Tillbridge Solar

Tillbridge Solar Project

EN010142

Volume 6
Environmental Statement
Chapter 13: Noise and Vibration
Document Reference: EN010142/APP/6.1

Regulation 5(2)(a)
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

April 2024
Revision Number: 00

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13. Noise and Vibration

13.1 Introduction

13.1.1 This chapter presents the findings of an assessment of the likely significant effects on noise and vibration as a result of the Tillbridge Solar Project (hereafter referred to as 'the Scheme'). For more details about the Scheme, refer to **Chapter 3: Scheme Description** of this Environmental Statement (ES) **[EN010142/APP/6.1]**.

13.1.2 This chapter assesses noise and vibration effects on human receptors and does not include the assessment of noise and vibration on ecological or heritage receptors. Where relevant, the impacts of noise and vibration on heritage receptors would be assessed in **Chapter 8: Cultural Heritage** of this ES **[EN010142/APP/6.1]**, and the impacts of noise and vibration on ecological receptors would be assessed in **Chapter 9: Ecology and Nature Conservation** of this ES **[EN010142/APP/6.1]**.

13.1.3 This chapter is supported by the following appendices of this ES **[EN010142/APP/6.2]**:

a. **Appendix 13-1: Legislation and Planning Policy**;

b. **Appendix 13-2: Acoustics Terminology**;

c. **Appendix 13-3: Baseline Noise Survey**; and

d. **Appendix 13-4: Noise Modelling**.

13.1.4 This chapter is supported by the following figure of this ES **[EN010142/APP/6.3]**:

a. **Figure 13-1: Noise Sensitive Receptors and Noise Monitoring Locations**.

b. **Figure 13-2: Operational Noise Contours**.

13.2 Legislation and Planning Policy

13.2.1 **Appendix 13-1** of this ES **[EN010142/APP/6.2]** identifies legislation, policy, and guidance of relevance to the assessment of likely significant noise and vibration effects of the Scheme.

13.3 Assessment Assumptions and Limitations

Baseline Assumptions and Limitations

13.3.1 It is currently anticipated that (subject to the necessary consents being granted) construction work will commence no earlier than late 2025 and is anticipated to last for a minimum of 24 months. It is anticipated that the earliest that commercial operations will commence is 2028. The operational life of the Scheme is to be 60 years.

13.3.2 While some temporary changes in baseline noise levels between the time of the baseline monitoring and the anticipated construction period may occur in some localities due to temporary noise sources such as construction works,

no developments are understood to be proposed that may influence noise levels in the operational noise Study Area (defined in paragraph 13.4.3) that would lead to a major additional and ongoing noise source which would notably alter the local baseline noise environment prior to 2028 (e.g. highway or railway schemes, major industrial facilities). Additionally, it is assumed that existing noise sources (i.e. road traffic and farm activities) are not expected to increase by a level that would affect baseline noise conditions. As such, baseline noise monitoring undertaken in July 2022 is considered to be representative of the future baseline scenario in 2028 when the Scheme is operational.

13.3.3 Any measurement of existing ambient or background sound levels will be subject to a degree of uncertainty. Environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, as well as meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a sample of the ambient levels. Every effort has been made such that measurements were undertaken in such a way as to provide a representative sample of conditions, such as avoiding periods of adverse weather conditions, and school holiday periods (which are often considered to result in atypical sound levels). However, a small degree of uncertainty will always remain in the values taken from a survey. A precautionary approach is adopted when analysing such data to provide a robust assessment.

Construction and Decommissioning Assumptions and Limitations

13.3.4 The assessment of construction and decommissioning noise (and vibration) has considered construction and decommissioning activities that have the potential to result in significant effects on identified receptors, based on information presented in **Chapter 3: Scheme Description** of this ES **[EN010142/APP/6.1]**, previous experience of similar schemes and professional judgement. These assessments are based on a reasonable representative worst-case scenario.

13.3.5 Construction and decommissioning noise predictions have been undertaken using the computer modelling software SoundPLAN ® (version 8.2) (Ref 1-3), based on expected plant items that are typically used in solar developments for the purposes of carrying out a quantitative assessment at this stage. Construction and decommissioning plant assumed in this assessment are summarised in **Appendix 13-4: Noise Modelling** of this ES **[EN010142/APP/6.2]**.

13.3.6 Predictions have been undertaken using BS 5228:2014+A1:2019 ‘Code of practice for noise and vibration control on construction and open sites’ (Ref 1-4) methodologies and AECOM library data of sound sources associated with the proposed construction and decommissioning activities. These sound sources are taken to be representative of the plant and/or activities that will be used during the construction and decommissioning process of the Scheme. Noise predictions were carried out to represent a conservative scenario where construction and decommissioning plant is operational nearest to the identified receptors and does not take into account quieter periods when limited activities take place or at further distances.

Consequently, noise predictions may overestimate construction and decommissioning noise levels and are therefore considered to be a reasonable likely worst case.

13.3.7 As part of the installation of solar panels, frame mounts are likely to be required to be installed into the ground through a form of piling. Additionally, piling is likely to be required for the Battery Energy Storage System (BESS) and Solar Station foundations. As a piling method has not yet been finalised, it is assumed as a reasonable worst-case that an auger piling method will be adopted, which is a typical approach in similar developments.

13.3.8 As described in **Chapter 3: Scheme Description** of the ES **[EN010142/APP/6.1]**, trenchless crossings will either consist of Horizontal Directional Drilling or Thrust Bore techniques. For the assessment of construction noise, it is assumed that trenchless crossing may require continuous into the night-time period, which is the most sensitive period in terms of noise impacts. Continuous trenchless crossing techniques that are likely to extend into the night-time period will be required to cross the former Cottam Power Station railway line, the River Trent and the East Midlands Railway.

13.3.9 Noise effects during the decommissioning phase of the Scheme is anticipated to be similar or less than noise effects during the construction phase. The decommissioning works would likely be shorter duration and less intensive, with fewer noisy activities (for example without the need for piling) than in the construction phase. The noise assessment is therefore presented jointly for the construction and decommissioning phases, with construction predictions and activities considered representative (or an overestimate) of the decommissioning phase. It is assumed, conservatively, that the significance of effects during decommissioning will be the same as for construction.

Operational Assumptions and Limitations

13.3.10 A series of assumptions were made for the generation of the operational noise model (see **Appendix 13-4: Noise Modelling** of this ES **[EN010142/APP/6.2]**), as follows:

a. Digital noise modelling of the Scheme once it is operational has been based on the parameters set out in **Figure 3-1: Indicative Principal Site Layout Plan** of this ES **[EN010142/APP/6.3]**;

b. Sound level data for operational noise-producing plant have been based on industry sound pressure level measurement data (see **Appendix 13-4: Noise Modelling** of this ES **[EN010142/APP/6.2]**);

c. The degree to which surrounding land uses are able to attenuate noise through ground absorption has been modelled based on recommended absorption coefficients from OS Mapping land use categories, and have been assumed to be largely soft (G=0.8) in all areas not defined;

d. Air temperature was assumed to be 10 degrees and humidity 80%, which are typical annual average weather conditions for Lincolnshire;

e. Three orders of reflection were modelled, i.e. the model calculations include contributions due to sound waves that have been reflected up to three times (e.g. due to objects);

f. Variation in ground heights (i.e. topography) has been incorporated into the noise modelling; and

g. All receptor points have been set at a standard height of 1.5m above local ground levels (representative of ground floor windows) for daytime noise and 4m above ground (representative of first floor windows) for night-time noise, as is standard industry practice.

13.3.11 Operational noise has been predicted with all plant being in maximum operation at all times of day as a worst-case assumption.

13.3.12 BESS cooling fans will operate dependent on ambient temperatures and would not be in a full mode of operation during cooler temperatures but have been assumed to operate fully at all times as a reasonable worst-case.

13.3.13 Sound level data for transformers in reduced modes of operation are not available from manufacturers and are therefore not available for the purposes of this assessment. Noise predictions are based on inverters and cooling fans operating at full load so are likely to be overestimated. Consequently, this is considered to represent a reasonable worst-case assessment.

13.3.14 No major vibration sources are envisaged to be introduced as part of the Scheme and as such an assessment of operational vibration was scoped out of the Environmental Impact Assessment (EIA) (see **Appendix 1-1: EIA Scoping Report** of this ES **[EN010142/APP/6.2]**).

13.4 Assessment Methodology

Study Area

13.4.1 The Study Area was defined to include noise and vibration receptors likely to be at risk of possible direct and indirect impacts from the Scheme, termed the Zone of Influence (ZoI), which forms the Study Area for the assessment.

13.4.2 The potential ZoI for construction noise effects from the Principal Site and the Cable Route Corridor will include receptors within 300m from the Order limits, based on the results from preliminary modelling, and based on guidance in BS 5228-1 stating that construction noise predictions are generally reliable up 300m. Additionally, a Study Area of 50m either side of construction traffic routes (see **Chapter 16: Transport and Access, ES Volume 1 [EN010142/APP/6.1]**) has been defined based on guidance in the Design Manual for Roads and Bridges LA111 (DMRB) (Ref 1-11).

13.4.3 The Study Area for operational noise effects is defined at 500m from the Principal Site, based on the results from preliminary modelling. It is considered that receptors further than 500m from the Principal Site will experience considerably lower levels of noise and vibration emissions as these will attenuate over distance, resulting in negligible noise effects from the Scheme.

Sensitive Receptors

13.4.4 Potential sensitive receptors (i.e. buildings whose occupants may be disturbed by adverse noise and vibration levels, and structures that are sensitive to vibration) have been taken into consideration when assessing the effects associated with noise and vibration levels from the construction, decommissioning and operational phases of the Scheme.

13.4.5 The approach to the assessment of non-residential receptors differs from that adopted for residential receptors. This is because government policy for noise in the Noise Policy Statement for England (NPSE) (Ref 1-1) is based on relationships between noise and health/quality of life, and noise insulation of a typical dwelling and is not considered applicable to non-residential receptors. As such, the types of receptors that may experience significant effects due to the construction and operation of the Scheme are identified in **Table 13-1** as residential and non-residential.

Table 13-1: Receptor Types

Receptor Group	Receptors in Group
Residential	Individual dwellings and private open spaces (e.g. gardens)
Non-residential	Non-residential community facilities such as schools, hospitals, places of worship, and noise sensitive commercial properties

13.4.6 The effect of noise and vibration generated during the construction, decommissioning and operational phases of the Scheme are considered at nearby sensitive receptors. A number of receptors that may be affected have been considered in this assessment. The sensitive receptors considered are the nearest receptors to the Site (i.e. the receptors that will experience the highest levels of noise and vibration). Although noise and vibration may be perceptible at other receptors in the area around the Scheme, effects will not be significant if they are suitably controlled at the identified receptors.

13.4.7 Noise-sensitive receptors have been identified through a desktop study of aerial imagery and mapping across both the Principal Site and Cable Route Corridor and are presented in **Figure 13-1: Noise Sensitive Receptors and Noise Monitoring Locations** and summarised in **Table 13-2**.

13.4.8 Some receptors identified in **Appendix 1-1: EIA Scoping Report** of this ES **[EN010142/APP/6.2]**) have been removed due to refinement of the proposed Cable Route Corridor. The receptors removed are those no longer within the Study Area.

Table 13-2: Sensitive Receptors

Receptor Reference	Location	Receptor Type	Approximate Co-ordinates	Principal Site Receptor	Cable Route Corridor Receptor
R1	Church Farm, School Lane	Residential	488116, 389930	✓	
R2	Moorlands Magin Moor, Harpswell Lane A631	Residential	489616, 390827	✓	
R3	Hemswell Grange, Harpswell Lane A631	Residential	490745, 390709	✓	
R4	Harpswell Hill Mobile Home Park, Harpswell Lane	Residential	492819, 390233	✓	
R5	Harpswell Village	Residential	493240, 389972	✓	
R6	Heapham Village	Residential	488270, 388481	✓	
R7	Springthorpe Grange, School Lane	Residential	489289, 390139	✓	
R8	Harpswell Low Farm, Harpswell Lane A631	Residential	490518, 390432	✓	
R9	Grange Cottage / Grange Bungalow / Harpswell Grange, Harpswell Lane A631	Residential	491329, 390490	✓	
R10	Hermitage Low Farmhouse, Common Lane	Residential	492133, 388981	✓	

Receptor Reference	Location	Receptor Type	Approximate Co-ordinates	Principal Site Receptor	Cable Route Corridor Receptor
R11	Billyards Farm, Common Lane	Residential	491152, 388354	✓	
R12	Manor Farm / Low Farm Cottage / Heapham Cliff Farm, Common Lane	Residential	489994, 388334	✓	
R13	Grange Farm / South View, Common Lane	Residential	489127, 388393	✓	
R14	Glentworth Grange / Low Farm / Spitals Farm / Orchard House / Westlands Farm, Kexby Road	Residential	492034, 387121	✓	
R15	Northlands Cottages, Northlands Road	Residential	493585, 388292	✓	
R16	Tilby-Dale, Stow Road B1231	Residential	487955, 383435		✓
R17	Sort Hills, Willingham Road	Residential	485564, 382477		✓
R18	Marton Village	Residential	484539, 381712		✓
R19	Trent Port, Trent Port Road	Residential	483444, 381543		✓
R20	Cottam Village	Residential	481915, 380118		✓
R21	Westbrecks Farm, Westbrecks Lane	Residential	480138, 380017		✓

Receptor Reference	Location	Receptor Type	Approximate Co-ordinates	Principal Site Receptor	Cable Route Corridor Receptor
R22	Moor Farm	Residential	489877, 384250		✓
R23	Lowfield Farm	Residential	489876, 384433		✓
R24	Davidson's Farm / Ivy Cottage / Magin Moor Farm	Residential	489961, 384849		✓
R25	Parish Farm	Residential	490174, 386217	✓	
R26	Low Field Farm	Residential	490470, 387322	✓	
R27	1-4 Flat Tops, Normanby	Residential	488306, 382778		✓
R28	Normanby by Stow Village	Residential	488208, 383063		✓
R29	Stow Park	Residential	485523, 381538		✓
R30	Grange Farm Stables / Marton Grange	Residential	485156, 381664		✓
R31	Poplar Farm	Residential	484629, 381475		✓
R32	63-67 / 66-80, High Street, Marton	Residential	484078, 381175		✓

Receptor Reference	Location	Receptor Type	Approximate Co-ordinates	Principal Site Receptor	Cable Route Corridor Receptor
R33	Brampton Grange	Residential	484341, 380973		✓
R34	Manor Farm, Tillbridge Lane	Residential	486240, 381447		✓
R35	Danes Farm / Highfield Farm	Residential	486918, 381327		✓
R36	Manor Court, Stow	Residential	487984, 381909		✓
R37	22-29, Church Road, Stow	Residential	488113, 382433		✓
R38	Church View Farm	Residential	488460, 382539		✓
R39	Glentworth Village	Residential	479771, 379173	✓	
NR1	All Saints Church, Heapham	Non-residential	487799, 388513	✓	
NR2	St Chad's Church, Harpswell	Non-residential	493589, 389970	✓	
NR3	St Michael's Church, Glentworth	Non-residential	494585, 388110	✓	

Public Rights of Way Receptors

13.4.9 Noise is assessed based on the effect on health and quality of life. Noise generated by the construction, operational and decommissioning phases of the Scheme will only affect Public Rights of Way (PRoW) users for limited periods of time when they are in close proximity to a noise source.

13.4.10 It is acknowledged that short-term exposure to noise can cause disturbance to PRoW users and result in adverse noise effects. Planning Practice Guidance Noise (Ref 1-2) identifies an adverse noise effect as something that "*affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life*." This is considered to describe the level of noise effect that may be perceived by PRoW users.

13.4.11 However, given the linear nature of PRoWs, the range of noise impacts along them forming the ambient noise environment, and the transient usage of a PRoW, a material change in the experience of using the PRoW as a whole as a result of noise emissions from the Scheme, which could affect PRoW users' health or quality of life, is not anticipated. Consequently, no significant adverse effects on PRoW users have been identified as arising from the Scheme and a detailed assessment of noise and vibration effects on PRoW users is scoped out.

13.4.12 The NPSE (Ref 1-1) provides a means for noise effects to be identified. It allows for adverse effects on health and quality of life to occur where all reasonable steps have been taken to reduce these effects whilst taking into account sustainable development.

13.4.13 In accordance with the NPSE, all reasonable steps to minimise the effects of noise on PRoW users will be taken during the construction, operational and decommissioning phases of the Scheme. These measures are set out in the **Framework CEMP [EN010142/APP/7.8]**, **Framework Operational Environmental Management Plan (OEMP) [EN010142/APP/7.9]** and **Framework Decommissioning Environmental Management Plan (DEMP) [EN010142/APP/7.10]** submitted alongside the Development Consent Order (DCO) Application. The production of detailed versions of these documents prior to the commencement of the relevant stage of the Scheme will be secured through the DCO.

Baseline Noise Monitoring Methodology

13.4.14 Baseline noise monitoring has been carried out to establish the existing noise climate in the area around the Principal Site in order to define representative background noise conditions. This data is used to define operational noise limits (see **Table 13-9**). As cables will be installed underground, there are no operational noise risks associated with them. Consequently, noise monitoring at sensitive receptors along the Cable Route Corridor (R16-24 and R27-38) has not been undertaken as construction noise criteria are not dependent on measured baseline noise data (see **Table 13-8)**.

13.4.15 Noise monitoring procedures followed guidance from BS 7445-1:2003 'Description and environment of environmental noise – Part 1: Guide to

quantities and procedures' (Ref 1-7) and BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (Ref 1-8). All noise measurements included $L_{Aeq,T}$ and $L_{A90,T}$ sound level indicators.

13.4.16 Letters were sent to residents of identified receptors to request access for noise monitoring. Where access was not possible at desired private properties, a representable public access location was chosen at a place where it was deemed secure for leaving long term equipment. Noise monitoring was undertaken for one week during one of two separate time periods from 8th to 15th July or 15th to 22nd July 2022. These periods are considered representative of typical baseline noise conditions, being outside of school holiday periods.

13.4.17 Monitoring locations are shown in Figure 13-1: Noise Sensitive Receptors and Noise Monitoring Locations of this ES [EN010142/APP/6.3] and summarised in Table 13-3 below. The monitoring locations have been allocated as representative of the local noise environment at a selection of noise-sensitive receptors for the Principal Site based on their surroundings and relative distance to nearby sound sources (in particular road traffic). This is summarised in Table 13-3.

13.4.18 Noise monitoring was undertaken at ML1 based on an early iteration of the Order limits. The location is outside the Study Area for the current Order limits, so it is not representative of any identified sensitive receptors. However, the monitoring results are included in the ES for completeness.

Table 13-3: Noise Monitoring Locations

Location Reference	GPS Coordinates	Monitoring Period	Representative of Receptors
ML1	53.409376, -0.697182	15/07/2022–22/07/2022	None
ML2	53.397114, -0.6818	15/07/2022–22/07/2022	R1, R7
ML3	53.387573, -0.681393	15/07/2022–22/07/2022	R6, NR1
ML4	53.387303, -0.648457	15/07/2022–22/07/2022	R12, R13
ML5	53.397194, -0.594485	08/07/2022–15/07/2022	R2, R3, R4, R5, R8, R9, NR2
ML6	53.373882, -0.611465	08/07/2022–15/07/2022	R14, R25
ML7	53.383584, -0.589237	08/07/2022–15/07/2022	R15, R39, NR3
ML8	53.39078, -0.613441	08/07/2022–15/07/2022	R10, R11

Sources of Information

Desktop Survey

13.4.19 Sources of information consulted include:

a. Aerial imagery of the Order limits and surrounding area to define sensitive receptors and monitoring locations;

b. Plant noise source data were taken from measurements of other solar farms using similar equipment to those proposed, from manufacturer specifications, and from British Standard 5228 (Ref 1-4) and AECOM noise library data; and

c. **Chapter 3: Scheme Description** of this ES **[EN010142/APP/6.1]** for information on the operational Scheme, construction and decommissioning.

Impact Assessment Methodology

Overview of Construction and Decommissioning Works

13.4.20 For the purposes of assessing noise and vibration, the construction programme has been summarised into four scenarios that represent high Noise Generating Activities (NGA). These activities are most likely to generate likely significant effects and are as follows:

a. NGA1 – Construction of substations.

b. NGA2 – Installation of BESS, inverters, and transformers.

c. NGA3 – Construction of ground-mounted solar PV panels.

d. NGA4 – Cable installation (general works).

e. NGA5 – Trenchless cable installation at Cottam Power Station railway line, the River Trent and the East Midlands Railway (assumed as trenchless methods, which is worst-case for noise).

13.4.21 The earliest construction could start is late 2025 and construction will require an estimated 24 months, which represents a construction period where all works are undertaken concurrently, and as such, provides a worst-case scenario for noise and vibration assessment. The majority of works activities would be completed under core working hours as set out in **Table 13-4**.

Table 13-4: Core working hours

Days	Core working hours
Monday to Friday	07:00 – 19:00
Saturday	07:00 – 13:00
Sundays and Bank Holidays	No works

13.4.22 Some works activities may need to occur out of these hours/times due to activities requiring to be undertaken continuously (such as trenchless methods – part of NGA5) if it is not safe or practical to end it at 19:00 on a particular day. Where work outside of times is necessary, prior notification will be provided to the Local Planning Authority (LPA), in the form of a

Control of Pollution Act (CoPA) (Ref 1-9) Section 61 consent application where necessary.

NGA1 – Construction of On-site Substations

13.4.23 The following activities will be undertaken to construct the on-site substations:

a. Installation of electric cabling;

b. Construction of foundations (assumed to include piling);

c. Import of components to site; and

d. Installation of transformers, shunt reactors, switchgear, and other ancillary electrical equipment.

NGA2 – Installation of Solar and BESS Stations

13.4.24 Solar farm infrastructure such as inverters and transformer stations will be installed in Solar Stations, requiring the following steps prior to installation:

a. Excavation of the base;

b. Piling and creation of concrete formwork for concrete foundation;

c. Concrete pour;

d. Installation of electric cabling;

e. Import of components to site; and

f. Installation of inverters, transformers, and battery storage units.

NGA3 – Construction of Solar PV Panels

13.4.25 A supporting substructure of mounting struts (up to a maximum depth of 4 m) are required for each PV string, although various factors will help to inform the number and arrangement of panels and strings. It is assumed at this stage that the installation method will be auger piling. Although the installation method of substructure for solar PV panels is yet to be confirmed, piling represents a reasonable worst case in terms of noise emissions.

NGA4 – Cable Route Corridor

13.4.26 The Cable Route Corridor comprises an area within which the high voltage cables will be laid in order to connecting the Principal Site with the national transmission system at National Grid Cottam Substation. It is proposed that the cables will be installed by a combination of open cut and trenchless methods. Open cut methods will be utilised more commonly across the underground cable route as it will be utilised when installing the cables within open agricultural land.

NGA5 – Trenchless Cable Installation Works

13.4.27 Trenchless crossing techniques would be required to avoid surface obstacles that would prevent open cut trench installation method. For normal crossings, a Thrust Bore method (or equivalent) could be employed, which would not generate higher noise levels than open cut trenching. For wider crossings, a different technique would be required such as trenchless methods. The wider crossings have the potential to last of a number of days and would be continuous operations.

13.4.28 Trenchless crossings will be required to cross the former Cottam Power Station railway line, the River Trent and the East Midlands Railway. As these are substantial crossings, it is likely that trenchless methods would be required. This is considered to be a worst-case in terms of noise effects due to the potential requirement for extended working hours into more noise sensitive periods of the day.

Prediction Methodology

13.4.29 Noise levels experienced by sensitive receptors during such works depend upon several variables, the most significant of which are:

a. The noise generated by plant or equipment used on site, generally expressed as sound power levels (Lw) or the vibration generated by the plant;

b. The periods of use of the plant on site, known as its on-time;

c. The distance between the noise/vibration source and the receptor;

d. The noise attenuation due to ground absorption, air absorption and barrier effects; and

e. The time of day or night the works are undertaken.

Assessment Criteria

13.4.30 This preliminary environmental assessment has been undertaken following relevant guidance, including the NPSE.

13.4.31 The NPSE sets definitions for ‘significant adverse effects’ and ‘adverse effects’ using the concepts:

a. Lowest Observed Adverse Effect Level (LOAEL) – the level above which, as an average response, adverse effects on health and quality of life can be detected; and

b. Significant Observed Adverse Effect Level (SOAEL) – the average response level above which, as an average response, significant adverse effects on health and quality of life occur.

13.4.32 The NPSE states that:

13.4.33 “*It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times*”.

13.4.34 Noise levels exceeding the SOAEL should be avoided as far as reasonably practicable. For noise levels exceeding the LOAEL, the NPSE states that:

13.4.35 “*It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur*”.

13.4.36 All noise effects are local, only affecting nearby sensitive receptors, and are direct in nature; however, defining a likely effect and whether it is significant or not depends on the nature of a noise source. Likely effects have been defined based on guidance set out in national policy.

13.4.37 Government policies for noise are generally based on community exposure response relationships and noise insulation of a typical dwelling. Consequently, an assessment based on LOAELs and SOAELs cannot be applied to non-residential sensitive receptors. As such, the approach to the assessment of non-residential receptors differs from that adopted for residential receptors. Non-residential receptors are considered on a case-by-case basis by considering the applicable design criteria for good internal noise levels.

Construction and Decommissioning Noise Criteria

13.4.38 Annex E of BS 5228-1 provides example methods for the assessment of the significance of construction noise effects. With reference to the NPSE (Ref 1-1), the LOAEL and SOAEL thresholds have been set in **Table 13-5** below. Although there is currently a lack of evidence relating to health effects due to construction and decommissioning noise, the defined LOAEL and SOAEL have been accepted as appropriate in other consented major schemes[1]. Additionally, the LOAEL and SOAEL for construction noise are defined in DMRB LA111 (Ref 1-11), which further supports the criteria in **Table 13-5.** The Unacceptable Adverse Effect Level (UAEL) for construction noise is based on the trigger level for temporary rehousing as set out in section E.4 of BS 5228-1 (Ref 1-4).

Table 13-5: Thresholds of Potential Effects of Construction and Decommissioning Noise at Residential Buildings

Time Period	**Threshold Value ($L_{Aeq,T}$ dB)**		
	LOAEL	SOAEL	UAEL
Day (07:00 – 19:00) Saturday (07:00 – 13:00)	65	75	85
Evening (19.00 – 23.00) Weekends (13.00–23.00 Saturdays and 07.00–23.00 Sundays)	55	65	75
Night (23.00 – 07.00)	45	55	65

The values apply to a location one metre from a residential building façade containing a window, ignoring the effect of the acoustic reflection from that façade.

13.4.39 Although a significant effect due to construction and decommissioning activities may be determined through an assessment based on exceedances of the defined SOAELs for construction noise and vibration, consideration of the significance of the effect for temporary construction and decommissioning activities exceeding the LOAEL is undertaken through qualitative consideration of the following:

a. Duration of temporary likely effects:

b. Frequency of events;

[1] For example High Speed 2, A14 Cambridge to Huntingdon, Thames Tideway and Manston Airport.

c. Number of receptors; and

d. Sensitivity of receptor.

Construction and Decommissioning Vibration

13.4.40 BS 5228-2 provides further guidance on the perception of vibration within occupied buildings. This provides a simple method of determining annoyance alongside evaluation of cosmetic damage associated with vibration. **Table 13-6** details Peak Particle Velocity (PPV) levels (a standard measure of vibration effects) and their potential effect on humans and provides a description of construction and demolition vibration impacts on human receptors. These levels are used to define the LOAEL and SOAEL for human exposure to vibration.

Table 13-6: Criteria for magnitude of impacts for construction and decomissioning (human response)

Magnitude of impact	PPV vibration level	BS 5228-2 description of impact
LOAEL	0.3mm/s	“Vibration might be just perceptible in residential environments.” *
SOAEL	1.0mm/s	“It is likely that vibration of this level in residential environments will cause complaint, but it can be tolerated if prior warning and explanation has been given to residents.”

* Note to table: This includes similar uses e.g. hotels, bed and breakfasts

Source: BS 5228-2:2009+A1:2014 Table B.1

13.4.41 The recommended PPV vibration limits for transient vibration, above which cosmetic damage could occur for different types of buildings are also provided in BS 5228-2 and presented in **Table 13-7**. For these limits, 'minor damage' is possible at vibration magnitudes that are greater than twice those given in **Table 13-6**, and 'major damage' can occur at values greater than four times the tabulated values. Consequently, the significance of effect has been provided based on the sensitivity of a building to vibration induced cosmetic damage.

Table 13-7: Transient vibration guide values for cosmetic damage (building response)

	Peak component particle velocity in frequency range of predominant pulse, at which cosmetic damage could occur	
Type of building	**4Hz to 15Hz**	**15Hz and above**
Reinforced or framed structures, industrial and heavy commercial buildings	50mm/s at 4Hz and above	50mm/s at 4Hz and above

	Peak component particle velocity in frequency range of predominant pulse, at which cosmetic damage could occur	
Type of building	**4Hz to 15Hz**	**15Hz and above**
Unreinforced or light framed structures, residential or light commercial buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

Note 1: A potential negligible effect (not significant) is indicated at vibration levels up to the threshold values.

Note 2: A potential minor adverse effect (not significant) is indicated at vibration levels up to a magnitude of twice the threshold values.

Note 3: A potential moderate adverse effect (significant) is indicated at vibration levels up to a magnitude of four times the threshold values.

Note 4: A potential major adverse effect (significant) is indicated at vibration levels equal

to or greater than a magnitude of four times the threshold values.

Source: BS 5228-2:2009+A1:2014 Table B.2 Transient vibration guide values for cosmetic damage

13.4.42 Given that criteria in **Table 13-7** relate to the risk of cosmetic damage, they are dependent on the type of building and its physical sensitivity to vibration. The criteria presented relate to the potential for cosmetic damage, not structural damage; cosmetic damage would precede the onset of any structural damage.

13.4.43 All identified noise and vibration effects occur on the local level, with the potential to result in either negligible, adverse, or significant adverse impacts. No noise and vibration beneficial effects are anticipated to occur.

13.4.44 Identified noise and vibration impacts on human receptors during the construction works are short-term or medium-term temporary impacts, lasting for the duration of the construction works or a shorter period when construction works are close to receptors. Cosmetic damage to buildings is a permanent effect (unless and until repaired) but does not recur after construction and decommissioning works have concluded.

Construction and Decommissioning Traffic Noise

13.4.45 During the peak construction period, there will be up to 120 Heavy Goods Vehicle (HGV) deliveries (240 movements per day) on the strategic road network per day and up to 1,225 staff that will access the Principal Site using light vehicles. The Cable Route Corridor will require a maximum of 170 staff per day across the route. Four groups of 30 construction staff will travel to/ from any one of site accesses/ cable contractor compounds per day and two groups of 25 construction staff will travel to/ from any one of the trenchless compounds per day. Traffic during decommissioning is expected to be similar to (or less than) the construction phase.

13.4.46 Construction and decommissioning traffic noise have been assessed for a representative worst-case day during the construction stage based on

information in **Chapter 3: Scheme Description** of this ES **[EN010142/APP/6.1]**. Predicted construction traffic noise levels along the main access routes have been compared to measured ambient noise levels so a potential change in noise can be derived.

13.4.47 The temporary changes in road traffic noise levels due to construction traffic at a distance of 5m from the local road network have been assessed against criteria relating to short-term changes in noise from Table 3.54a of DMRB LA111 (Ref 1-11). While these criteria relate to Basic Noise Levels (BNL) as determined by CRTN (i.e. $L_{A10,18h}$ noise levels) and this comparison uses $L_{Aeq,12h}$ noise levels, the criteria are considered a suitable reference for estimating the change in absolute road traffic noise level due to construction traffic, and in determining the likelihood of significant effects. Assessment criteria are presented in **Table 13-8**.

Table 13-8: Construction Traffic Noise Assessment Criteria

Effect Level	Magnitude criteria
Negligible	≥ 0dB and < 1dB
Minor	≥ 1dB and < 3dB
Moderate	≥ 3dB and < 5dB
Major	≥ 5dB

Source: DMRB LA111 Table 3.54a

Operational Noise

13.4.48 Noise predictions of the operational Scheme have been undertaken using SoundPLAN, which implements the calculation procedures of ISO 9613 'Acoustics – Attenuation of Sound During Propagation Outdoors' (Ref 1-11), to predict the propagation of noise away from the Scheme in all directions and to quantify resultant noise levels at the identified noise sensitive receptor locations.

13.4.49 Operational noise has been assessed following BS 4142 guidance, whereby the rating level of noise emissions from activities are compared against the background level of the pre-development noise climate. Source data for operational noise emissions is presented in **Appendix 13-4 [EN010142/APP/6.2]**. The relevant parameters in this instance are as follows:

a. Background sound level – $L_{A90,T}$ – defined in the Standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval ('T') measured using a 'fast' time weighting and quoted to the nearest whole number of decibels;

b. Specific sound level – $L_{Aeq,Tr}$ – the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr; and

c. Rating level – $L_{Ar,Tr}$ – the specific sound level plus any adjustment made for the characteristic features of the noise.

13.4.50 BS 4142 recognises that certain acoustic features of a sound source can increase the impact over that expected based purely on the sound level. The standard identifies the following features to be considered:

a. Tonality - a penalty of 2dB is applied for a tone which is just perceptible at the receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible;

b. Impulsivity - a penalty of 3dB is applied for impulsivity which is just perceptible at the receptor, 4dB where it is clearly perceptible and 6dB where it is highly perceptible. An impulse is defined as the sudden onset of a sound;

c. Intermittency - a penalty of 3dB can be applied if the intermittency of the specific sound is readily identifiable against the residual acoustic environment at the receptor i.e. it has identifiable on/off conditions; and

d. Other sound characteristics - a penalty of 3dB can be applied where the specific sound features characteristics that are neither tonal nor impulsive, but are readily distinctive against the residual acoustic environment.

13.4.51 BS 4142 states the following regarding the assessment of impacts, comparing the rating level of the new noise source with the existing background level:

a. "*Typically, the greater this difference, the greater the magnitude of the impact*.

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

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

d. *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*."

13.4.52 The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

13.4.53 BS 4142 advises that, where rating levels and background levels are low, which is the case in rural areas surrounding the Order limits, the assessment of operational noise should take into context the absolute noise level. The ANC Guide to BS 4142 (Ref 1-13) provides context to this by stating:

"BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30dB L_{A90}, and low rating levels as being less than about 35dB $L_{Ar,Tr}$".

13.4.54 The ANC Guide further suggests that:

> *"…similar values would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate".*

13.4.55 A minimum rating level of 35dB $L_{Ar,Tr}$ for the LOAEL would align with guidance in PPGN (Ref 1-2), which defines noise below the LOAEL as follows:

> *"Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life".*

13.4.56 BS 8233:2014 Guidance on sound insulation and noise reduction for buildings. (Ref 1-14) and the World Health Organization (WHO) 'Guidelines for Community Noise' (1999) (Ref 1-15) provide guidance levels for internal noise within dwellings of 30dB $L_{Aeq,T}$ for good sleeping conditions at night. In accordance with examples in Annex A of BS 4142, it is assumed that building envelope attenuation would be reduced to approximately 10dB by a partially open window. Consequently, an external SOAEL of 40dB $L_{Ar,Tr}$ has been adopted for the night-time.

13.4.57 The assessment criteria for noise from fixed plant installations are summarised in **Table 13-9**.

Table 13-9: Operational Noise Assessment Criteria

Effect Level	Rating Level (external) at Receptor, $L_{Ar,Tr}$	
	Daytime (07:00-19:00) and Evening (19:00-23:00)	**Night-time (23:00-07:00)**
LOAEL	Less than or equal to the typical background level ($L_{A90,T}$) – minimum of 35dB $L_{Ar,Tr}$	Less than or equal to the typical background level ($L_{A90,T}$) – minimum of 30dB $L_{Ar,Tr}$
SOAEL	Greater than 10dB above the background noise level – minimum of 45dB $L_{Ar,Tr}$	Greater than 10dB above the background noise level – minimum of 40dB $L_{Ar,Tr}$

13.4.58 Identified operational noise impacts are long-term effects occurring over the operational life of the Scheme.

Operational Vibration

13.4.59 The Scheme includes the use of battery storage infrastructure, electrical connection infrastructure including transformers and inverters, potentially includes tracker panel motors and mechanisms, and solar PV panels. None of these components are a source of perceptible ground-borne vibration and would not require specific measures to control vibration emissions.

13.4.60 Operational vibration was scoped out of the EIA as there are no operational sources of vibration (see **Appendix 1-1: EIA Scoping Report** of this ES **[EN010142/APP/6.2]**).

Non-Residential Receptors

13.4.61 Design guides for good internal conditions in non-residential receptors are set indoors. The only non-residential receptors in this assessment are places of worship (NR1, NR2, and NR3 identified in **Table 13-2**). Design criterion from BS 8233: 2014 for place of worship, counselling, meditation or relaxation is considered applicable. This design criterion is a range of 30-35dB $L_{Aeq,T}$. Assuming that the churches may have doors or windows open at some points during the year, the maximum external noise level (assuming 15dB attenuation for a partially open door or window) before the design criterion would be exceeded would be 50dB $L_{Aeq,T}$.

13.5 Stakeholder Engagement

13.5.1 A request for an EIA Scoping Opinion, **Appendix 1-2: EIA Scoping Opinion** of this ES **[EN010142/APP/6.2]**, was sought from the Secretary of State through the Planning Inspectorate in 2022 as part of the EIA Scoping Process. A summary of the Planning Inspectorate's responses relating to noise and vibration scoping, and a summary of how these have been addressed in this ES Chapter are presented below in **Table 13-10**.

Table 13-10: Summary of Scoping Opinion conclusions on noise and vibration

Consultee	Summary of Scoping Opinion made by Planning Inspectorate	How has the matter been addressed?	Location of response in the chapter
Planning Inspectorate	The Applicant proposes to scope out an assessment of noise associated with operational traffic on the basis that once operational the Proposed Development would generate minimal traffic. Considering the characteristics of the Proposed Development, and the anticipated level of traffic generation, the Inspectorate is content that this matter can be scoped out. However the ES description of development should confirm the anticipated trip generation (including number and type of vehicles) during operation to justify this.	A confirmation of the anticipated numbers of permanent staff and anticipated maintenance visits has been described, including potential types of vehicles.	**Section 3.6** of **Chapter 3: Scheme Description** of this ES **[EN010142/APP/6.1]**.
.Planning Inspectorate	The Applicant proposes to scope out an assessment of operational vibration effects on the basis that no major vibration sources are anticipated to be introduced as part of the Proposed Development. Considering the nature of the Proposed Development during operation the Inspectorate is content to scope this matter out. However, the ES should describe the potential sources of vibration arising from the operation of e.g. substation, battery storage infrastructure, and tracker panel mechanisms, as well as any measures to control emissions.	A description of potential operational vibration sources has been included. Given this concluded none of the Scheme components would generate vibration, no proposed measures to control vibration have been included.	**Section 13.4**, paragraph 13.4.59
Planning Inspectorate	Figure 14-1 shows the location of the “nearest noise-sensitive receptors” in relation to the Proposed Development. The ES should provide a plan showing the location of all sensitive receptors assessed to aid understanding of the potential for significant effects relating to noise.	The locations of all sensitive receptors assessed are now presented in an accompanying figure.	**Figure 13-1: Noise Sensitive Receptors and Noise Monitoring Locations** of this ES **[EN010142/APP/6.3]**
Planning Inspectorate	The Scoping Report states that only noise and vibration effects on human receptors will be assessed within the Noise and Vibration	The potential for noise and vibration effects on	**Chapter 8: Cultural Heritage** of this ES and

Consultee	Summary of Scoping Opinion made by Planning Inspectorate	How has the matter been addressed?	Location of response in the chapter
	chapter of the ES and effects on ecological and cultural heritage receptors will be assessed within the respective aspect chapters of the ES. There is no reference to noise effects within the Cultural Heritage section of the Scoping Report and so it is not clear whether this will be considered within the ES. The ES should ensure that noise and vibration effects on cultural heritage assets are included within the ES, including consideration of effects on setting. Similarly, whilst the Ecology chapter of the Scoping Report refers to the potential for noise and vibration effects on ecological features during construction, the potential for operational noise effects is not listed (noting that operational vibration can be scoped out, as agreed in Box ID 3.8.2 above). The ES should ensure that the potential for noise and vibration effects on all sensitive receptors (human, ecological, and cultural heritage) are assessed.	cultural heritage and ecological receptors are covered in the Cultural Heritage and Ecology and Nature Conservation ES chapters.	**Chapter 9: Ecology and Nature Conservation** of this ES **[EN010142/APP/6.1]**
Planning Inspectorate	The Scoping Report states that solar PV panels, mounting structures, and cabling do not produce noise during operation. However, Scoping Report paragraph 3.6 identifies that the type of panel to be used is not yet determined and tracking panels may be used. Should this type of panel be used, the ES should assess the potential for significant noise effects on receptors during operation.	Tracking motors have been included in operational noise modelling.	**Section 13.3**, paragraph 13.3.10.
Planning Inspectorate	The Scoping Report states that although significant effects relating to construction noise level will be determined based on exceedances of a Threshold Value, professional judgement will also be used to refine the significance of effects. For example, it is stated that only noise levels above the Threshold Value for more than 10-days/ weekends/ nights in	Reference to consideration of whether exceedances of the SOAEL occur for more than 10-days/ weekends/ nights in a	**Section 13.4**

Consultee	Summary of Scoping Opinion made by Planning Inspectorate	How has the matter been addressed?	Location of response in the chapter
	a 15 consecutive day period or 40 days/ weekends/ nights within a 6-month consecutive period would be considered significant. This appears to be based on British Standard Guidance (BS 5228: Code of practice for noise and vibration control on construction and open sites – Part 1: Noise). However, this guidance refers to the above criteria in the context of this being the level at which noise insulation or temporary rehousing should be offered by Developers. The Inspectorate is of the opinion that there is potential for significant effects to occur at lower noise levels which would not require insulation or rehousing. The ES should justify the approach to defining significant effects, drawing on established practice and guidance where possible.	15 consecutive day period or 40 days/ weekends/ nights within a 6-month consecutive period has been removed.	

13.5.2 The further consultation undertaken as part of pre-application engagement was recorded in the Preliminary Environmental Information Report (PEI Report). **Table 13-11** outlines the statutory consultation responses received since the PEI Report relating to noise and vibration and how these have been addressed through the ES. Responses have been grouped thematically where relevant, but all relevant consultees are listed.

13.5.3 Additional comments relating to noise have been received relating to a resident at East Cottage, Northlands Road, which is part of receptor group R15 (see**Table 13-2**). The resident has Autistic Spectrum Disorder and is sensitive to noise, which causes distress. As this chapter assesses noise based on national policy requirement as set out in **Appendix 13-1: Legislation and Planning Policy** of this ES **[EN010142/APP/6.2]**, the average response to noise is assessed. Consequently, this chapter does not consider how noise may impact on someone who is sensitive. However, consultation with representatives of East Cottage residents is ongoing to determine how the best practicable acoustic environment can be provided. Details of the consultation and measures adopted to control noise at East Cottage will be submitted during the examination.

Table 13-11: Main matters raised through the Statutory Consultation

Consultee	Summary of main matter raised	How has the matter been addressed?	Location of response in the chapter
West Lindsey District Council	Whilst the PEI Report chapter concludes effects are not significant, on the basis that they are at or around the Significant Observed Adverse Effect Level, it is considered that there is an identified environmental impact here that needs to be addressed through mitigation at the very least.	Embedded mitigation measures secured in the **Framework CEMP [EN010142/APP/7.8]** and **Framework OEMP [EN010142/APP/7.9]** submitted alongside this DCO represent all reasonable steps to minimise adverse levels of noise and vibration.	Section 13.7 contains details on embedded mitigation.
Bassetlaw District Council	The Tillbridge Solar project appears to be just one of a number of projects that are likely to connect to the National Grid at Cottam. I would ask that the applicants from each of the proposed projects liaise to examine the possibility of the cabling route infrastructure being shared between all the projects to avoid need for multiple routes and the consequent	The Applicant is working closely with Low Carbon and Island Green Power and meet regularly to discuss achieving a shared corridor in order to minimise disruption during the construction period.	**Joint Report on the Interrelationship with other National Infrastructure projects [EN010142/APP/7.6]**.

Consultee	Summary of main matter raised	How has the matter been addressed?	Location of response in the chapter
	disturbance to many more residents.		
Members of the public	Concerns of noise emissions from solar farm infrastructure causing disturbance.	**Chapter 13: Noise and Vibration of the ES [EN010142/APP/6.1]** provides an assessment of operational noise effects on residents of identified sensitive receptors. No significant operational noise effects on health or quality of life are identified.	An assessment of noise emissions from solar farm infrastructure is presented in **Section 13.8**.

13.6 Baseline Conditions

13.6.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to noise and vibration. Further details of the methodology and results of the baseline noise surveys are presented in **Appendix 13-3: Baseline Noise Survey** of this ES **[EN010142/APP/6.2]**.

Existing Baseline

Principal Site

13.6.2 During the baseline noise surveys, road traffic noise from the surrounding road network was present at the majority of the locations. At locations furthest away from roads, such as ML2 and ML4, wind noise was seen to be most dominant noise source. ML5, ML6, and ML8 saw bird song as the most dominant noise source. At ML2 and ML6 local farming activity noise was observed. At ML3, ML4, ML6, ML7 and ML8, aircraft using Sturgate Airfield were also seen to have a contribution to the noise environment. Further local noise sources that influence noise conditions are fauna, farming activities and local resident activities.

13.6.3 A summary of the noise monitoring results is presented in **Table 13-12**. Typical ambient ($L_{Aeq,1h}$) and background ($L_{A90,1h}$) sound levels are presented for the daytime, evening and night for weekdays and weekends.

Table 13-12: Existing Baseline Sound Levels Summary

Location Reference	Week Period	Sound Level Indicator	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
ML1	Weekday	$L_{Aeq,1h}$	71	66	65
		$L_{A90,1h}$	48	34	27
	Weekend	$L_{Aeq,1h}$	72	67	64
		$L_{A90,1h}$	44	36	28
ML2	Weekday	$L_{Aeq,1h}$	50	43	45
		$L_{A90,1h}$	36	30	27
	Weekend	$L_{Aeq,1h}$	50	46	45
		$L_{A90,1h}$	44	34	27
ML3	Weekday	$L_{Aeq,1h}$	54	46	43
		$L_{A90,1h}$	34	28	23
	Weekend	$L_{Aeq,1h}$	59	49	42
		$L_{A90,1h}$	33	28	23
ML4	Weekday	$L_{Aeq,1h}$	45	38	37

Location Reference	Week Period	Sound Level Indicator	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
		$L_{A90,1h}$	34	28	26
	Weekend	$L_{Aeq,1h}$	40	39	34
		$L_{A90,1h}$	34	28	26
ML5	Weekday	$L_{Aeq,1h}$	47	45	40
		$L_{A90,1h}$	39	34	25
	Weekend	$L_{Aeq,1h}$	44	42	40
		$L_{A90,1h}$	37	34	27
ML6	Weekday	$L_{Aeq,1h}$	47	44	43
		$L_{A90,1h}$	33	28	23
	Weekend	$L_{Aeq,1h}$	46	42	41
		$L_{A90,1h}$	34	25	24
ML7	Weekday	$L_{Aeq,1h}$	44	40	40
		$L_{A90,1h}$	29	27	25
	Weekend	$L_{Aeq,1h}$	46	33	35
		$L_{A90,1h}$	28	26	25
ML8	Weekday	$L_{Aeq,1h}$	42	37	41
		$L_{A90,1h}$	34	26	24
	Weekend	$L_{Aeq,1h}$	44	36	42
		$L_{A90,1h}$	34	26	26

Cable Route Corridor

13.6.4 The Cable Route Corridor is assessed against construction noise and vibration only, since below ground cables will not generate operational noise. The baseline sound sources are also largely similar to those in the vicinity of the Principal Site. The LOAEL and SOAEL values set for the Principal Site are therefore considered to also be applicable to the Cable Route Corridor, and no baseline surveys are necessary for this area.

Future Baseline

13.6.5 The future baseline scenarios are set out in **Chapter 5: EIA Methodology** of this ES **[EN010142/APP/6.1]**. In the absence of the Scheme, it is considered that the future baseline noise environment will be higher than represented by the July 2022 measurement ambient sound levels. This is due to natural growth of road traffic flows resulting in increased noise in the local area.

13.6.6 The assessments assume that the measured baseline data is representative of future baseline conditions. A lower assumed baseline would result in the same or higher noise impacts, and therefore the adopted approach represents a conservative approach.

13.6.7 The assessment of construction traffic noise effects accounts for the future peak construction year, which includes natural traffic growth. However, the operational noise assessment assumes that the measured baseline data is representative (i.e. no higher) than future baseline conditions, which represents a reasonable worst-case scenario.

13.7 Embedded Design Mitigation

13.7.1 This section contains the mitigation measures relevant to this chapter that are already incorporated into the Scheme design, as described in **Chapter 3: Scheme Description** of this ES **[EN010142/APP/6.1]**.

Construction and Decommissioning

13.7.2 Measures to control noise as defined in Annex B of BS 5228-1 and measures to control vibration as defined in Section 8 of BS 5228-2 will be adopted where reasonably practicable. These embedded measures represent Best Practicable Means (BPM) and will be secured within the **Framework CEMP [EN010142/APP/7.8]** for the construction phase and the **Framework DEMP [EN010142/APP/7.10]** submitted with the DCO for the decommissioning phase. These documents would be secured through DCO requirements.

13.7.3 BPM that will be implemented during construction and decommissioning works and secured through the CEMP and DEMP are presented below:

a. Ensuring that all appropriate processes, procedures and measures are in place to minimise noise before works begin and throughout the construction programme.

b. All contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2) which should form a prerequisite of their appointment.

c. Where reasonably practicable, noise and vibration are controlled at source (e.g. the selection of inherently quiet plant and low vibration equipment), review of the works programme and methodology to consider quieter methods, consideration of the location of equipment on-site and control of working hours.

d. Use of modern plant, complying with applicable UK noise emission requirements.

e. Hydraulic techniques for breaking concrete or rocks to be used in preference to percussive techniques, where reasonably practicable.

f. Drop heights of materials will be minimised.

g. Plant and vehicles will be sequentially started up rather than all together.

h. Off-site pre-fabrication where reasonably practicable.

i. Use of screening locally around significant noise producing plant and activities.

j. Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturer's specifications.

k. All construction plant and equipment to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use.

l. Loading and unloading of vehicles, dismantling of site equipment or moving equipment or materials around the Order limits to be conducted in such a manner as to minimise noise generation, as far as reasonably practicable.

m. All vehicles used on-site shall incorporate reversing warning devices as opposed to the typical tonal reversing alarms to minimise noise disturbance where reasonably practicable.

n. Provision of information to the relevant local authority and local residents to advise of potential noisy works that are due to take place.

o. Unnecessary revving of engines will be avoided, and equipment will be switched off when not in use.

p. Plant will always be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading will also be carried out away from such areas.

13.7.4 Core working hours for construction activities are set out in **Table 13-4**.

13.7.5 A construction noise monitoring scheme shall be developed as per requirements of the **Framework CEMP [EN010142/APP/7.8]** submitted alongside the DCO following appointment of a Principal Contractor and prior to commencement of construction works. Monitoring during the decommissioning phase will be undertaken in accordance with the **Framework DEMP [EN010142/APP/7.10]** submitted with the DCO application.

13.7.6 The effect of noise and vibration on nearby sensitive receptors can be minimised through a good communication strategy. Prior to construction works being undertaken, liaison will be undertaken with occupiers of sensitive receptors that may be adversely affected by construction noise and vibration.

13.7.7 The communication strategy and noise complaint system will be secured through the DCO as part of the **Framework CEMP [EN010142/APP/7.8]** and **Framework DEMP [EN010142/APP/7.10]** submitted alongside the DCO.

13.7.8 As requirements and locations for trenchless activities will not be finalised until a principal contractor is appointed, a hierarchy of mitigation measures is contained in the **Framework CEMP [EN010142/APP/7.8]** submitted alongside the DCO to ensure that significant noise effects do not occur due to potential night-time works.

13.7.9 Where practicable, avoid trenchless methods within 200m (the distance at which significant effects are predicted at night) of residential receptors (although this will depend on the results of the ground investigation survey):

a. Where trenchless activities may occur within 200m of sensitive receptors, the option for open cut cable laying will be explored as an alternative to trenchless methods;

b. The potential for the use of quieter equipment than listed in **Appendix 13-4: Noise Modelling** of this ES **[EN010142/APP/6.2]** will be explored by the Principal Contractor; and

c. Depending on the location, plant and timing of works, temporary acoustic fencing will be installed around the Order limits to screen receptors from noise emission if trenchless works are required within 200m of a sensitive receptor. This mitigation could provide 10dB of attenuation when the noise screen completely hides the sources from the receiver.

13.7.10 Where necessary, the Applicant will submit an application for prior consent to carry out noisy work under Section 61 of the CoPA 1974 to demonstrate that noise and vibration has been minimised as far as reasonably practicable. The Section 61 application will set out the specific method of working, calculations of noise levels at nearby receptors, the actual working hours required, noise monitoring locations, details of communication measures and the mitigation measures implemented to minimise noise and vibration impacts.

13.7.11 Consideration has been given to traffic routing, timing and access points to the Scheme to minimise noise impacts at existing receptors as detailed in **Chapter 16: Transport and Access** of this ES **[EN010142/APP/6.1]**.

13.7.12 Management of construction traffic on the highway network will be managed through the **Framework Construction Traffic Management Plan (CTMP) [EN010142/APP/7.11]**, which will be secured through the DCO. Appropriate routing of construction and decommissioning traffic on public roads and along access tracks will be pursuant to the CTMP.

Operation

13.7.13 Embedded operational mitigation measures are summarised as follows:

a. Plant selection (noise emissions will be one of the criteria evaluated when procuring equipment for use on the site).

b. Design layout of elements within the Order limits to minimise noise at receptors, including:

i. Locating the Solar Stations in areas away from large concentrations of receptors such that noise emissions from electrical equipment are less impactful; and

ii. Location and orientation of inverters and transformers.

c. Transformers may be standalone units or pre-assembled with inverters and switchgear to form a single contained unit (i.e. enclosed).

13.7.14 Plant that will be used in the Scheme has not yet been finalised. Consequently, a conservative approach of considering the reasonable worst-

case options has been taken when defining noise source emissions data and it may be possible that quieter plant can be incorporated into the final design. Quieter plant would be the most effective way of controlling noise emissions.

13.7.15 The Scheme layout has been optimised to locate inverters as far as practically possible from sensitive receptors where the highest levels of noise were predicted. In general, there is a commitment to locate Solar and BESS Stations at least 250m from residential properties.

13.7.16 Although the indicative Scheme layout has been optimised to minimise noise levels at sensitive receptors, there is a requirement to retain some flexibility where infrastructure will be located on-site. Consequently, if there is a decision in the future to move noise generating infrastructure closer to sensitive receptors than shown in **Figure 13-1: Noise Sensitive Receptors and Noise Monitoring Locations** of this ES **[EN010142/APP/6.3]**, the Applicant commits that noise at sensitive receptors will be no higher than the levels presented in **Section 13.8**. This commitment will be secured through a requirement of the **draft DCO [EN010142/APP/3.1]**.

13.7.17 Low frequency noise can be very difficult to predict with a high level of certainty and similarly hard to identify and resolve if present. This is because it can be generated by the unexpected interactions between system components and can be amplified by the geometry of the site and receptor buildings. The issue of low frequency noise will be considered throughout the detailed design for the on-site substations and eliminated through design, or appropriately mitigated (isolation and attenuation measures) where appropriate. This commitment will be secured through a requirement of the **draft DCO [EN010142/APP/3.1]**.

13.8 Assessment of Likely Impacts and Effects

13.8.1 The Scheme as outlined in **Chapter 3: Scheme Description** of this ES **[EN010142/APP/6.1]** has been considered in assessing the likely impacts and effects of the Scheme, whilst considering the embedded mitigation described in the previous section.

Construction (2025 to 2027) and Decommissioning (2088)

13.8.2 This section discusses the potential noise and vibration effects on sensitive receptors arising during the construction and decommissioning phases of the Scheme. The indicative programme and duration of likely installation methods are described in **Chapter 3: Scheme Description** of this ES **[EN010142/APP/6.1]**.

Construction and Decommissioning Noise Effects (Principal Site and Cable Route Corridor)

13.8.3 Construction noise predictions were undertaken at receptor locations identified in Table 13-2 for each of the NGA scenarios 1-5.

13.8.4 Construction noise predictions were undertaken at sensitive receptor locations identified in **Table 13-13** for each NGA, and for all NGAs occurring simultaneously as a worst-case. Levels below 30dB are considered to be negligible and are not reported.

Table 13-13: Construction and Decommissioning Noise Predictions

Receptor Reference	Indicative Free-Field Construction Noise Levels During Daytime Construction Activity (dB $L_{Aeq,12h}$)				
	NGA1	NGA2	NGA3	NGA4	Worst-case
R1	31	48	50	32	50
R2	44	57	70	48	70
R3	<30	52	63	47	63
R4	<30	48	47	40	48
R5	<30	48	49	45	49
R6	<30	47	46	30	47
R7	42	63	55	54	63
R8	31	55	67	55	67
R9	<30	52	65	43	65
R10	31	58	69	57	69
R11	<30	57	62	51	62
R12	<30	62	74	47	74
R13	<30	55	62	38	62
R14	<30	50	48	42	50
R15	38	51	50	45	51
R16	<30	<30	<30	48	48
R17	<30	<30	<30	49	49
R18	<30	<30	<30	61	61
R19	<30	<30	<30	49	49
R20	<30	<30	<30	61	61
R21	<30	<30	<30	50	50
R22	<30	<30	<30	58	58
R23	<30	<30	<30	65	65
R24	<30	<30	<30	59	59
R25	<30	39	32	51	51
R26	<30	51	47	51	51
R27	<30	<30	<30	53	53
R28	<30	<30	<30	65	65
R29	<30	<30	<30	50	50

Receptor Reference	Indicative Free-Field Construction Noise Levels During Daytime Construction Activity (dB $L_{Aeq,12h}$)				
	NGA1	NGA2	NGA3	NGA4	Worst-case
R30	<30	<30	<30	59	59
R31	<30	<30	<30	57	57
R32	<30	<30	<30	65	65
R33	<30	<30	<30	54	54
R34	<30	<30	<30	48	48
R35	<30	<30	<30	58	58
R36	<30	<30	<30	44	44
R37	<30	<30	<30	47	47
R38	<30	<30	<30	45	45
R39	31	45	39	39	45
NR1	<30	41	38	<30	41
NR2	<30	47	46	45	47
NR3	<30	40	36	36	40

13.8.5 All predicted noise levels remain below the daytime SOAEL (75dB LAeq,T) for all daytime construction scenarios and are therefore **not significant**. Predicted noise levels that are equal to or above LOAEL but below SOAEL are predicted during NGA3 at R2, R8, R9, R10, R23 and R2; and during NGA4 at R23 and R24.

13.8.6 Construction noise levels that are equal to or exceed the LOAEL represent noise that is present and intrusive. Mitigation measures and noise management plans will be put into place to ensure that construction noise is minimised at all times throughout the construction programme. BPM (as defined in Section 72 of the Control of Pollution Act) measures are covered in **Section 13.7** to reduce construction noise as far as reasonably practicable.

13.8.7 For NGA5, trenchless activities may last for up to three days and involve activities at an entry pit and a reception pit. At this stage of the Scheme, three locations for trenchless installation methods have been identified at the Cable Route Corridor that are likely to require continuous work. For the purposes of the noise assessment, trenchless methods have been identified as worst-case trenchless cable installation method due to the potential requirement for night-time working. Potential trenchless method locations are listed in **Table 13-14** along with receptors within 500 m, at which adverse levels of noise may occur.

Table 13-14: Trenchless Method Locations and Receptos

Trenchless Crossing	Receptor	Estimated Distance	Predicted Noise $L_{Aeq,1h}$ dB
Cottam Power Station railway line	No receptors within 500m		
River Trent	R19	450m	47
East Midlands Railway	R17	280m	52
	R29	160m	57
	R30	110m	61

13.8.8 It is noted that trenchless method operations will only occur during the construction phase (cable installation) and will not occur during decommissioning. As the trenchless crossing activities at the entry pit will generate the highest level of noise, calculations of noise have been based on a reasonable worst-case assumption that all potential trenchless method sites are entry pits.

13.8.9 The night-time LOAEL is defined at 45dB LAeq,T and the night-time SOAEL is defined at 55dB LAeq,T (see **Table 13-5**). Calculations of trenchless method noise (see **Appendix 13-4: Noise Modelling** of this ES **[EN010142/APP/6.2]**) indicate that significant effects (an exceedance of SOAEL) may occur at night at sensitive receptors within 200m of activities. Adverse levels of noise may occur at receptors farther away; however, embedded mitigation measures satisfy NPSE requirements that allow adverse impacts to occur providing reasonable steps have been taken to reduce these effects. Consequently, the assessment of trenchless method noise focuses on receptors within 200m of a potential entry pit location.

13.8.10 Calculations of trenchless method noise indicate the SOAEL would be exceeded at R29 and R30. These receptors would experience significant noise effects if trenchless methods are required at night. However, it should be noted that this identification of a likely significant effect is precautionary as it is expected that trenchless activities outside of the daytime period would only be required if there is a clear and obvious benefit, such as for safety reasons or to avoid daytime disruption to many people or, in the case of the East Midlands Railway if required by the asset owner.

13.8.11 The hierarchy of mitigation measures for trenchless activities listed in paragraph 13.7.9 will ensure that trenchless method activity noise effects will be reduced as far as reasonably practicable. This hierarchy includes the use of acoustic fencing which, if required, could provide up to 10dB of noise attenuation. Consequently, noise from trenchless activities at locations R29 and R30 would reduce to below the night-time SOAEL of 55dB LAeq,T and noise effects be **not significant**.

13.8.12 For all works that are undertaken outside core work periods, a Section 61 consent (Control of Pollution Act, Ref 1-9) would be voluntarily applied for and will contain details on the methodology, mitigation, communication strategy and monitoring. If Section 61 consent is not applied for, it will be

open for the local authority to serve a notice pursuant to Section 60 of that Act specifying actions to control noise if it considers it appropriate to do so, in accordance with the terms of that provision. It is not a pre-requisite for Section 61 consent to be in place at any time for the purposes of construction or operation of the Scheme although it is common practice for such applications to be made in advance.

Construction and Decommissioning Vibration Effects

13.8.13 It is generally accepted by vibration experts that, without a highly detailed understanding of the media, waveform, and frequency distribution, ground-borne vibration prediction methods are "*beset with complexities and uncertainties*" (Ref 1-16). However, it is unlikely that typical construction and decommissioning working routines would generate levels of vibration at local receptors at a level where cosmetic damage would be expected to be sustained or cause adverse effects for local residents. The level of impact at different receptors will be dependent upon a number of factors including distance between the works, ground conditions and the specific activities being undertaken. Consequently, vibration effects are defined with reference to information in guidance documents identified in the following paragraph.

13.8.14 Surface plant, such as cranes, compressors and generators, are not recognised as sources of high levels of ground-borne vibration. Reference to Figure C2 of 'Control of Vibration and Noise During Piling' (Ref 1-17) confirms that Peak Particle Velocity (PPV) values significantly less than 5mm/s are generated by such machinery, even at distances of only 10 m. For example, the indication is that a bulldozer would generate a PPV of approximately 0.6mm/s and a "*heavy lorry on [a] poor road surface"* would generate a PPV of less than 0.1mm/s at 10m. These values are well below levels at which cosmetic building damage are predicted to occur; the lower levels being 15mm/s for predominantly transient vibrations and 7.5mm/s for continuous vibrations at the base of residential or lighter framed commercial buildings. The aforementioned values are also below the 1.0mm/s SOAEL (see **Table 13-6**) where it is likely that vibration in residential environments will result in complaints but can be tolerated if prior warning and explanation is given to residents.

13.8.15 It has been assumed, based on construction requirements for similar projects, that Cased Continuous Flight Auger (CCFA) piling may be required for construction of the on-site substations (NGA1), Solar Stations (NGA2) and solar PV panels (NGA3). Analysis of historic BS 5228-2 CFA piling data (see **Appendix 13-4: Noise Modelling** of this ES **[EN010142/APP/6.2]**) identifies the PPV SOAEL at approximately 15m and the PPV LOAEL at approximately 40m.

13.8.16 No receptors are within 40m of the on-site substations or any Solar Stations.

13.8.17 No receptors are within 15m of a solar PV area; however, R10 and R12 are within 40m and may experience PPV levels exceeding the LOAEL for temporary periods.

13.8.18 The highest levels of vibration that would be generated by cable laying activities (NGA4) would be the use of vibratory roller during reinstatement. Vibratory rollers may generate adverse levels of vibration (i.e., exceeding

0.3mm/s) at receptors within 50m and significant levels of vibration (i.e., exceeding 1.0mm/s) at receptors within 25m.

13.8.19 Receptors within 25 and 50m of the Cable Route Corridor are identified as R27, R28, R30, R31, R32 and R33. These may experience PPV levels exceeding the LOAEL for temporary periods.

13.8.20 Receptors within 25m of the Cable Route Corridor are identified as R18 and R23. These receptors may experience PPV levels exceeding the SOAEL for temporary periods.

13.8.21 As stated in **Table 13-6**:

"It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents".

13.8.22 For PPV vibration levels anticipated to exceed 1.0mm/s, prior warning will be provided on the timings and duration of vibration generating activities. This will be secured through the **Framework CEMP [EN010142/APP/7.8]** and **Framework DEMP [EN010142/APP/7.10]**, which will be secured through the DCO. Given the short duration of these activities affecting individual receptors (no longer than a day), prior warning is considered sufficient to offset significant effects.

13.8.23 Similar levels of vibration to piling may be generated by trenchless activities (NGA5). As the nearest receptor to areas of the Cable Route Corridor where trenchless activities may take place is also approximately 110m away, ground borne vibration is unlikely to be an issue during trenchless activities.

13.8.24 Accordingly, at this stage, it is anticipated that all construction and decommissioning vibration effects at nearby sensitive receptors would be **not significant**.

Construction and Decommissioning Traffic Noise Effects

13.8.25 The potential changes in road traffic noise from these roads as a result of the Scheme have been considered by calculating a CRTN BNL at 10m next to roads within the CRTN prediction range and comparing the change. **Table 13-15** presents the results of the assessment.

Table 13-15: Construction and Decommissioning Traffic Noise Assessment

Road ID	Road	Baseline BNL dB	Baseline and Construction Traffic BNL dB	Change in Traffic Noise Level, dB	Effect Level
Rd1	A631, West of School Lane	71.9	72.3	+0.4	Negligible
Rd1	A631, East of Minor Access South	71.1	71.9	+0.8	Negligible

Road ID	Road	Baseline BNL dB	Baseline and Construction Traffic BNL dB	Change in Traffic Noise Level, dB	Effect Level
Rd1	A631, West of Minor Access South	70.9	72.1	+1.2	Minor Adverse
Rd1	A631, West of B1398	70.5	71.9	+1.4	Minor Adverse
Rd1	B1398, North of A631	68.9	69.0	+0.1	Negligible
Rd2	A631, East of B1398	69.9	71.7	+1.8	Minor Adverse
Rd3	B1398, South of A631	67.6	69.0	+1.4	Minor Adverse
Rd4	A631, Hanover Hill, West of Spital Lane	69.8	71.8	+2.0	Minor Adverse
Rd5	A15, North of Spital Lane	74.6	75.0	+0.4	Negligible
Rd6	A631, East of A15	69.9	70.0	+0.1	Negligible
Rd7	A15, South of A631	74.9	75.2	+0.3	Negligible
Rd8	High Street, West of B1241	63.6	66.3	+2.7	Minor Adverse
Rd9	B1241, South of Cot Garth Lane	66.9	69.2	+2.3	Minor Adverse
Rd10	B1241, North of Fleets Road	63.9	67.1	+3.2	Moderate Adverse
Rd11	Tillbridge Road, West of Thorpe Lane	69.9	71.7	+1.8	Minor Adverse
Rd12	Stow Park Road, East of Adams Way	68.9	71.0	+2.1	Minor Adverse
Rd13	High Street, South of Willingham Road	69.7	70.0	+0.3	Negligible

Road ID	Road	Baseline BNL dB	Baseline and Construction Traffic BNL dB	Change in Traffic Noise Level, dB	Effect Level
Rd14	High Street, South of Wapping Lane	69.3	70.6	+1.3	Minor Adverse
Rd15	Cottam Road, East of Westbrecks Lane	63.8	68.7	+4.9	Moderate Adverse

13.8.26 It is anticipated that the primary construction activities along the Cable Route Corridor will progress at approximately 100m per day. Cable installation and cable jointing bays will follow behind excavation in the same sequence. The construction compounds are located between 2 and 5km apart along the Cable Route Corridor and therefore any one access would only be utilised for up to two months for the primary construction activities, excluding cabling and jointing bays activities. Therefore, impacts for sensitive receptors along the local highway network would only be experienced for a maximum of two months as a result of the primary construction activities (excluding cabling and jointing bays).

13.8.27 Temporary changes in noise due to construction traffic at the majority of roads are identified as ranging from Negligible to Minor Adverse and **not significant**. The exception to this is at receptors along the B1241, North of Fleets Road and Cottam Road, East of Westbrecks Lane, which are predicted to experience temporary Moderate Adverse effects for a duration of approximately two months, which are **significant**.

13.8.28 Changes in road traffic noise have only been calculated from roads with flows of greater than 1,000 Average Annual Weekday Traffic (AAWT). This is because the CRTN (Ref 1-6) calculations are unreliable for traffic flows below an AAWT of 1,000. Consequently, a qualitative assessment of potential construction traffic noise effects has been undertaken based on average hourly construction traffic flows.

13.8.29 HGV movements will be distributed evenly across a 10-hour window. The average hourly number of HGV movements forecast on low-flow trafficked roads are presented in **Table 13-16**.

Table 13-16: Average Hourly HGV Movements on Low-flow Roads

Road ID	Road	Average HGV Movements per Hour
Rd16	School Lane, South of A631	7
Rd17	Cow Lane, East of Common Lane	13
Rd18	Fillingham Lane, East of Farm Track	40

Road ID	Road	Average HGV Movements per Hour
Rd19	Kexby Lane, East of Upton Road	13
Rd20	Headstead Bank, South of Broad Lane	29

13.8.30 The highest number of average hourly vehicle movements along a low traffic flow road is 29 and 40 movements per hour on Fillingham Road and Headstead Bank, respectively. This level of construction traffic may cause disturbance and result in a significant effect due to potential for receptors "*having to keep windows closed most of the time because of the noise*" (referenced from PPGN noise exposure hierarchy table – reproduced in **Appendix 13-1** of this ES **[EN010143/APP/6.2]**. Whilst this level of construction traffic is identified as significant, the intensity of movements is not such that would warrant a Major Adverse effect. Consequently, construction traffic on Fillingham Lane, East of Farm Track and Headstead Bank, South of Broad Lane would result in a temporary Moderate Adverse effect for a duration of approximately two months, which is significant.

13.8.31 Construction traffic on all other low-flow roads is not sufficient enough to be considered significant; however, disturbance may result in receptors "*having to close windows for some of the time because of the noise*" referenced from PPGN noise exposure hierarchy table – reproduced in **Appendix 13-1: Noise and Vibration Legislation and Policy** of this ES **[EN010142/APP/6.2]**). This level of effect is equivalent to a temporary **Minor Adverse effect** and **not significant**.

Operation

13.8.32 For the assessment of operational noise during the daytime (07:00 to 19:00 hours) the typical background level has been defined from a Weekend daytime period with lower noise levels compared to a weekday, as to provide a worst-case assessment scenario. It has been assumed that all plant is in operation continuously during the daytime.

13.8.33 There is not anticipated to be any noticeable impulsive or intermittent characteristics from plant noise emissions experienced at the surrounding receptors. Transformers within the BESS compound can have tonal features, although noise emissions from the BESS will be dominated by the cooling fans such that any tonal features of the transformers will not be noticeable. However, overall plant noise emissions experienced at receptors will likely be perceived as a distinctive continuous and steady hum; therefore a 3dB correction to account for noise that is 'distinctive against the residual acoustic environment' has been applied in determining the rating level.

13.8.34 Details of the calculations are provided in **Appendix 13-4: Noise Modelling** of this ES **[EN010142/APP/6.2]**.

13.8.35 As the night-time period provides the most onerous assessment criteria and operational noise is assumed to be constant as a worst-case assumption, the assessment presented in **Table 13-17** only considers night-time periods with all items of plant operating, as a worst-case assessment.

Table 13-17: Operational Noise Effects

Receptor Reference	Background Sound Level $L_{A90,T}$	LOAEL / SOAEL	Predicted Rating Level, $L_{Aeq,Tr}$, dB
Below LOAEL			
R1	27	30 / 40	29
R4	25	30 / 40	28
R5	25	30 / 40	29
R6	23	30 / 40	25
R14	23	30 / 40	27
R39	25	30 / 40	26
NR1	23	30 / 40	22
NR2	25	30 / 40	27
NR3	25	30 / 40	21
Above or equal to LOAEL and below SOAEL			
R2	25	30 / 40	37
R3	25	30 / 40	30
R7	27	30 / 40	39
R8	25	30 / 40	33
R9	25	30 / 40	31
R10	24	30 / 40	36
R11	24	30 / 40	34
R12	26	30 / 40	37
R13	26	30 / 40	31
R15	25	30 / 40	31
R26	23	30 / 40	30
Above or equal to SOAEL			
No exceedances of SOAEL have been predicted			

13.8.36 At receptors R1, R4, R5, R6, R14, R39, NR1, NR2 and NR3, operational noise is below the LOAEL, indicating no adverse impact. At all other receptors, the LOAEL is exceeded, however, the SOAEL is not exceeded at any location, indicating non-significant adverse impacts. No significant impacts are predicted. The NPSE states that:

"…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur".

13.8.37 Reasonable steps to reduce noise are covered in **Section 13.7** and have been applied in noise predictions. Consequently, although adverse levels of noise are identified at some receptors, NPSE requirements are complied with through provision of embedded mitigation.

13.9 Additional Mitigation and Enhancements

Additional Mitigation

13.9.1 No additional measures are proposed to mitigate noise and vibration emissions during the construction phase following the above embedded measures, given that there are not expected to be any significant effects as a result of the Scheme.

13.9.2 Where significant construction and decommissioning traffic noise effects have been identified (at paragraphs 13.8.27 and 13.8.30) per the standardised modelling undertaken, it is considered these effects are addressed when applying the context and nature of the construction and decommissioning traffic and phasing to be undertaken. The construction of the Cable Route Corridor will be undertaken in four concurrent phases over the 24-month programme. It is anticipated that each phase would have a dedicated team for the trenched cable element and there would be an additional two teams dedicated to construction of the trenchless crossings. The detailed sequencing will be determined by the principal contractor, once appointed, however, it is anticipated that one team would start at National Grid Cottam Substation and one at on-site Substation B within the Principal Site with the other two starting at separate points along the Cable Route Corridor. The individual cable route corridor teams will travel to construction compounds within their dedicated works area and therefore, there will be limited overlap of construction traffic along the local highway network by the construction teams. The only overlap of teams along the local highway network would be where two work areas join.

13.9.3 A method of scheduling construction traffic from different work teams so they do not overlap is secured in the **Framework CEMP [EN010142/APP/7.8]** and the **Framework DEMP [EN010142/APP/7.10]**. The secured avoidance of the overlap of this construction traffic is considered sufficient mitigation to address any potential of the identified significant effects.

13.9.4 No additional mitigation measures are proposed for the operational phase following the above embedded measures, given that there are not expected to be any significant effects as a result of the Scheme.

Enhancements

13.9.5 No enhancement measures are proposed during construction, operation or decommissioning following the incorporation of the embedded measures described above.

13.10 Residual Effects

13.10.1 This section summarises the residual effects of the Scheme on Noise and Vibration following the implementation of embedded and additional mitigation.

13.10.2 Significant residual effects are defined in accordance with national noise policy as an exceedance of the SOAEL. The SOAELs for each assessment topic are defined in **Table 13-5** (Scheme construction and decommissioning noise), **Table 13-6** (Scheme construction and decommissioning vibration) and **Table 13-9** (Scheme operation). The exception to this is the assessment of construction traffic noise, which is assessed as the magnitude of change of road traffic noise (see **Table 13-8**).

13.10.3 No exceedances of the SOAEL are predicted during NGA1, NGA2, NGA3 and NGA4 construction and decommissioning activities and therefore residual effects remain as in the assessment of likely effects – **not significant**.

13.10.4 There would be no exceedances of SOAEL due to trenchless method activities (NGA5) and therefore the residual effects remain as presented in the assessment of likely effects – **not significant**.

13.10.5 The construction traffic noise assessment assumes that, as a worst-case, there is potential for significant noise arising from construction traffic if each of the three construction teams cumulatively used the same routes. With the mitigation measures secured in the CEMP to ensure no overlap of construction team traffic, average HGV movements along roads in **Table 13-16** would be, at worst, 14 movements per hour. As discussed in paragraph 13.8.31, this level of traffic would be equivalent to a temporary **minor adverse** effect and **not significant**. Similarly, ensuring no overlap of construction traffic would result in effects at receptors along B1241, North of Fleets Road and Cottam Road, East of Westbrecks Lane being reduced to **minor adverse** and **not significant**.

13.10.6 At receptors adjacent to all other construction traffic routes, residual effects would be **not significant**.

13.10.7 No exceedances of the SOAEL are predicted during the decommissioning phase and therefore residual effects remain as in the assessment of likely effects – **not significant**.

13.10.8 No exceedances of the SOAEL are predicted during the operational phase and therefore residual effects remain as in the assessment of likely effects – **not significant**.

Table 13-18: Residual effects – Noise and Vibration (construction and decommissioning)

Receptor	Description of impact	Embedded mitigation	Significance of effect with embedded mitigation	Additional mitigation/enhancement measures	Residual effect
Residential receptors: R1–R39	Temporary noise emissions due to on-site substation construction activities (NGA1)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Non-residential receptors: NR1-NR3	Temporary noise emissions due to on-site substation construction activities (NGA1)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Residential receptors: R1–R39	Temporary noise emissions due to Solar Station construction activities (NGA2)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Non-residential receptors: NR1-NR3	Temporary noise emissions due to Solar Station construction activities (NGA2)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Residential receptors: R1, R6, R10, R12, R13	Temporary noise emissions due to solar PV panel construction activities (NGA3)	As set out in Section 13.7	Above or equal to LOAEL and below SOAEL (not significant)	As set out in Section 13.9	Not significant
Residential receptors: R2–R5, R7-R9, R11, R14-R39	Temporary noise emissions due to solar	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant

Receptor	Description of impact	Embedded mitigation	Significance of effect with embedded mitigation	Additional mitigation/enhancement measures	Residual effect
	PV panel construction activities (NGA3)				
Non-residential receptors: NR1-NR3	Temporary noise emissions due to solar PV panel construction activities (NGA3)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Residential receptors: R23, R24	Temporary noise emissions due to cable laying activities (NGA4)	As set out in Section 13.7	Above or equal to LOAEL and below SOAEL (not significant)	As set out in Section 13.9	Not significant
Residential receptors: R1-R22, R25-R39	Temporary noise emissions due to cable laying activities (NGA4)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Non-residential receptors: NR1-NR3	Temporary noise emissions due to cable laying activities (NGA4)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Residential receptors: R17, R19, R29, R30	Temporary noise emissions due to trenchless method activities (NGA5)	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Road Link: Rd10, Rd15, Rd18, Rd20	Temporary noise emissions due to construction traffic	As set out in Section 13.7	Moderate Adverse (significant)	Scheduling of construction traffic so there is no overlap between different work teams as set out in **Section 13.9**	Not significant

Receptor	Description of impact	Embedded mitigation	Significance of effect with embedded mitigation	Additional mitigation/enhancement measures	Residual effect
All receptors	Temporary vibration due to NGA1, NGA2, NGA3, NGA4, NGA5	As set out in **Section 13.7**	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Road Link: Rd1, Rd2, Rd3, Rd4, Rd8, Rd9, Rd11, Rd12, Rd14, Rd16, Rd17, Rd19	Temporary noise emissions due to construction traffic	As set out in Section 13.7	Minor Adverse (not significant)	As set out in Section 13.9	Not significant
Road Link: Rd1, Rd5, Rd6, Rd7, Rd13	Temporary noise emissions due to construction traffic	As set out in Section 13.7	Negligible (not significant)	As set out in Section 13.9	Not significant

Table 13-19: Residual effects – Noise and Vibration (operation)

Receptor	Description of impacts including duration	Embedded mitigation	Significance of effect with embedded mitigation	Additional mitigation/enhancement measures	Residual effect
Residential receptors: R1, R4, R5, R6, R14, R39	Permanent noise emissions from the Scheme infrastructure	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Non-residential receptors: NR1-NR3	Permanent noise emissions from the Scheme infrastructure	As set out in Section 13.7	Below LOAEL (not significant)	As set out in Section 13.9	Not significant
Residential receptors: R2, R3, R7, R8, R9, R10, R11, R12, R13, R15 and R26	Permanent noise emissions from the Scheme infrastructure	As set out in Section 13.7	Above or equal to LOAEL and below SOAEL (not significant)	As set out in Section 13.9	Not significant

13.11 Cumulative Effects

13.11.1 An assessment of cumulative effects is provided in **Chapter 18: Cumulative Effects and Interactions** of this ES **[EN010142/APP/6.1]**.

13.12 References

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Ref 1-2 Ministry of Housing, Communities & Local Government (2019); Planning Practice Guidance - Noise. Available at: https://www.gov.uk/guidance/noise--2 [Accessed 19 December 2023]

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Ref 1-4 British Standards Institute (2014) BS 5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites.– Part 1: Noise. London: BSI.

Ref 1-5 British Standards Institute (2014) BS 5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites.– Part 2: Vibration. London: BSI.

Ref 1-6 Department of Transport/Welsh Office (1988), Calculation of Road Traffic Noise. Her Majesty's Stationery Office, London.

Ref 1-7 British Standards Institute (2003) BS 7445 – Description and environment of environmental noise – Part 1: Guide to quantities and procedures. London: BSI.

Ref 1-8 British Standards Institute (2019) BS 4142:2014+A1:2019 – Methods for rating and assessing industrial and commercial sound. London: BSI.

Ref 1-9 Her Majesty's Stationery Office (1974); Control of Pollution Act. Available at https://www.legislation.gov.uk/ukpga/1974/40 [Accessed 16 January 2024]

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Ref 1-11 Highways England (2020); Design Manual for Road and Bridges LA111: Noise and Vibration, Revision 2.

Ref 1-12 International Organisation for Standardisation (ISO) (1996) ISO 9613 Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation. Switzerland: ISO

Ref 1-13 Acoustics & Noise Consultants (ANC) (2020) BS 4142:2014+A1:2019 Technical Note, Version 1.0

Ref 1-14 British Standards Institute (2014); BS 8233 – Guidance on sound insulation and noise reduction for buildings, BSi, London.

Ref 1-15 World Health Organization (1999); Guidelines for Community Noise.

Ref 1-16 Hiller, D. M., and G. I. Crabb, (2000); Groundborne Vibration Caused by Mechanised Construction Works. TRL Report 429.

Ref 1-17 Selby, A.R. (1997). "Control of vibration and noise during piling." Brochure publication, British Steel, UK