in Phase 2) at up to 62 locations along the cable route, each with a hardstanding area of 775m^2 within a compound of 3400m^2;
- CCS – seven sites covering an aggregated area of up to 37.71ha;
- Access via existing roads and tracks and therefore haul road is required only where joints are placed in remote areas. A maximum of 18.05km (of 5.5m width) haul road is required. Temporary track matting may be required if ground conditions are very poor. As a worst case scenario, it is assumed that all haul road will be removed and the ground reinstated on completion of Phase 1 and will be replaced and then removed again during Phase 2;
- Transport to site, cable pulling and jointing at up to 124 (62 during Phase 1 and 62 during Phase 2) (each with 2 cables so 248 joints) jointing bays;

- Installation of up to 248 kiosks for cable maintenance; and
- Up to 300m of open trenching for cables from the end of pre-installed ducts to the substation(s);
- Up to two substation(s) within a 3.04ha compound;
- Up to 235m of open trenching for cables from the substation(s) to ducts pre-installed by National Grid; and
- Reinstatement of land.

16. Full details of the Single Phase and Two Phased approaches are provided within Chapter 5 Description of the Development.

17. The final routeing of cables connecting into the substation is not known at the current time. Therefore the pre-installed ducts will end just beyond the western boundary of the screening trees and bunding installed by East Anglia ONE to the east of the East Anglia THREE substation. Therefore the final stretch of cables will be open trenched from the end of the ducts to the substation. This will be a maximum distance of 300m. Likewise, National Grid will install ducts to connect into the existing Bramford substation but these will end at the boundary of the National Grid land, therefore EATL will need to open trench up to the end of these ducts, a distance of up to 235m. In both cases the cables would be laid directly into trenches.

18. As discussed in Chapter 5 Description of the Development (section 5.6.6.2.2) East Anglia THREE Limited (EATL) will investigate opportunities to leave haul road in place between projects and/or phases to further minimise impacts, this would be dependent upon the agreement of individual landowners and the approval of the local authorities. EATL consider that for noise and vibration it would be more disruptive for all receptors to install and remove haul road twice under the Two Phased approach due to the increased vehicle movements necessary, disturbance to the ground and associated noise, dust and visual effects, than to leave it in situ. In addition, given that locations where haul road would be left in place is dependent upon individual landowner decisions and local authority approval, at this stage it is not possible to determine where this may occur and which receptors would be affected. Therefore, this potential case is not assessed independently as it is considered that the impacts of leaving the haul road in situ between phases falls within the magnitude of effects assessed under the two construction approaches presented.

Table 26.2 Worst Case Assumptions

Impact	Key design parameters forming worst case scenario	Rationale
Construction Impacts		
Impact 1: Increased noise on residential receptors at landfall during construction	*Single Phase* • Construction of one transition bay compound • Pulling of up to 12 cables through pre-installed ducts • Cable pull through based on East Anglia ONE use of short HDD method will require construction plant to access beach to enable excavation of duct end, cable landing and installation through pre-installed ducts • Likely to require up to 10 weeks working *Two Phased* • Construction of up to two transition bay compounds • Pulling of up to 12 cables (six in each phase) through pre-installed ducts Likely to require two sets of up to 10 weeks working • Cable pull through based on East Anglia ONE use of short HDD method will require construction plant to access beach to enable excavation of duct end, cable landing and installation through pre-installed ducts	A Single Phase and Two Phased approach to construction both assumes East Anglia ONE has been installed with ducts Should the short duct method be applied, a duct exit point trench would be required in the intertidal zone to enable the cables to be installed within the buried duct. To reach the duct and exit point trench a temporary ramp and haul road down to the base of the sea cliffs will be needed. Sensitive receptors which fall within the noise impact buffer zone.
Impact 2: Increased noise on residential receptors along the onshore cable route during construction	*Single Phase* • Pulling of up to 12 cables through pre-installed ducts • Creation of 7 CCS • Likely to require up to 29 weeks working *Two Phased* • Pulling of up to 12 cables (six in each phase) through pre-installed ducts • Creation of 7 CCS • Likely to require 29 weeks construction, 50 week gap, 29	Sensitive receptors which fall within the noise impact buffer zone.

Impact	Key design parameters forming worst case scenario	Rationale
	weeks construction	
Impact 3: Increased noise on residential receptors at substation(s) during construction	*Single Phase* • Up to two substations would be built in one construction period • Potential use of piling to create foundation suitable for heavy equipment. • 55 weeks construction build out - this will consist of up to 43 weeks of construction and mechanical and electrical fitting followed by 12 weeks of testing and commission. *Two Phased* • Up to 2 substations would be built (one substation would be built during each phase) • Potential use of piling to create foundation suitable for heavy equipment. • 123 weeks construction build out - this will consist of 76 weeks of construction and mechanical and electrical fitting split between two periods over a total of 112 weeks. At the end of each construction phase 12 weeks of testing and commission will follow.	Sensitive receptors which fall within the noise impact buffer zone.
Impact 4: increased noise on residential receptors from off-site construction traffic noise	Construction vehicle access routes *Single Phase* • Construction, use and removal of up to 18.05km of temporary haul road to be used during construction • Limited creation of access or track upgrading work • Limited additional vehicles accessing cable pulling sites • Using existing laneway systems • See *Table 26.8* for total vehicle movements *Two Phased* • Construction, use and removal of	Sensitive receptors located adjacent to construction traffic routes

Impact	Key design parameters forming worst case scenario	Rationale
	18.05km of temporary haul road to be used during cable and duct installation, repeated for second phase • Limited creation of access or track upgrading work • Limited additional vehicles accessing cable pulling sites • Using existing laneway systems • See *Table 26.8* for total vehicle movements	
Operational Impacts		
Impact 1: increased noise on residential receptors at the landfall and along the onshore cable route	*Single Phase and Two Phased* Occasional maintenance visits may be required at transition and jointing bay (up to 1 visit per pit per annum)	
Impact 2: increased noise on residential receptors from the substations operating concurrently at 100% capacity	*Single Phase and Two Phased* Operational noise from the concurrent operation of East Anglia ONE and East Anglia THREE substations	Operational noise impact.
Decommissioning Impacts		
Impact 1: Increased noise on residential receptors during decommissioning	*Single Phase and Two Phased* • Impacts arising from decommissioning are anticipated to be at the same or lower level of environmental impact to those of the construction phase	The onshore elements of the proposed East Anglia THREE project will be subject to a decommissioning plan

26.3.3 Embedded Mitigation

19. Embedded mitigation relating to noise and vibration is summarised in *Table 26.2* below. The final details of the construction mitigation would be developed once the exact plant types and locations are confirmed, this will be subject to procurement and contracting. The table first presents general mitigation measures (which would apply to all parts of the onshore electrical transmission works), and mitigation measures which would apply specifically to the landfall, onshore cable route and substation are described separately.

20. The operational noise emissions from the East Anglia THREE substation will be governed by similar Development Consent Order (DCO) requirements and noise

restrictions to those placed on East Anglia ONE. Therefore, EATL will commit to a requirement that noise emissions attributable to the substation shall not result in a noise level which exceeds 5dB above the background noise level ($L_{A90,1hr}$) during the day and 35dB $L_{Aeq\ 15min}$ during the night at Bullenhall Farm, Hill Farm and Woodlands Farm.

21. The Outline Code of Construction Practice (CoCP) for the proposed East Anglia THREE project demonstrates the types of measures that will be proposed by EATL during construction. Embedded mitigation measures consistent with the Outline CoCP relevant to noise and vibration are reproduced in *Table 26.3*.

Table 26.3 Embedded Mitigation

Embedded Mitigation relating to Noise and Vibration	
Parameter	**Mitigation measures embedded into the project design**
General	
Construction	The draft DCO requirement 26 states that no stage of the connection works shall commence until a written scheme for noise and vibration management for that stage has been submitted to and approved by the relevant planning authority. The scheme for noise and vibration management must form part of the Code of Construction Practice (CoCP). Best practice noise mitigation measures, to be implemented and controlled through the Noise and Vibration Management Scheme, will include: • Management of construction operating hours. • Implementation of traffic management measures such as agreed routes for construction traffic. • Use of screens and noise barriers / acoustic screens. • Construction site layout to minimise or avoid reversing with use of banksmen where appropriate. Output noise from reversing alarms set at levels for health and safety compliance. • Use of modern, fit for purpose, well maintained plant and equipment to minimise noise generation. Plant and vehicles will be fitted with mufflers / silencers maintained in good working order. Use of silenced equipment, as far as possible and low impact type compressors and generators fitted with lined and sealed acoustic covers. Doors and covers housing noise emitting plant will be kept closed when machines are in use. • No music or radios to be played on site. • Ensuring engines are switched off when machines are idle. • Regular communication with site neighbours to inform them of the construction schedule, and when noisy activities are likely to occur. Use of pre-construction survey to identify road surface irregularities which require remediation in order to mitigate vibration impacts.
Landfall	
No embedded mitigation further to the general measures listed above.	

Embedded Mitigation relating to Noise and Vibration	
Onshore cable route	
Construction	Buffer zone applied to Construction Consolidation Sites (CCS) such that the boundary of the CCS is not within 100m of the nearest residence.
Substation(s)	
Operation	The operational noise emissions from the proposed East Anglia THREE substation(s) will be governed by a draft DCO noise restriction to 5dB above the background level (LA90,1hr) during the day and 35dB $L_{Aeq\ 15min}$ during the night at Bullenhall Farm, Hill Farm and Woodlands Farm that has been advised for East Anglia ONE. Industry standard noise mitigation schemes (including consideration of design) around the substation compound will be required to ensure that noise emissions from the East Anglia THREE either alone or in combination with East Anglia ONE and a future East Anglia Offshore Wind Limited (EAOW) project do not exceed the levels stated in the draft DCO noise requirement.

26.4 Assessment Methodology

26.4.1 Guidance

22. The assessment of potential impacts upon onshore noise and vibration receptors has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision making documents for Nationally Significant Infrastructure Projects (NSIP). Those relevant to the proposed East Anglia THREE project 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).

23. The specific assessment requirements for noise, as detailed in the NPS, are summarised in *Table 26.4* together with an indication of the section of this chapter where each is addressed. Where any part of the NPS has not been followed within the assessment an explanation as to why the requirement was not deemed relevant, or has been met in another manner, is provided.

24. National Policy Statement for Electricity Networks Infrastructure (EN-5) sets out additional technology-specific considerations on the following generic impacts considered in EN-1:

- Biodiversity and Geological Conservation;
- Landscape and Visual; and
- Noise and Vibration.

Table 26.4 NPS Assessment Requirements

NPS Requirements	NPS Reference
Where noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment: • a description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise; • identification of noise sensitive premises and noise sensitive areas that may be affected; • the characteristics of the existing noise environment; • a prediction of how the noise environment will change with the proposed development; • in the shorter term such as during the construction period; • in the longer term during the operating life of the infrastructure; • at particular times of the day, evening and night as appropriate. • an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas; and • measures to be employed in mitigating noise. The nature and extent of the noise assessment should be proportionate to the likely noise impact.	EN-1 paragraph 5.11.4
The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered.	EN-1 paragraph 5.11.5
The extent to which generic impacts set out in EN-1 are relevant may depend upon the phase of the proposed development being considered. For example, land-based traffic and transport and noise issues may be relevant during the construction and decommissioning periods only, depending upon the specific proposal.	EN-3 paragraph 2.6.4
Generic information on the assessment of noise and vibration impacts, including noise associated with the construction, operation and decommissioning of most energy infrastructure, are covered in detail in Section 5.11 of EN-1. The noise associated with the construction and decommissioning of the proposed infrastructure, including construction traffic, is covered in EN-1.	EN-3 paragraph 2.7.52
Audible noise effects can also arise from substation equipment such as transformers, quadrature boosters and mechanically switched capacitors. Transformers are installed at many substations, and generate low frequency hum. Whether the noise can be heard outside a substation depends on a number of factors, including transformer type and the level of noise attenuation present (either engineered intentionally or provided by other structures). Noise may also arise from discharges on overhead line fittings such as spacers, insulators and clamps.	EN-5 paragraph 2.9.7

25. In addition, the following legislation, standards and guidance have been used and considered in the course of the noise assessment:

- The Control of Pollution Act, 1974 (COPA);

- The Environmental Protection Act, 1990 (EPA);
- Noise Policy Statement for England (NPSE) (Department for Environment, Food and Rural Affairs (DEFRA) 2010);
- National Planning Policy Framework (NPPF) (Department for Communities and Local Government (DCLG, 2012);
- National Planning Practice Guidance (NPPG) (DCLG, 2014);
- British Standard (BS) 7445-2:1991 "Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use" (British Standards Institute (BSI) 1991);
- BS5228-1:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites - Part 1 Noise" (BSI 2014);
- British Standard (BS) 5228-2:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration" (BSI, 2014);
- BS4142:2014 "Method for rating and assessing industrial and commercial sound" (BSI 2014);
- BS8233:2014 "Sound insulation and noise reduction for buildings. Code of practice" (BSI 2014);
- Calculation of Road Traffic Noise (CRTN) (Department of Transport 1988); and
- Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7 "Noise and Vibration" (Highways Agency (HA) 2011).

26. EN-1 states in paragraph 4.1.5 that:

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

26.4.2 Data Sources

27. The following data sources were used to inform the impact assessment (*Table 26.4)*.

Table 26.4 Data Sources Features

Data	Year	Coverage	Confidence	Notes
East Anglia ONE Chapter 26 Noise and Vibration and Appendices	2012	Development boundary	High	Baseline noise survey information. Assessment methodology. Substation noise emission levels.
East Anglia THREE Chapter 27 Traffic and Transport	2015	Development boundary	High	Baseline traffic flows. Construction and operational development traffic flows
BS 5228-1:2009+A1:2014	2014	n/a	High	Assumed construction equipment used for noise calculations

26.4.3 Impact Assessment Methodology

28. For the purpose of the noise and vibration impact assessment the study area is the onshore electrical transmission works (including access), outlined in Chapter 5 Description of the Development plus the following buffers (see section 26.4.4.1 for details of buffers):

- Landfall - 75m;
- Onshore cable route - 80m; and
- Substation – 200m.

29. These study areas are shown on *Figure 26.1 and 26.4*.

26.4.3.1 National Planning Policy Framework

30. The NPPF (published March 2012) has replaced Planning Policy Guidance (PPG) (including PPG 24: Planning and Noise) as the means by which noise is considered within the planning regime. The NPPF does not contain assessment criteria, instead providing a series of policies, giving local authorities the flexibility in meeting the needs of local communities.

31. The use of various British Standard methodologies for noise assessments has been incorporated in this assessment:

26.4.3.2 BS7445: 2003 Description and Measurement of Environmental Noise

32. BS 7445 provides the framework within which environmental noise should be quantified and procedures to be followed. The standard also refers to BS EN 61672, which prescribes the equipment necessary for such measurements.

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

33. Construction noise impacts arising from equipment, vehicular movements and processes related to the construction phase of a development are assessed by calculating the difference between the ambient noise level and the predicted construction noise added to the ambient noise level ($L_{Aeq,T}$). BS 5228 provides a methodology for calculating noise levels from construction plant.

34. The assessment predicts noise emissions from various construction activities, which are then compared against threshold levels (based on background noise levels), at noise sensitive receptors. Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65dB $L_{Aeq\ 12hr}$ during day time, 55dB $L_{Aeq\ 4hr}$ in the evening and weekends and 45dB $L_{Aeq\ 8hr}$ L_{Aeq} at night time from construction noise alone (where daytime is considered to be Monday-Friday 07:00 - 19:00, Saturday 07:00 - 13:00, evening and weekend is considered to be Monday-Friday 19:00 - 23:00, Saturday 13:00 - 23:00, Sunday 07:00 - 23:00 and night-time is considered to be 23:00 - 07:00).

35. Noise generated by construction activities which do not exceed these lower cut off levels (for example 65dB(A) for daytime construction activities) are considered to be of negligible significance.

36. It is important to note that noise levels considered significant under BS5228-1 are viewed in the context of construction noise. As a result these noise levels are considered to be temporary, intermittent and of comparatively short duration within the construction phase of the proposed East Anglia THREE project.

37. As the impact is anticipated to be temporary and intermittent during the construction phase these significance levels are higher than those proposed for long term, continuous noise resulting from the operation of industrial processes (Industrial noise assessment: BS4142:2014 “Method for rating and assessing

industrial and commercial sound" (BSI 2014) and World Health Organisation (WHO) Night Noise Guidelines for Europe).

38. The method within BS 5228-1 has been used to assess noise from construction works associated with landfall transition bays, onshore cable pulling CCS and the substation(s).

26.4.3.4 CRTN & DMRB

39. The CRTN produced by the Department of Transport / Welsh Office provides a method for the prediction of noise from road traffic. The Highways Agency DMRB, Volume 11, Section 3, Part 7 HD 213/11 Noise and Vibration, provides guidance on the assessment of noise impacts from roads and contains guidance for assessing the likely impact of noise generated by road traffic. The criteria for short term effects are presented in *Table 26.*5 and are reproduced from Table 3.1 of DMRB.

Table 26.5 DMRB criteria for determining magnitude of impact in the short-term

Increase in traffic noise level (dB $L_{A10,18h}$)	Impact magnitude
0.0dB	No Change
0.1 – 0.9dB	Negligible
1.0 – 2.9dB	Minor
3.0 – 4.9dB	Moderate
>= 5.0dB	Major

40. The DMRB criteria have been used in the assessment of changes to traffic noise as a result of proposed construction HGV traffic.

26.4.3.5 Operational industrial noise assessment: BS 4142:2014 Method for rating and assessing industrial and commercial Sound and World Health Organisation (WHO) Night Noise Guidelines for Europe (NNG).

41. Noise from plant is typically assessed in the context of BS 4142, which involves a comparison of the rating level and the measured background (L_{A90}) noise level at potential receptor locations.

42. BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises

used for residential purposes upon which sound is incident, and combines procedures for assessing the impact in relation to:

- The development of new industrial and/or commercial sources affecting existing receptors; and
- Planning for new private and commercial residential development being brought near existing industrial or commercial sources.

43. The standard is a major update on previous editions incorporating a rigorous assessment of uncertainty in environmental noise measurements and introducing the concepts of "significant adverse impact" rather than likelihood of complaints. Common principles with the previous edition are the consideration of the characteristics of the sound under investigation, time of day and frequency of occurrence.

44. The standard applies to industrial/commercial and background noise levels outside residential buildings and for assessing whether existing and new industrial/commercial noise sources are likely to give rise to significant adverse impacts on the occupants living in the vicinity.

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

46. BS 4142 refers to the following;

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

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

The lower the rating level relative to the measured background sound level the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact"

47. In the context of this assessment BS 4142 provides a methodological framework for considering the impact of the operational phase noise impacts of the project, focussed on the operation of the substation(s).

48. When assessing the noise from a source, which is classified as the Rated Noise Level, it is necessary to have regard to the acoustic features that may be present in the noise. Section 9.1 of BS 4142 states:

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

49. The methods for assessing whether an acoustic feature is present are:

- Subjective method;
- Objective method for tonality; and
- Reference method.

For all methods a rating penalty for tones of up to 6 dB can be added, while for impulsive noise a correction of up to 9 dB can be applied. The perception of audibility at the monitoring location determines the value of the penalty to be applied.

50. For the objective and reference methods sections 9.3.2 and 9.3.3 and Annexes C and D of the standard should be referred to.

51. Noise from electricity infrastructure can contain tonal components (the "mains hum"). As such, a 6dB rating penalty has been applied to predicted noise levels from the substation(s) when assessed to BS4142.

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

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

53. Noise from externally mounted plant is relatively simple to mitigate through the design measures, such as: equipment selection, location of equipment, installation of attenuators or enclosure of equipment.

54. The previous version of BS 4142 (1997) suggests that the standard is not suitable for use in situations where both the industrial rating noise level and the background noise are very low (below about 35 and 30dB(A) respectively). Where this occurs, the World Health Organisation NNG can be used, e.g. for the protection of residential receptors where both the background noise level and predicted industrial noise level are considered very low.

55. The WHO report provides guidelines and recommendations for health protection. For the primary prevention of subclinical adverse health effects related to night noise in the population, it is recommended that the population should not be exposed to night noise levels greater than $L_{night,outside}$ = 40dB during the part of the night when most people are in bed. However, as BS4142 would be considered appropriate should plant rating noise levels at residential receptors be greater than 35dB(A) (including a tonal penalty) the actual limit for plant noise would be 35dB(A). The level of 35dB(A) is therefore used within this chapter as the threshold designating a high magnitude of effect when assessing operational noise from the substation and its effect on the noise environment of a key receptor during the night.

56. During the daytime a threshold of 5dB above background ($L_{A90,1hr}$) has been used to designate a high magnitude of effect when assessing operational noise from the substation and its effect on the noise environment of a key receptor.

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

57. BS5228-2 provides guidance on the control of vibration from construction sites and response limits for cosmetic damage in buildings and provides limits at which the vibration level (measured as a peak particle velocity) would result in cosmetic damage at a range of vibration frequency levels.

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

59. BS 5228-2 also presents levels of vibration that may cause complaint, which is predicted to occur between 0.3 mm/s (just perceptible) and 1.0 mm/s (likely to cause complaint).

26.4.4 Prediction Methods

26.4.4.1 On-site construction noise

60. The assessment of construction noise is predicted utilising a methodology provided by BS5228, and is based on the project description (outlined in Chapter 5 Description of the Development). The plant required for construction would be determined by the contractor selected post-consent and therefore assumed plant has been used in

predictions, based on an estimation of noise levels provided by the equipment supplier.

61. Noise level data have been taken from Annex C and D of BS 5228-1: 2009+A1:2014. All sound pressure levels are given at a distance of 10m from the measured plant. Operational time refers to the percentage the equipment is on in an hour when it is deployed on site within working hours and an on time of 75% is assumed, based on professional judgement and experience of this type of project.

Table 26.6 Assumed construction equipment and noise emissions used for noise calculations (BS 5228-1:2009+A1:2014)

Activity	Assumed construction equipment	Noise emissions (dB(A) at 10m from source)
Transition Bay (Landfall)	Telehandler	78
	30T Excavator	75
	Loader	67
	Tractor & Trailer	79
Jointing bays	Generator	62
	Telehandler	78
	30T Excavator	75
	Loader	67
	Tractor & Trailer	79
CCS / Haul Road	Loader	67
	D8 Dozer	86
	Grader	86
	Road Roller	80
	9T Dumper	77
	10T Excavator	75
	Tractor & Trailer	79
	Bowser	79
	Sweeper	76
Substation	30T Excavator	75
	Dozer	86
	9T Dumper	77
	Backactor Excavator	75

Activity	Assumed construction equipment	Noise emissions (dB(A) at 10m from source)
	Road Roller	80
	Telehandler	78
	Mobile Crane	78
	Static Crane	78
	3T Dumper	77
	Scissor Lift	67
	Concrete Pump	78
	Hydraulic Hammer Piling	89

62. It is assumed that the majority of construction works would be restricted to daytime working hours. The exceptions to this are limited activities at the substation including concrete pours.

63. As an initial screening exercise, the distance from construction works at which the construction noise daytime lower impact threshold of 65dB $L_{Aeq\ 12hr}$ would be exceeded was calculated. This 'buffer' distance, within which the construction noise limit is likely to be exceeded, is shown for the different construction activities in *Table 26.7*. The use of the 65dB $L_{Aeq\ 12hr}$ construction noise limit is discussed further in the context of the baseline noise survey results in section 26.5.1 below.

Table 26.7 Construction buffer distances for low magnitude impact

Construction works	Noise buffer distance (m)
Landfall – transition bay construction and cable pull	75
Onshore cable route - jointing bay construction and cable pull	80
Substation construction	200

64. A distance propagation calculation was performed on each of the sound power levels listed in *Table 26.6* to establish the point at which the 65dB $L_{Aeq\ 12hr}$ impact level would be achieved for the different construction phases. Using a geographic information system (GIS) it was then possible to determine any areas where residential properties would be exposed to construction noise levels greater than the 65dB $L_{Aeq\ 12hr}$ impact threshold level. As the 65dB $L_{Aeq\ 12hr}$ threshold represents the change from negligible to low magnitude effect for normal daytime working, it follows that any receptors outside the buffer areas will experience a negligible effect, as per BS 5228:2009 + A1:2014.

26.4.4.2 Off-site construction traffic noise

65. Off-site construction related traffic impacts were assessed by calculating the relative increase in road traffic flow on road links used by construction traffic.

66. Following the methodology contained in DMRB (Volume 11, Section 3, Chapter 3) an initial screening assessment was undertaken to assess whether there were any significant changes in traffic volumes as a result of the development. Any road links with a predicted increase in traffic volume of 25%, or a decrease of 20%, were identified in the initial part of the assessment. Such changes in traffic volume would correspond to a 1dB(A) change in noise level over an 18 hour period on the relevant road link. A change in noise level of less than 1dB(A) is regarded as imperceptible and therefore negligible with regard to impact significance. If there is no increase greater than 25% or a decrease of 20% or greater, then the guidance indicates that no further assessment needs to be conducted (Highways Agency 2011).

67. Where road links are predicted to have an increase of greater than 25% or a decrease of 20%, a noise level calculation should be undertaken following the procedure outlined in CRTN.

68. *Table 26.8* presents the 18-hour Annual Average Weekday Traffic (AAWT) data for the roads used during the construction programme; data were sourced from Chapter 27 Traffic and Transport and utilising the same road classification.

Table 26.8 AAWT traffic data used for the construction traffic noise assessment (see Chapter 27 Traffic and Transport)

Road Link ID number & name		2020 Baseline flows AAWT		2020 Baseline + Single Phase		2020 Baseline + Two Phased		2023 Baseline + Two Phased	
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs
1	A14 between the J51 and J52	55833	7512	56064	7728	56046	7715	59041	8117
2	A14 between the J52 and J53	61996	8273	62485	8629	62423	8610	65748	9052
3	A1156 south from J53	22140	797	22286	879	22268	879	23455	922
4	A14 between the J53 and J55	58538	7442	58963	7773	58915	7754	62054	8152
5	A12 south from J55	54517	6157	55064	6589	55006	6562	57930	6891
6	Paper Mill Lane	2640	127	3007	436	2977	415	3117	420
7	B1113	5561	764	5877	970	5821	956	6117	995
9	A14 between the J55 and J56	67249	9100	67744	9517	67693	9487	71301	9975
10	A14 between the J56 and J58	54189	8130	54684	8547	54633	8518	57540	8954
11	A14 south from J58	35439	6648	35625	6771	35602	6766	37503	7123
12	Trimley Road	4280	103	4344	157	4340	157	4570	162

Road Link ID number & name		2020 Baseline flows AAWT		2020 Baseline + Single Phase		2020 Baseline + Two Phased		2023 Baseline + Two Phased	
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs
13	Newbourne Road / Ipswich Road	2850	260	2926	326	2906	310	3059	324
14	A12 between J58 and Top Street	48778	2110	49408	2573	49329	2535	51946	2648
15	Top Street / Main Road	8893	252	9609	682	9512	652	9990	666
16	A12 between Top Street and the A1152	41390	1751	41661	1905	41663	1931	43884	2025
17	A12 north from the A1152	22091	1105	22175	1105	22156	1105	23341	1164
18	B1078 west from the A12	2782	131	2788	131	2786	131	2936	138
19	B1079 from the A12 to Grundisburgh	8076	279	8213	389	8236	415	8670	430
20	Ipswich Road south from Grundisburgh	8076	279	8158	353	8157	353	8590	368
21	B1077 between the B1078 and A1156	4998	171	5113	253	5108	253	5376	262
22	A1214 west from the	21093	840	21218	840	21186	840	22319	885

Road Link ID number & name		2020 Baseline flows AAWT		2020 Baseline + Single Phase		2020 Baseline + Two Phased		2023 Baseline + Two Phased	
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs
	A12								
23	B1078 between the A140 and B1077	3831	181	3853	181	3847	181	4053	191
24	A140 north-east of J51	20045	2024	20067	2024	20061	2024	21137	2133
25	A14 north of J51	48412	7384	48649	7594	48628	7581	51225	7976
26	A1152	9547	561	9597	605	9596	605	10109	635
27	B1083 south from the A1152 to south of Shottisham	2417	110	2467	154	2466	154	2596	160
28	B1438	13283	350	13366	394	13356	394	14069	413
29	B1083 south from Shottisham	1370	60	1420	104	1419	104	1493	107
30	School Lane and Waldringfield Road	2414	81	2535	193	2491	153	2621	157

26.4.4.3 Construction related vibration

69. Ground borne vibration can result from construction works and may lead to perceptible levels of vibration within nearby properties, which can at higher levels cause annoyance to residents. In extreme cases, cosmetic or structural building damage can occur, however vibration levels have to be very high and such cases are rare.

70. High vibration levels generally arise from 'heavy' construction works such as percussive piling, deep excavation, or dynamic ground compaction. In comparison, construction of the cable route, landfall and substation(s) will generate relatively low levels of vibration. The use of piling, to create foundations for heavy equipment and buildings, during the construction of the substation(s) has not been discounted; however there is a large separation distance (c.530m) present between the construction works and nearest receptor at Woodlands Farm.

71. There is generally a large separation distance between construction works and residential properties at most project locations, with only a small number of properties within 100m of the works. Where properties are located within this distance, the specific receptor distances are deemed large enough to protect receptors from construction related ground borne vibration. It is considered that given the separation distances that ground borne vibration could not be expected to adversely affect receptors. As a result ground borne vibration from construction activities has been scoped out of any further assessment in this ES.

72. Should any discontinuities (e.g. potholes) exist on the roads adjacent to residential receptors or any listed buildings it is considered that there is the potential for vibration levels to exceed the minimum peak particle velocity (PPV) as specified in BS5288-2. However, the road conditions prior to construction are an unknown and therefore the impact from construction vibration is uncertain.

73. A programme of works to develop mitigation in the form of either temporary or permanent fills could be applied where cracks or potholes are identified that could result in vibration peaks. This programme of works would be developed in discussion with local authority highways engineers.

26.4.4.4 Operational noise from the substation(s)

Single Phase and Two Phased

74. Under a Single Phase approach to construction, the East Anglia THREE cable connection will feed into a separate and dedicated substation compound, comprising

up to two substations, located alongside the pre-existing East Anglia ONE converter station.

75. Under a Two Phased approach to construction one substation would be constructed during each phase.

76. The capacity of the substations under a Single Phase or Two Phased approach would be identical (up to 1200MW) and equivalent to the capacity of the East Anglia ONE substation.

77. The proposed East Anglia THREE substation(s) are to be, in total, of similar size, structure and configuration to the converter station for East Anglia ONE, therefore the assumptions used in both assessments are the same. Acoustic theory would dictate that the introduction of the proposed East Anglia THREE substation(s) (producing the same noise emission sources) would represent a doubling of sound energy and thus provide a 3dB increase in the predicted receptor levels. It is considered appropriate to use the converter station modelling results obtained in the East Anglia ONE ES as an accurate representation of the noise impact associated with the proposed East Anglia THREE project and increase the predicted rated receptor levels by 3dB.

78. The noise from the East Anglia ONE converter station / substation(s) has been predicted by modelling the noise sources using CadnaA noise modelling software. CadnaA incorporates prediction methodology within ISO 9613: 1993 Acoustics - Attenuation of sound during propagation outdoors. The CadnaA software package is a commercially available package which implements many national and international acoustic calculation standards, including those typically used within the UK.

79. A three-dimensional model of the proposed surrounding area was constructed, based on topographical data, ordnance survey mapping and indicative layout plans of the converter station / substation(s). Typical noise emission data for the items of electrical equipment and their typical locations was obtained from a potential supplier.

80. The following points should be taken into account regarding the noise model:

- All noise emitting equipment was modelled as a point source, at a height of 3m above ground. This is considered to provide a worst case conservative approach to larger, higher structures and sound sources;
- All converter station / substation(s) equipment was assumed to be operating concurrently, including all cooling/air handling units;

- The ground surrounding each converter station / substation(s) was assumed to be 'soft' (i.e. grassland), which is representative of the actual ground conditions, whereas within the substation(s) the ground was assumed to include hard and acoustically reflective surfaces, such as concrete;
- Acoustic propagation effects were calculated using the ISO 9613 method;
- Free field noise levels were calculated at first floor height for each receptor, as the results were slightly higher than at ground floor level; and
- A +5dB 'acoustic feature' penalty, as defined in BS 4142:1997, was added to the noise level calculated at each receptor. This was to account for the tonal nature of noise from the converter station / substation(s), and represented a conservative approach.

81. The 5dB 'acoustic feature' penalty detailed above was derived from BS 4142:1997. Updates to BS 4142 in 2014 changed this penalty to a maximum of 6dB. The 6dB penalty has therefore been used within this assessment when calculating noise levels due to the substations/converter stations.

82. The noise levels were calculated at the closest noise sensitive receptors to the converter station / substation(s) sites.

83. Operational vibration from the converter stations / substation(s)

84. Ground borne vibration may potentially arise from the operation of electrical converter station / substation(s) and associated plant. There is a very large separation distance between the converter station / substation(s) site and residential properties. Where properties are located outside of the 100m buffer zone, the distances are deemed large enough to protect receptors from operational related ground borne vibration. It is considered that given the separation distances of over 100m that ground borne vibration could not be expected to adversely affect receptors. As a result ground borne vibration from the operation of the converter station / substation(s) has been scoped out of any further assessment in this ES.

26.4.4.5 Decommissioning phase impacts

85. The decommissioning activities with the potential to have an impact on noise and vibration would be similar to those occurring during the construction phase assuming the infrastructure is removed. As such, the potential noise and vibration impacts associated with the decommissioning phase were assessed qualitatively with reference to the potential impacts associated with the construction phase (albeit likely to be of lower magnitude of effect).

26.4.5 Sensitivity

86. To identify the significance of any potential noise and vibration impacts the sensitivity of each receptor was considered based on the criteria provided within *Table 26.9*.

Table 26.9 Definition of terms relating to the sensitivity of generic receptors

Sensitivity	Definition
High	Hospitals (e.g. operating theatres or high dependency units), care homes at night
Medium	Residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities, national parks, during the day; and temporary holiday accommodation at all times
Low	Offices, shops, outdoor amenity areas, long distance footpaths, doctors surgeries, sports facilities and places of worship
Negligible	Warehouses, light industry, car parks, agricultural land

26.4.6 Magnitude

26.4.6.1 Impact magnitude – on-site construction noise

87. The construction noise criteria presented in *Table 26.10* are based on the guidance contained within BS5228. Annex E of BS5228 proposes 65dB $L_{Aeq\ 12hr}$ as a potential daytime construction noise limit, where the existing ambient (L_{Aeq}) noise level is itself below 65dB $L_{Aeq\ 12hr}$. As the majority of locations surveyed within the cable corridor had average daytime L_{Aeq} values below 65dB $L_{Aeq\ 12hr}$, this 'limit' was considered an appropriate value to use in this assessment as the threshold level for a negligible magnitude effect. Subsequent impact magnitude thresholds are based on the methodology provided in BS4142, which states that an exceedance of background noise levels by 5dBA is likely to indicate an adverse impact (Medium) and an exceedance of 10dBA is likely to indicate a significant adverse impact (High).

88. The use of the 65dB $L_{Aeq\ 12hr}$ as a threshold level is further supported by the working hours for construction activities predicted for East Anglia THREE daytime works falling within daytime hours. The exceptions to this would be some limited activities during construction at the substation.

Table 26.10 Construction noise impact magnitude criteria

Construction noise level at receptor (dB $L_{Aeq,12h}$)	Impact magnitude
<64dB	Negligible
65 – 69dB	Low
70 – 74dB	Medium
> 75dB	High

26.4.6.2 Impact magnitude – construction related traffic noise

89. *Table 26.11* shows noise impact criteria for the assessment of changes in road traffic noise due to the addition of project related construction traffic. This table has been derived from Table 3.1 of DMRB.

90. It is important to note that the magnitude of construction noise impacts are derived from changes to the baseline level rather than the trigger or threshold level approach used with respect to onsite construction noise impacts on receptors. This approach affords better protection from noise impacts of the development for receptors in relatively quiet existing environments

Table 26.11 Changes in construction traffic noise - impact magnitude criteria

Increase in traffic noise level (dB $L_{Aeq,12h}$)	Impact magnitude
0.0dB	No Change
0.1 – 0.9dB	Negligible
1.0 – 2.9dB	Minor
3.0 – 4.9dB	Moderate
>= 5.0dB	Major

26.4.6.3 Impact magnitude – substation(s) operational noise

91. It is proposed that the East Anglia THREE cable connection will feed into a separate substation(s), located alongside the East Anglia ONE converter station. It is considered appropriate to use the converter station modelling results obtained in the East Anglia ONE ES as an accurate representation of the noise impact associated with East Anglia THREE and increase the original predicted rated receptor levels by 3dB.

92. The Predictive noise model and calculations are provided as *Appendix 26.1.*

93. A high impact magnitude is experienced, during the daytime, when predicted noise levels exceed 5dB above the background noise level ($L_{A90,1hr}$) including tonal penalty.

94. A negligible impact magnitude is experience, during the daytime, when predicted noise levels are less than 5dB above the background noise level ($L_{A90,1hr}$) including tonal penalty.

95. A high impact magnitude is experienced, during the night, when predicted noise levels exceed 35dB ($L_{Aeq,15min}$) including tonal penalty.

96. A negligible impact magnitude is experience, during the night, when predicted noise levels are less than 35dB ($L_{Aeq,15min}$) including tonal penalty

97. BS 4142 states that an exceedance of background noise levels by 5dBA is indicative of an adverse impact, depending on the context and an exceedance of 10dBA is indicative of a significant adverse impact, depending on the context. Due to the tonality of substation(s) noise a 6dBA correction penalty was applied to all predicted rating levels at receptor locations.

98. To identify the significance of any potential noise and vibration impacts the sensitivity of each receptor was considered based on the criteria provided within *Table 26.9.*

99. The definition of the magnitude levels for a receptor is given in *Table 26.12*.

Table 26.12 Definitions of the magnitude levels for a receptor

Magnitude	Definition
High	During the day predicted noise levels exceed 5dB above the background ($L_{A90,1hr}$) including tonal penalty. During the night, predicted noise levels exceed 35dB ($L_{Aeq,15min}$).
Medium	n/a
Low	n/a
Negligible	During the day predicted noise levels are less than 5dB above the background ($L_{A90,1hr}$) including tonal penalty. During the night, predicted noise levels are below 35dB ($L_{Aeq,15min}$).

100. Note that unlike other chapters of this ES, this assessment considers the magnitudes to be binary (as detailed within the section 26.2.5 of the East Anglia ONE assessment) in relation to the threshold exceeded. Therefore, although an exceedance of over 35dB ($L_{Aeq,15min}$) may not be high enough to be detected above background noise levels, for the purposes of this assessment this results in a high magnitude.

26.4.7 Impact significance

101. The combination of receptor sensitivity and impact magnitude was used to derive the overall impact criteria, as shown in *Table 26.13*.

Table 26.13 Impact Significance Matrix

Sensitivity	Magnitude				
	High	Medium	Low	Negligible	No change
High	Major	Major	Moderate	Minor	No impact
Medium	Major	Moderate	Minor	Negligible	No impact
Low	Moderate	Minor	Minor	Negligible	No impact
Negligible	Minor	Negligible	Negligible	Negligible	No impact

102. The impact significance categories are defined as shown in *Table 26.14*.

Table 26.14 Impact Significance Definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No impact	No impact, therefore no change in receptor condition.

103. Potential impacts identified as major and moderate impacts are deemed to be significant in terms of the EIA and have been avoided or reduced through mitigation, where possible. Minor impacts become more important when considering potential, cumulative impacts or interactions.

104. Embedded mitigation and existing commitments to good practice are discussed in section 26.3.3, and are referred to throughout the impact assessment. The impact assessment takes into account the embedded mitigation before coming to a conclusion of the potential impact to a receptor. If any additional mitigation is required, this is included within the impact assessment in section 26.6, and a description of any residual impact post-mitigation is provided.

26.4.8 Cumulative Impact Assessment

105. For a general introduction to the methodology used for the Cumulative Impact Assessment, please refer to Chapter 6 Environmental Impact Assessment Methodology.

106. This assessment assumes that East Anglia ONE, the proposed East Anglia THREE project and a future project would be constructed consecutively. As a result there is not anticipated to be a situation where cumulative construction noise impacts between East Anglia Offshore Windfarm projects would arise. Potential would remain for cumulative impacts to arise as a result of other un-related major infrastructure construction works that may be undertaken during the same time period as the proposed East Anglia THREE project.

107. Separate converter stations / substations, all assumed to contain identical noise emission sources would be constructed for East Anglia ONE, the proposed East Anglia THREE project and a future project. Acoustic theory would dictate that the introduction of a second and then potential future third substation would represent a potential 5dB increase in the predicted receptor levels, if all three substations were operating concurrently at 100% capacity.

108. It is deemed appropriate to use the converter station modelling results obtained in the East Anglia ONE ES as an accurate representation of the noise impact associated with the proposed East Anglia THREE project, and future projects, and increase the original predicted rated receptor levels by a worst case 5dB for the three stations operating concurrently.

26.4.9 Transboundary Impact Assessment

109. The proposed development is not located close to any international boundaries and there will be no transboundary effects in relation to noise and vibration.

26.5 Existing Environment

26.5.1 Noise Survey

110. As the East Anglia THREE cable connection will feed directly into substation(s) adjacent to the East Anglia ONE converter station and the onshore cable route and landfall will be identical, it is deemed appropriate to use the baseline data obtained in support of the East Anglia ONE ES. The noise assessment for East Anglia ONE is summarised below and included in *Appendix 26.1*.

111. Attended measurements were conducted at three residential receptors surrounding the proposed substation(s) location during the day of the 29th September 2011 and early morning on the 30th September 2011. The closest residential receptors

identified are isolated houses separated from the site by agricultural land. The three receptors chosen for noise monitoring, and agreed with the local Environmental Health Department, (the nearest three properties) were:

- CS2 – Hill Farm House;
- CS6 – Bullenhall Farm (also R9); and
- CS7 – Burstall Hall.

112. Further measurements were taken on 29th to the 31st May 2012 at locations representing residential receptors nearest to CCSs along the onshore cable route (*Table 26.15*).

113. The weather during all survey dates was considered suitable for noise measurements (see *Appendix 26.1*).

114. *Figure 26.2* shows the location of the receptors in relation to the onshore cable route and converter station / substation(s).

26.5.2 Environmental Baseline

26.5.2.1 Onshore Cable Route

115. The onshore cable route largely runs through rural areas. *Table 26.15* presents a description of the noise environment associated with each receptor location. Identification numbers are associated with CCS numbers above. *Figure 26.3* shows the onshore cable route with monitoring locations. Due to the geographical extent of the route, receptors are not individually specified for individual approaches to construction in the impact section of this chapter.

Table 26.15 Onshore Cable Route Noise Measurement Locations

Location	Address	Daytime Notes	Night Time Notes
R1	Premier Inn	Dominated by traffic noise on the A14, occasional train to the west, birds in the trees	Dominated by HGV noise on A14
R2	Top Street	Traffic on local road, birds, larger vehicles and sirens on A12	Birds, aircraft and very distant engine noise from Martlesham creek
R3	Broom Hill park	Birds and pedestrians, some boats on Martlesham Creek and occasional passing vehicles – early finish due to lawn mower, train line operational but not observed during measurement	Engine or Generator on creek, distant vehicle noise from A12

Location	Address	Daytime Notes	Night Time Notes
R4	Church Car park	Small amounts of local traffic, distant A12, train passing to north, birds and breeze in trees.	Distant hum of traffic and water cannon in field (also distant)
R5	Crossing At Red House Farm	Field close by being ploughed by loud farm machinery– no measurements taken (see R11 for representative location)	
R6	Little Bealings, village hall car park	Passing vehicles and birds in trees, occasional aircraft overhead	Very quiet, dripping of recent rain, high level aircraft
R7	Pine Lodge, Westerfield Road, south of golf course	Vehicle noise on Westerfeld Road, some bird noise	
R8	Sycamore House, Somersham Road	Distant A14, traffic on Somersham road, some bird noise	
R9	Same location as measurement CS3 undertaken for converter station / substation(s) below.		
R10	Bramford Road	Traffic on Bramford Road, nearby animals at egg shop	Traffic on Bramford Road, A14, owls
R11	Kirton Lodge / Sluice Farm (also used as R5)	Moved away from farm noise but some distant tractor activity audible. Little local traffic, A14 audible (HGV) to west. Ended early due to tractor in local field	
R12	Ferry lane close to MOD site	Local traffic, birds and insects, stopped early due to increasing wind	Visited on two nights, high wind both times, assume similar to R13 as very quiet location far from A14/A12
R13	North of Newbourne, at rear of golf course	Birds, distant farm noise, no traffic, voices from golf course	Very distant generator, no audible road noise, sprinkler on golf course

116. Full details of measured noise levels can be found in Appendix 26.1. In summary, with the exception of receptors R7 and R8, the existing L_{Aeq} day noise levels at the measurement locations are below the 65dB(A) minimum limit for construction noise assessed in accordance with BS5228. The threshold level for construction noise is therefore 65dB(A) during the day, except at R7 (threshold level of 66dB(A)) and R8 (threshold level of 68dB(A)).

26.5.2.2 Substation Compound

117. The substation compound is situated in a quiet, rural area and as such there are few dominant noise sources. During daytime hours, increased traffic levels on the nearby A14 and A1071 make a significant contribution to the ambient and background noise levels. Peak noise levels are generally as a result of individual vehicles passing close to a receptor location, farm vehicles in the fields or noise from animals such as dogs or geese. Whilst it was possible to see the active National Grid Bramford substation from the monitoring positions, including vehicle movements from ongoing construction works, no on-site activity was audible during the measurement times.

118. At night, the existing Bramford substation is a noise feature in the area, although it is less so during the daytime. Other noise sources include high altitude aircraft, wind in the trees and birds.

119. *Figure 26.2* shows the substation, with the receptors and monitoring locations highlighted. The following is a description of the receptors and monitoring locations chosen.

Location MP1 – Bullenhall Farm, NGR TM102 466

120. The daytime monitoring was undertaken on the grassed area immediately to the front of Bullenhall Farm house. The existing substation was not audible at the location, which is in a hollow with no line of sight to the substation. The area was quiet with the dominant noise being from wind in the nearby trees. There was a very distant hum audible from traffic noise. Other noise events that occurred during the monitoring period included: geese (64dB(A)); residents talking; phone ringing; vehicle movements; and high level aircraft (41-45dB(A))

121. Night-time monitoring was conducted on the access lane to the property at the entrance to the yard, approximately 70m from the façade of the property. This location was used at the request and advice of the resident due to the potential for disturbance to them, their dogs and the numerous geese that would create noise if woken. Noise levels at this location were representative of noise levels at the property. During the monitoring period, the noise was dominated by the hum from the substation. A crackle noise from the nearby pylons was also audible and owls “hooted” at regular intervals. Patches of mist were noted on the fields around the monitoring position.

Location MP2 – Hill Farm House NGR: TM 090 465

122. The daytime monitoring was undertaken at the access point to a field adjacent to the dwelling. The noise levels in the area are dominated by a mixture of: traffic, audible on distant roads and passing the monitoring location; movement of trees; and aircraft. Although visible, no noise was audible from the substation, approximately 750m to the east of the monitoring location. Passing vehicles generated the highest noise levels.

123. Night-time monitoring was conducted in the same location as in the daytime. No traffic passed the monitoring location and only a hum from the substation was audible.

Location MP3 – Burstall Hall, NGR: TM 102 450

124. Receptor CS3 is on a public footpath at the southeast corner of Burstall Long Wood. This is to the east of Burstall Hall, the desired receptor location, to which access was not available at the time of the survey as this is on private land.

125. The noise level at the location is dominated by the sound of distant traffic to the south. The wind in the trees was also a contributing factor. During the last ten minutes of the survey a crop duster began passing the site spraying fertiliser on a field. As such the survey was terminated early.

126. The night survey was conducted at a location on a nearby public road for security reasons. No traffic passed the monitoring location, however traffic on other nearby roads was noted to be the primary noise source in the area. The noise level at this night-time location is considered representative of that at the residence, and no noise from the existing substation was audible.

127. Measurement results are presented in and *in Appendix 26.1* of this Chapter.

128. The background noise levels around the proposed substation location during the night are between 20 and 30dB(A), which would be considered ‘very low’ in accordance with BS4142.

129. The monitoring undertaken at three locations around the East Anglia ONE converter station location, during both the day and the night, has encompassed a worst case scenario for the background noise level in the likely area of the converter station / substation(s) location. As low background noise levels have been measured, further monitoring of noise levels in the area are unlikely to determine a background noise level at any receptor that would change the noise limits recommended by this assessment.

26.6 Potential Impacts

130. The following assessments focus on the impact of predicted noise on residential receptors as these are considered to be the determining receptor when considering impact significance. Residences are generally the nearest type of receptor to the proposed construction works. Commercial and leisure facilities are of a lower sensitivity and therefore where these are closer than residences to aspects of the construction, the impact significance would be less.

131. Along the onshore cable route there are locations where users of Public Rights of Way (PRoW) could be affected by noise from construction works but this would be temporary as the user passes the works; please refer to Chapter 22 Land Use for amenity impacts upon PRoW.

132. Reference should be made to Chapter 5 Description of the Development, for full details of the activities proposed during the construction phase. However, in summary, the activities considered to have the potential to generate a noise and vibration impact are:

- Construction of onshore cable systems including landfall joint transition bay and cable jointing pits and pull-through of cables;
- Construction of onshore substation(s), associated infrastructure and landscaping; and
- Operational onshore substation(s).

133. The two different construction approaches (as outlined in section 22.3 and Chapter 5 Description of the Development) are considered separately, or grouped where there is considered to be no difference in impact between the different approaches.

26.6.1 Potential Impacts During Construction

26.6.1.1 Impact 1: Increased noise on residential receptors at landfall

Single Phase and Two Phased

134. It is assumed that East Anglia ONE project has been constructed. Consequently the ducts required for East Anglia THREE are pre-installed. As a result the works on site will require access to the beach to assist in pulling the cable through the pre-installed duct to make landfall at the transition pits.

135. As a worst-case scenario, it has been assumed that at the landfall location construction plant equipment will be required during normal daylight working hours

for duration of up to 10 weeks. *Table 26.16* presents the predicted noise level at the nearest residential receptor including embedded mitigation, as outlined in *Table 26.2*.

Table 26.16 Landfall Transition Bay Noise

Transition Bay Location	Nearest receptor to Transition Bay	Approximate Distance to Transition Bay	Predicted Receptor Noise level	Impact Magnitude
Bawdsey Landfall	Ferry Road residences	320m	43dB(A)	Negligible

136. The results show that predicted noise levels from construction works at the landfall location would be of negligible magnitude on receptors of medium sensitivity and therefore impacts would be of **negligible** significance.

26.6.1.2 Impact 2: Increased noise on residential receptors during onshore cable works

Single Phase

137. As part of East Anglia ONE, ducts will have been installed for use by the proposed East Anglia THREE project. As a result the approach to cable installation is comparatively light with respect to the use of noise generating equipment and activities on site. Pre-determined locations jointing bays will be constructed and the cable pulled through from the preceding jointing bay. Joints in the cable will be made at the jointing bays to enable easy access and servicing.

138. The need to build construction access roads is minimised through making optimal use of existing farm access tracks. In this way bulk material movement is minimised. Light construction plant can be used to construct junction pits and to pull the cable through.

139. A construction noise screening exercise was undertaken using a 65dB(A) impact buffer. An overview of the 65dB(A) construction noise buffer is shown in *Figure 26.3*.

140. The predicted noise level at each of the selected receptors, incorporating embedded mitigation, is presented in *Table 26.19*.

Table 26.19 Construction noise levels calculated at specific identified receptors

Receptor ID	Property	Noise from cable installation dB $L_{Aeq\ 11hr}$	Impact magnitude	Impact Significance
NSR1	Low Farm	62	Negligible	**Negligible**
NSR2	Dukes Hill	59	Negligible	**Negligible**

Receptor ID	Property	Noise from cable installation dB $L_{Aeq\ 11hr}$	Impact magnitude	Impact Significance
NSR3	Cherry Tree Farm	61	Negligible	**Negligible**
NSR4	Glebe Farm	61	Negligible	**Negligible**
NSR5	The Common	62	Negligible	**Negligible**
NSR6	Copenhagen Cottage	62	Negligible	**Negligible**
NSR7	Bullenhall Farm	56	Negligible	**Negligible**

141. *Table 26.19* shows that **negligible** impacts are predicted at all receptors close to the cable route.

142. It is not considered that other on site or off-site mitigation is required due to the relatively short duration of the works.

143. CCSs and haul roads will be established close to the landfall, along the cable route and for the substations. The CCSs will generally be used for storage of materials, equipment and plant, the haul road will be used for access to the jointing bays. The selected CCS locations and haul roads are not in the immediate vicinity of residential properties. As such, it is considered that they will not result in any significant construction noise affecting receptors and will therefore have a **negligible** effect.

144. No stage of the construction works will commence until a CoCP has been submitted to and agreed by the local authority, the CoCP will contain a written scheme for noise and vibration management during construction.

Two Phased

145. It is considered that the impacts during a Two Phased approach will replicate the impacts of the single phase approach over the two periods of construction. The slight reduction in the amount of excavated material for the junction pits is not anticipated to significantly reduce impacts.

26.6.1.3 Impact 3: Increased noise on residential receptors during substation(s) construction

Single Phase and Two Phased

146. One substation would be built under the Single Phase approach and two substations would be built (one during each phase) under the Two Phased approach, feeding into the National Grid at the nearby Bramford national grid substation.

147. The construction of the substation(s) may involve the use of driven piles to provide suitable foundations for heavy transmission plant and the buildings required to enclose most elements of the substation(s).

148. There are no properties within the construction noise impact buffer around the substation(s), as outlined in *Table 26.7* and shown on *Figure 26.4*. Therefore on-site construction works associated with the construction of the substation(s) under either the Single Phase or Two Phased approach to construction are predicted to result in an effect of negligible magnitude and therefore a **negligible** impact.

26.6.1.4 Impact 4: increased noise on residential receptors from off-site construction traffic noise

Single Phase

149. *Table 26.20* shows the calculated increase in traffic flow on the road links identified by the transport assessment as carrying construction traffic (see Chapter 27 Traffic and Transport).

Table 26.20 Construction traffic impacts – Single Phase

Link ID and Description		2020 Baseline flows AAWT		2020 Baseline + Single Phase		Overall Increase
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	
1	A14 between the J51 and J52	55833	7512	56064	7728	0.5%
2	A14 between the J52 and J53	61996	8273	62485	8629	0.9%
3	A1156 south from J53	22140	797	22286	879	0.7%
4	A14 between the J53 and J55	58538	7442	58963	7773	0.8%
5	A12 south from J55	54517	6157	55064	6589	1.1%
6	Paper Mill Lane	2640	127	3007	436	15.3%
7	B1113	5561	764	5877	970	6.2%
9	A14 between the J55 and J56	67249	9100	67744	9517	0.8%
10	A14 between the J56 and J58	54189	8130	54684	8547	1.0%
11	A14 south from J58	35439	6648	35625	6771	0.6%
12	Trimley Road	4280	103	4344	157	1.6%
13	Newbourne Road / Ipswich Road	2850	260	2926	326	2.9%
14	A12 between J58 and Top Street	48778	2110	49408	2573	1.4%
15	Top Street / Main Road	8893	252	9609	682	8.8%
16	A12 between Top Street and the A1152	41390	1751	41661	1905	0.7%
17	A12 north from the A1152	22091	1105	22175	1105	0.4%
18	B1078 west from the A12	2782	131	2788	131	0.2%
19	B1079 from the A12 to Grundisburgh	8076	279	8213	389	1.9%
20	Ipswich Road south from Grundisburgh	8076	279	8158	353	1.1%

Link ID and Description		2020 Baseline flows AAWT		2020 Baseline + Single Phase		Overall Increase
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	
21	B1077 between the B1078 and A1156	4998	171	5113	253	2.5%
22	A1214 west from the A12	21093	840	21218	840	0.7%
23	B1078 between the A140 and B1077	3831	181	3853	181	0.6%
24	A140 north-east of J51	20045	2024	20067	2024	0.1%
25	A14 north of J51	48412	7384	48649	7594	0.5%
26	A1152	9547	561	9597	605	0.6%
27	B1083 south from the A1152 to south of Shottisham	2417	110	2467	154	2.3%
28	B1438	13283	350	13366	394	0.7%
29	B1083 south from Shottisham	1370	60	1420	104	4.0%
30	School Lane and Waldringfield Road	2414	81	2535	193	5.5%

150. *Table 26.20* indicates no road links are likely to experience an increase in traffic flows greater than 25%; therefore no further assessment is considered necessary.

151. Notwithstanding the screening assessment for traffic noise, it was considered prudent to examine the traffic flow data further and undertake calculations of the Basic Noise Level (BNL) of roads experiencing a change in HGV flows of greater than 25%.

152. *Table 26.21* shows the calculated BNL for those links under the Baseline scenario and under a Single Phase approach.

Table 26.21 Calculated BNL – Single Phase

Link ID and Description		2020 Baseline BNL dB $L_{10,18hr}$	2020 Baseline + Single Phase BNL, dB, $L_{10,18hr}$	Overall Increase	Impact Magnitude
6	Paper Mill Lane	62.4	64.9	2.5	Minor
12	Trimley Road	62.7	63.2	0.5	Negligible
15	Top Street / Main Road	65.5	67.2	1.7	Minor
19	B1079 from the A12 to Grundisburgh	66.7	67.1	0.4	Negligible
21	B1077 between the B1078 and A1156	63.4	64.0	0.6	Negligible
27	B1083 south from the A1152 to south of Shottisham	61.0	61.5	0.5	Negligible
29	B1083 south from Shottisham	57.0	58.2	1.2	Minor
30	School Lane and Waldringfield Road	59.9	61.4	1.5	Minor

153. *Table 26.21* shows that predicted impacts are of **negligible** to **minor** magnitude and therefore of negligible to minor significance.

Two Phased

154. *Table 26.22* shows the calculated increase in traffic flow on the road links identified by the transport assessment as carrying construction traffic (see Chapter 27 Traffic and Transport).

Table 26.22 Construction traffic impacts – Two Phased

Link ID and Description		2020 Baseline flows AAWT		2020 Baseline + Two Phased		Overall Increase	2023 Baseline + Two Phased		Overall Increase
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs		Total Vehicles	Total HGVs	
1	A14 between the J51 and J52	55833	7512	56046	7715	0.5%	59041	8117	5.7%
2	A14 between the J52 and J53	61996	8273	62423	8610	0.9%	65748	9052	6.1%
3	A1156 south from J53	22140	797	22268	879	0.7%	23455	922	5.9%
4	A14 between the J53 and J55	58538	7442	58915	7754	0.8%	62054	8152	6.0%
5	A12 south from J55	54517	6157	55006	6562	1.1%	57930	6891	6.3%
6	Paper Mill Lane	2640	127	2977	415	15.3%	3117	420	18.1%
7	B1113	5561	764	5821	956	6.2%	6117	995	10.0%
9	A14 between the J55 and J56	67249	9100	67693	9487	0.8%	71301	9975	6.0%
10	A14 between the J56 and J58	54189	8130	54633	8518	1.0%	57540	8954	6.2%
11	A14 south from J58	35439	6648	35602	6766	0.6%	37503	7123	5.8%
12	Trimley Road	4280	103	4340	157	1.6%	4570	162	6.8%
13	Newbourne Road / Ipswich Road	2850	260	2906	310	2.9%	3059	324	7.3%
14	A12 between J58 and Top Street	48778	2110	49329	2535	1.4%	51946	2648	6.5%
15	Top Street / Main Road	8893	252	9512	652	8.8%	9990	666	12.3%
16	A12 between Top Street and the A1152	41390	1751	41663	1931	0.7%	43884	2025	6.0%
17	A12 north from the A1152	22091	1105	22156	1105	0.4%	23341	1164	5.7%
18	B1078 west from the A12	2782	131	2786	131	0.2%	2936	138	5.5%
19	B1079 from the A12 to Grundisburgh	8076	279	8236	415	1.9%	8670	430	7.4%

Link ID and Description		2020 Baseline flows AAWT		2020 Baseline + Two Phased		Overall Increase	2023 Baseline + Two Phased		Overall Increase
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs		Total Vehicles	Total HGVs	
20	Ipswich Road south from Grundisburgh	8076	279	8157	353	1.1%	8590	368	6.4%
21	B1077 between the B1078 and A1156	4998	171	5108	253	2.5%	5376	262	7.6%
22	A1214 west from the A12	21093	840	21186	840	0.7%	22319	885	5.8%
23	B1078 between the A140 and B1077	3831	181	3847	181	0.6%	4053	191	5.8%
24	A140 north-east of J51	20045	2024	20061	2024	0.1%	21137	2133	5.4%
25	A14 north of J51	48412	7384	48628	7581	0.5%	51225	7976	5.8%
26	A1152	9547	561	9596	605	0.6%	10109	635	5.9%
27	B1083 south from the A1152 to south of Shottisham	2417	110	2466	154	2.3%	2596	160	7.4%
28	B1438	13283	350	13356	394	0.7%	14069	413	5.9%
29	B1083 south from Shottisham	1370	60	1419	104	4.0%	1493	107	8.9%
30	School Lane and Waldringfield Road	2414	81	2491	153	5.5%	2621	157	8.6%

155. *Table 26.22* indicates no road links are likely to experience an increase in traffic flows greater than 25%; therefore no further assessment is considered necessary.

156. Again, notwithstanding the screening assessment for traffic noise, it was considered prudent to examine the traffic flow data further and undertake calculations of the Basic Noise Level (BNL) of roads experiencing a change in HGV flows of greater than 25%.

157. *Table 26.23* shows the calculated BNL for those links under the Baseline scenario and under a Two Phased approach.

Table 26.23 Calculated Basic Noise Level (BNL) – Two Phased

Link ID and Description		2020 Baseline BNL dB $L_{10,18hr}$	2020 Baseline + Two Phased BNL, dB, $L_{10,18hr}$	2023 Baseline + Two Phased BNL, dB, $L_{10,18hr}$	Maximum Overall Increase	Impact Magnitude
6	Paper Mill Lane	62.4	64.9	64.9	2.5	Minor
12	Trimley Road	62.7	63.2	63.4	0.7	Negligible
15	Top Street / Main Road	65.5	67.2	67.2	1.7	Minor
19	B1079 from the A12 to Grundisburgh	66.7	67.1	67.4	0.7	Negligible
21	B1077 between the B1078 and A1156	63.4	64.0	64.2	0.8	Negligible
27	B1083 south from the A1152 to south of Shottisham	61.0	61.5	61.8	0.8	Negligible
29	B1083 south from Shottisham	57.0	58.2	58.4	1.4	Minor
30	School Lane and Waldringfield Road	59.9	61.4	61.1	1.5	Minor

158. *Table 26.23* shows that predicted impacts are of negligible to minor magnitude and therefore of **negligible** to **minor** significance.

26.6.2 Potential Impacts During Operation

26.6.2.1 Impact 1: increased noise on residential receptors at the landfall

159. There would be **no** operational noise effects from the landfall location of the onshore cable route.

26.6.2.2 Impact 2: increased noise on residential receptors along the onshore cable route

160. There would be small amounts of traffic associated with occasional maintenance of the cable (undertaken at the jointing bays). The noise increase as a result of this traffic and as a result of maintenance works on the cable would be of negligible magnitude on receptors of medium sensitivity and therefore of **negligible** significance

26.6.2.3 Impact 3: increased noise on residential receptors from the substation(s)

161. For both Single Phase and Two Phased approach, the impacts of the predicted noise levels from the substation(s) at surrounding residential receptors (medium sensitivity) are presented in *Table 26.24*. The impacts are defined by comparison with impact criteria within section 26.4.6.3.

162. The proposed East Anglia THREE project will commit to a requirement limiting operational noise from the substation(s) to no greater than 5dB above the background noise level ($L_{A90,1hr}$) during the daytime and 35dB $L_{Aeq,\ 15\ min}$ during the night at Bullenhall Farm, Hill Farm and Woodlands Farm. The effect of this requirement will be such that noise emissions from the proposed East Anglia THREE project will not exceed the prescribed limit at any of the identified receptors.

163. *Table 26.24* shows the maximum operational noise impact (i.e. during the night).

Table 26.24 Predicted substation(s) operational noise impact (worst case concurrent operation with East Anglia ONE)

Location	Name	Receptor Sensitivity	Predicted Noise Level	With Tonal Penalty	Impact magnitude	Impact Significance Without Mitigation
CS1	Canes Farm	Medium	29	35	Negligible	**Negligible**
CS2	Hill Farm	Medium	30	36	High	**Major adverse**
CS3	Black Cottage	Medium	25	31	Negligible	**Negligible**

Location	Name	Receptor Sensitivity	Predicted Noise Level	With Tonal Penalty	Impact magnitude	Impact Significance Without Mitigation
CS4	Woodlands Farm	Medium	30	36	High	**Major adverse**
CS5	Willow Cottage	Medium	28	34	Negligible	**Negligible**
CS6	Bullenhall Farm	Medium	30	36	High	**Major adverse**
CS7	Burstall Hall	Medium	27	33	Negligible	**Negligible**
CS8	Walnut Tree Farm	Medium	26	32	Negligible	**Negligible**

164. The results show that noise levels would be of negligible to high magnitude on receptors of medium sensitivity during the night and therefore of **negligible** to **major** significance.

165. Without mitigation the predicted noise level of the substations operating concurrently will potentially give rise to an exceedance of the 35dB $L_{Aeq\ 15min}$ night time noise limit at, Bullenhall Farm, Hill Farm and Woodlands Farm. The proposed East Anglia THREE project will commit to a requirement not to exceed 35dB $L_{Aeq\ 15min}$ during the night time at Canes Farm, Bullenhall Farm, Hill Farm, Willow Cottage and Woodlands Farm. Detailed mitigation for each project will be set out in an operational Noise and Vibration Management Scheme to be agreed with the Local Authorities. Measures likely to be considered as part of these schemes will involve:

- Selection of quieter equipment;
- Installation of acoustic enclosures;
- Installation of acoustic barriers (fire walls may be required around the substation transformers, which may provide some acoustic benefit);
- Screening of substations further by the construction of a landform / embankment around the site (see Chapter 29 Seascape, Landscape and Visual Amenity for more details), which will protect against flooding and may also provide up to 10dB attenuation;
- Silencing of exhausts/outlets for air handling/cooling units; and

- Locating equipment to take advantage of screening inherent in the design, i.e. from the substation hall(s) or control room buildings.

166. Given the hard commitment to a comprehensive mitigation programme to reduce night time noise below the 35db threshold, the residual impacts following mitigation are predicted to be **negligible** at all locations.

26.6.3 Potential Impacts During Decommissioning

167. This section describes the potential impacts of the decommissioning of the onshore electrical transmission works with regards to impacts on noise and vibration. The decommissioning of the project would be as required by the requirements in the Development Consent Order. The approach provided below provides a high level likely approach which could be taken. Further details are provided in Chapter 5 Description of the Development.

26.6.3.1 Landfall and Onshore Cable Route

168. The onshore cables the proposed East Anglia THREE would be decommissioned (de-energised) and the cables left in-situ. Jointing and transition bays will also be left in-situ. Therefore there would be **no impacts** at the landfall or along the onshore cable route.

26.6.3.2 Substation

169. In relation to the substation(s) the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology will be determined later within the project lifetime, but are expected to include:

- Dismantling and removal of electrical equipment;
- Removal of building services equipment;
- Demolition of the buildings and removal of fences; and
- Landscaping and reinstatement of the site.

170. Noise impacts associated with the decommissioning of both the cable route and substation(s) will be similar to those identified for the construction of both elements.

171. Decommissioning would be undertaken in line with legislation, policy and best-practice guidance current at the time.

26.7 Cumulative Impacts

172. This section describes the cumulative impact assessment for noise, taking into consideration other plans, projects and activities.

173. In its simplest form, the cumulative impact assessment strategy involves consideration of whether impacts on a receptor can occur on a cumulative basis between East Anglia ONE, the proposed East Anglia THREE project and future projects and other activities, projects and plans for which sufficient information regarding location and scale exist.

174. As each project will be constructed at different times and are not anticipated to be constructed concurrently there is no opportunity for cumulative construction impacts to occur between the East Anglia ONE, East Anglia THREE or future projects.

Table 26.25 Potential cumulative impacts

Impact	Potential for cumulative impact	Data confidence	Rationale
Construction - Single Phase approach	No	Medium	Projects have distinct and separated timetables
Construction - Two Phased approach	No	Medium	Projects have distinct and separated timetables
Operation	Yes	High	Operational noise impact of East Anglia ONE, the proposed East Anglia THREE project and future substations operating concurrently.
Decommissioning	No	High	Assume East Anglia ONE, the proposed East Anglia THREE project and future projects are decommissioned at different times

Table 26.26 Summary of Projects considered for the CIA in Relation to noise and vibration

Project	Status	Construction / operation period	Approx. Distance from Direct Impacts Study Area (km)	Project definition	Project data status	Included in CIA	Rationale
East Anglia ONE	Consented	2018 –2019 / 25 years	0	Offshore Windfarm Project Project description available	Complete/high	Yes	Construction would not overlap. Operational and decommissioning impacts only
Future EAOW project	Pre-application	Unknown	0	Offshore Windfarm Project Outline project data only	Incomplete/low	Yes	Construction would not overlap but consecutive disturbance possible. Operational and decommissioning impacts only
Sizewell C	Pre-application	Unknown	24.7	Nuclear Power Station No project detail available	Low	No	No spatial overlap with onshore electrical transmission works, overlap of socio-economic impacts – same labour market, economic area etc, also traffic on Woodbridge bypass
Bramford-Twinstead	Pre-application	Unknown	0	Outline only	Complete/high	No	May adjoin converter station location
SITA (EfW plant)	Operational	Unknown	0.5	Energy From Waste Plant Project description available	Complete/high	No	Would be operational before construction commences. No spatial

Project	Status	Construction / operation period	Approx. Distance from Direct Impacts Study Area (km)	Project definition	Project data status	Included in CIA	Rationale
							overlap with onshore electrical transmission works
SnOasis	Planning permission granted	Unknown	0.7	Winter sport centre. Master plans available	Incomplete/low	No	No spatial overlap traffic flows will be on same routes
Old Fisons site (land west of Paper Mill Lane)	Planning Application TBD	Unknown	0.7	Business park and housing scheme. Master plans available	Complete/high	No	No spatial overlap traffic flows will be on same routes
Adastral park	Planning permission granted	Unknown	0.8	Business park and housing scheme. Master plans available	Complete/high	No	No spatial overlap [traffic flows will be on same routes]
Ipswich Garden Suburb	Identified in adopted Core Strategy	Primarily after 2020	3	Urban development north of Ipswich. Master Plan at consultation phase.	Incomplete / medium	No	Greenfield site. No overlap with landfall, onshore cable route or converter station location. Due to distance recreational pressure will focus on Orwell Estuary and not Deben Estuary. [traffic flows will be on same routes]
Progress Power,	Planning permission	Construction 2017-18, operation by 2019.	28	Gas fired power station	Complete/ high	No	No overlap with landfall, onshore cable route or

Project	Status	Construction / operation period	Approx. Distance from Direct Impacts Study Area (km)	Project definition	Project data status	Included in CIA	Rationale
Eye, Suffolk	granted			development			substation(s) location. Likely to be constructed prior to East Anglia THREE commencement
Land North Of Woods Lane, Melton, Suffolk	Conditionally Allowed	Unknown	2.7	Outline planning for a residential development for 180 dwellings (8.27ha in size) to include open space and provision of ecological habitat areas.	High	No	No overlap with landfall, onshore cable route or substation(s) location.

26.7.1.1 Cumulative substation operation

175. The impacts of the predicted noise levels from East Anglia ONE, the proposed East Anglia THREE project and future project converter stations / substations at surrounding residential receptors (medium sensitivity) are presented in *Table 26.27*. The impacts are defined by comparison with impact criteria within section 26.4.6.3.

176. The operational noise emissions from the proposed East Anglia THREE project substation and any subsequent substation(s), will be governed by a similar draft DCO noise requirement to that advised for East Anglia ONE. It is anticipated that the noise of the operational substation (including transformers, air handling units and cooling fans) will result in an increase in noise in the environment which will not exceed 35dB $L_{Aeq,\ 15\ min}$ at Bullenhall Farm, Hill Farm and Woodlands Farm.

177. Separate substations, all assumed to contain identical noise emission sources, would be constructed for each project. Acoustic theory would dictate that the introduction of a second and then a subsequent third identical substation would represent a potential 5dB increase in the predicted receptor levels, if all three substations were operating concurrently at 100% capacity. It is deemed appropriate to use the substation modelling results obtained in the East Anglia ONE ES as an accurate representation of the noise impact associated with the proposed East Anglia THREE project, and the future EAOW project, and increase the original predicted rated receptor levels by a worst case 5dB for the three stations operating concurrently.

178. *Table 26.27* shows the maximum operational noise impact (i.e. during the night):

Table 26.27 Predicted substation operational noise impact (concurrent operation of the first and subsequent East Anglia Projects)

Location	Name	Receptor Sensitivity	Predicted Noise Level	With Tonal Penalty	Impact magnitude	Impact Significance Without Mitigation
CS1	Canes Farm	Medium	31	37	High	**Major adverse**
CS2	Hill Farm*	Medium	32	38	High	**Major adverse**
CS3	Black Cottage	Medium	27	33	Negligible	**Negligible**
CS4	Woodlands Farm*	Medium	32	38	High	**Major adverse**
CS5	Willow Cottage	Medium	30	36	High	**Major adverse**

Location	Name	Receptor Sensitivity	Predicted Noise Level	With Tonal Penalty	Impact magnitude	Impact Significance Without Mitigation
CS6	Bullenhall Farm*	Medium	32	38	High	**Major adverse**
CS7	Burstall Hall	Medium	29	35	Negligible	**Negligible**
CS8	Walnut Tree Farm	Medium	29	35	Negligible	**Negligible**

*Subject to the draft 35dB $L_{Aeq, 5min}$ noise condition for East Anglia ONE

179. The results show that noise levels would range from a negligible to high magnitude on receptors of medium sensitivity and therefore of **negligible** to **major** significance during the night.

180. Without mitigation the predicted noise level of all three substations operating concurrently will potentially give rise to an exceedance of the 35dB $L_{Aeq\ 15min}$ at Canes Farm, Bullenhall Farm, Hill Farm, Willow Cottage, Burstall Hall and Woodlands Farm. The proposed East Anglia THREE project will commit to a requirement not to exceed 35dB $L_{Aeq\ 15min}$ at Bullenhall Farm, Hill Farm and Woodlands Farm during the night. Detailed mitigation will be set out in an operational Noise and Vibration Management Scheme to be agreed with the Local Authorities and suggestions are outlined earlier in this section. This would also include any discussions around future EAOW projects. Residual impacts following mitigation are predicted to be **negligible** at all locations.

26.8 Inter-relationships

181. In order to address the environmental impact of the proposed development as a whole, this section summarises the inter-relationships between noise receptors and other physical, environmental and human receptors (*Table 26.28*). The objective is to identify where the accumulation of effects on a single receptor, and the relationship between those effects, may give rise to more significant impact than those effects in isolation which may, in turn, result in a need for additional mitigation.

Table 26.28 Inter-relationships relevant to the assessment of noise impacts

Inter-relationship	Section where addressed	Linked Chapter
Influence of construction traffic on local amenity	Section 26.5, 26.6, 26.7	**Chapter 27 Traffic and Transport**

26.9 Summary

182. A comprehensive and robust impact assessment of the noise impacts likely to arise from the construction, operation, decommissioning of the proposed East Anglia THREE project have been undertaken. These are summarised in *Table 26.29* below. The data and primary analysis makes use of the work undertaken by the proposed East Anglia ONE project. A cumulative impact assessment has been presented which looks at up to three East Anglia Offshore Windfarm projects being developed and considers the impact of the concurrent operation of their onshore project components. In particular three identical substations.

183. Some potentially significant impacts have been identified arising from unmitigated construction works in some locations. However following the implementation of standard mitigation measures these levels can be reduced to a non-significant level.

184. The enduring noise impact from the operation of the project is the noise emissions from the substation(s). The substation(s) is located away from houses and buildings and the operational noise is not considered to be of significant impact. The following predicted impacts for noise and vibration have been identified.

Table 26.29 Potential Impacts Identified for Noise and Vibration

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction						
Impact 1: Increased noise on residential receptors at landfall during construction (Single Phased and Two Phased)	Ferry Road residences	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
Impact 2: Increased noise on residential receptors along proposed cable route during construction (Single Phase and Two Phased)	Low Farm	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
	Dukes Hill	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
	Cherry Tree Farm	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
	Glebe Farm	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
	The Common	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
	Copenhagen Cottage	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
	Bullenhall Farm	Medium	Negligible	Negligible	Embedded mitigation	Negligible Not significant
Impact 3: Increased noise on residential receptors at						

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
substation(s) during construction (Single Phase and Two Phased)	No impact predicted					
Impact 4: increased noise on residential receptors from off-site construction traffic noise (Single Phase and Two Phased)	Negligible to Minor impact predicted					
Operational Impacts						
Impact 1: increased noise on residential receptors at the landfall and along the onshore cable route	No impact predicted					
Impact 2: increased noise on residential receptors from the substation operating concurrently at 100% capacity Impacts	Canes Farm	Medium	Negligible	Negligible	Not required	Negligible Not significant
	Hill Farm	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Black Cottage	Medium	Negligible	Negligible	Not required	Negligible Not significant
	Woodlands Farm	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Willow Cottage	Medium	Negligible	Negligible	Not required	Negligible

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
						Not significant
	Bullenhall Farm	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Burstall Hall	Medium	Negligible	Negligible	Not required	Negligible Not significant
	Walnut Tree Farm	Medium	Negligible	Negligible	Not required	Negligible Not significant
Decommissioning						
	As per the construction phase					

185. No cumulative construction impacts are considered likely as the construction of the first and subsequent projects will take place separately. Consequently the cumulative impacts have been identified for the operational phase resulting from the noise emissions from up to three substations located close together. None of the cumulative impacts identified during the operational phase of the project (*Table 26.30*) are considered to be significant.

Table 26.30 Potential Cumulative Impacts Identified

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Concurrent Substation Operational Noise (East Anglia ONE, the proposed East Anglia THREE project and future project)	Canes Farm	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Hill Farm	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Black Cottage	Medium	Negligible	Negligible	Not required	Negligible Not significant
	Woodlands Farm	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Willow Cottage	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Bullenhall Farm	Medium	High	Major adverse	Outlined in Section 26.6.2	Negligible Not significant
	Burstall Hall Farm	Medium	Negligible	Negligible	Not required	Negligible Not significant
	Walnut Tree Farm	Medium	Negligible	Negligible	Not required	Negligible Not significant

26.10 References

British Standards Institution (1997) BS 4142:1997 – Method for rating industrial noise affecting mixed residential and industrial areas.

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The Highways Agency (2011) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7: Noise and Vibration.

Vattenfall and Scottish Power Renewables (2012) East Anglia ONE Offshore Wind Farm Environmental Statement.

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Chapter 26 Ends Here