



SUNNICA ENERGY FARM

Preliminary Environmental Information Report

Chapter 11: Noise and Vibration

Sunnica Ltd

AUGUST 2020



Contents

11	Noise and Vibration	1
11.1	Introduction.....	1
11.2	Legislation and Planning Policy	1
11.3	Assessment Assumptions and Limitations.....	6
11.4	Assessment Methodology	10
11.5	Stakeholder Engagement.....	19
11.6	Baseline Conditions.....	25
11.7	Design Measures and Impact Avoidance	26
11.8	Assessment of Likely Impacts and Effects	28
11.9	Additional Mitigation and Enhancement Measures.....	35
11.10	Residual Effects.....	35
11.11	Cumulative Effects.....	36
11.12	References	38

Tables

Table 11-1	Planning Practice Guidance noise exposure hierarchy.....	4
Table 11-2	Construction plant per site – Sunnica West Sites A and B	8
Table 11-3	Construction plant per site – Sunnica East Sites A and B.....	9
Table 11-4	Construction plant – Cable routes.....	10
Table 11-5	Sensitive receptor locations	11
Table 11-6	Noise monitoring locations.....	12
Table 11-7	Receptor Sensitivity	13
Table 11-8	Criteria for of magnitude impacts for construction and decommissioning noise.....	15
Table 11-9	Criteria for of magnitude impacts for construction and decommissioning vibration (human response).....	15
Table 11-10	Transient vibration guide values for cosmetic damage (building response)	16
Table 11-11	Criteria for of magnitude impacts for construction and decommissioning traffic noise.....	17
Table 11-12	Criteria for of magnitude impacts for fixed plant noise	18
Table 11-13	Classification of effects	19
Table 11-14	Key consultation responses to main matters	19
Table 11-15	Summary of long-term noise monitoring results.....	26
Table 11-16	Summary of short-term noise monitoring results	26
Table 11-17	Construction noise assessment	28
Table 11-18	Construction traffic noise assessment	30
Table 11-19	Operational noise assessment – Daytime periods.....	32
Table 11-20	Operational noise assessment – Night/Early morning/Late evening periods	32
Table 11-21	Summary of Magnitude of Impact and Significance of Effect.....	34
Table 11-22	Summary of Residual Effects during Construction and Decommissioning.....	35
Table 11-23	Summary of Residual Effects during Operation	36
Table 11-24	Cumulative Developments within 500m of the Scheme	36

11 Noise and Vibration

11.1 Introduction

- 11.1.1 This chapter of the PEI Report presents the findings of an assessment of the likely significant effects from Noise and Vibration as a result of the Scheme. For more details about the Scheme, refer to **Chapter 2: Scheme Location** and **Chapter 3: Scheme Description**.
- 11.1.2 This chapter identifies and proposes measures to address the potential impacts and likely significant effects of the Scheme on noise and vibration, during the construction, operation and decommissioning phases of the Scheme.
- 11.1.3 It assesses noise and vibration effects on human receptors and excludes assessment of noise and vibration on ecological or heritage receptors. In-combination effects on local ecological or heritage receptors due to the introduction of the proposed development are assessed in **Chapter 7: Cultural Heritage** and **Chapter 8: Ecology**.
- 11.1.4 A glossary of acoustic terminology is provided in **PEI Report Volume 2: Appendix 11A**.
- 11.1.5 This chapter is supported by the following figures in Volume 3:
- Figure 11-1: Site Boundary, Receptor Locations, and Noise Monitoring Positions
 - Figure 11-2: Noise Contour Plot – Construction Noise
 - Figure 11-3: Noise Contour Plot – Construction Traffic Noise
 - Figure 11-4: Noise Contour Plot – Operational Noise

11.2 Legislation and Planning Policy

- 11.2.1 This section provides an overview of the legislative and planning policy framework against which the Scheme will be considered for noise and vibration. These policies identify the need for a site-specific noise assessment to consider the impacts of construction / decommissioning and operational phase noise on local noise-sensitive receptors.

Legislation

Control of Pollution Act 1974

- 11.2.2 The Control of Pollution Act 1974 (CoPA) (Ref 11-1) requires that Best Practicable Means (BPM), as defined in section 72 of the CoPA, are adopted to control construction noise on any given site. Sections 60 and 61 of the CoPA provide the main legislation regarding enabling works and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the Local Authority with instructions to cease work until specific conditions to reduce noise have been adopted.

- 11.2.3 Section 61 of the CoPA provides a means to apply for prior consent to carry out noise generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on-site.
- 11.2.4 A Construction and Environmental Management Plan (CEMP) will be secured through the DCO application and will set out the Project's position on obtaining Section 61 consents.
- 11.2.5 Construction noise and vibration related assessments are presented in section 11.8.1 to 11.8.18 of this PEI Report.

Environmental Protection Act 1990

- 11.2.6 The Environmental Protection Act 1990 (EPA) (Ref 11-2) prescribes a statutory nuisance as noise (and vibration) emitted from premises (including land) that is prejudicial to health or a nuisance.
- 11.2.7 Local Authorities are required to investigate any public complaints of noise, and if they are satisfied that a statutory nuisance exists, or is likely to occur or recur, they must serve a noise abatement notice. A notice is served on the person responsible for the nuisance. It requires either simply the abatement of the nuisance or works to abate the nuisance to be carried out, or it prohibits or restricts the activity.
- 11.2.8 In determining if a noise complaint amounts to a statutory nuisance the Local Authority can take account of various guidance documents and existing case law as no statutory noise limits currently exist for defining a statutory nuisance. Demonstrating the use of BPM to minimise noise levels is an accepted defence against a noise abatement notice.
- 11.2.9 The DCO application will include a Statement of Statutory Nuisance, which will be informed by the noise and vibration chapter of the Environmental Statement.
- 11.2.10 Operational noise assessments are presented in section 11.8.19 to 11.8.28 of this PEI Report.

National Planning Policy

- 11.2.11 As outlined in **Section 1.3** of **Chapter 1: Introduction**, the EIA for the Scheme must have regard to the relevant policies of the NPPF and relevant NPSs. Key aspects of the NPPF and relevant NPSs, which have been considered during the development of this chapter, are outlined below
- NPS EN-1 (Ref 11-3), with particular reference to Section 5.11 and Paragraphs 5.11.4 to 5.11.7, in relation to the assessment of noise;
 - NPS EN-3 (Ref 11-4) with particular reference to Paragraphs 2.4.2, in relation to the design of a project to mitigate noise impacts;
 - NPS EN-5 (Ref 11-5), with particular reference to Section 2.9 and Paragraphs 2.6.8 to 2.9.9, in relation to rain-induced noise on overhead transmission lines; and
 - NPPF (Ref 11-7), with particular reference to Paragraph 170 and 180.

Noise Policy Statement for England

11.2.12 The National Policy Statement for England (NPSE) (Ref 11-6) seeks to clarify the underlying principles and aims in existing policy documents, legislation, and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

11.2.13 The NPSE sets out the long-term vision of the government's noise policy, which is to *"promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development"*.

11.2.14 This long-term vision is supported by three aims:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *"Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvements of health and quality of life."*

11.2.15 The 'Explanatory Note' within the NPSE provides further guidance on defining 'significant adverse effects' and 'adverse effects' using the concepts:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

11.2.16 With reference to the SOAEL, the NPSE states:

"It is recognised that 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. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

11.2.17 For situations where noise levels are between the LOAEL and SOAEL, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur.

11.2.18 LOAEL and SOAEL are defined in this PEI Report in sections 11.4.11 (construction and decommissioning noise), 11.4.13 (construction and decommissioning vibration), 11.4.17 (construction and decommissioning traffic noise), and 11.4.21 (operational noise).

National Guidance

Planning Practice Guidance Noise

11.2.19 The Planning Practice Guidance concerned with noise (PPG) (Ref 11-8) advises that

“Noise needs to be considered when development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced)”

11.2.20 It also provides guidelines that are designed to assist with the implementation of the NPPF.

11.2.21 The PPG states that local planning authorities should take account of the acoustic environment and in doing so consider:

- “whether or not a significant adverse effect is occurring or likely to occur;
- whether or not an adverse effect is occurring or likely to occur; and
- whether or not a good standard of amenity can be achieved.”

11.2.22 Factors to be considered in determining whether noise is a concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise, and cumulative effects.

11.2.23 Further details on the hierarchy of noise effects are presented in Table 11-1, which has been reproduced from PPG.

Table 11-1 Planning Practice Guidance noise exposure hierarchy

<i>Perception</i>	<i>Examples of Outcomes</i>	<i>Increasing Effect Level</i>	<i>Action</i>
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life	No Observed Adverse Effect	No specific measures required

Lowest Observed Adverse Effect Level

<i>Perception</i>	<i>Examples of Outcomes</i>	<i>Increasing Effect Level</i>	<i>Action</i>
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Local Planning Policy

- East Cambridgeshire District Local Plan Adopted April 2015 (Ref 11-9), with particular reference to Policy ENV 9: Pollution;
- East Cambridgeshire District Council SPD Renewable Energy Development (Commercial Scale) October 2014 (Ref 11-11) with reference to protecting residential amenity; and

- Forest Heath and St Edmundsbury Councils: Joint Development Management Policies Document (last updated February 2015) (Ref 11-13) with particular reference to Policy DM2: Creating Places - Development Principles and Local Distinctiveness and DM14: Protecting and Enhancing Natural Resources, Minimising Pollution and Safeguarding from Hazards.

11.3 Assessment Assumptions and Limitations

- 11.3.1 This preliminary assessment is based on baseline and design information available at the time of writing this PEI Report. A full assessment is being undertaken as part of the EIA and will be reported in the ES that will be submitted with the DCO application.
- 11.3.2 The measured ambient sound levels (taken in November 2019) have been considered as representative of the future baseline scenarios, with construction anticipated to commence in 2022 with a peak in 2023, operation to commence in 2025 and decommissioning to commence in 2065. No major developments (e.g. highway or railway schemes, industrial facilities) are currently understood to be proposed in the area that are likely to notably alter the local noise environment.
- 11.3.3 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, 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 such a measurement survey.
- 11.3.4 Construction noise predictions have been undertaken using the computer modelling software CadnaA® (v2019) (Ref 11-14), based on an example schedule of plant items that are typically used in such developments for the purposes of carrying out a quantitative assessment at this stage. Construction plant associated with the Sunnica West Sites A and B, Sunnica East Sites A and B, and Cable Routes are summarised in Table 11-2, Table 11-3 and Table 11-4.
- 11.3.5 Predictions have been undertaken using BS 5228:2014+A1:2019 'Code of practice for noise and vibration control on construction and open sites' (Ref 11-15) methodologies and AECOM library data of sound sources associated with the proposed construction activities. These sound sources are taken to be representative of the plant and/or activities that will be used during the construction process of the Scheme. Noise predictions were carried out to represent a conservative scenario where construction plant is operational nearest to the identified receptors and does not take into account quieter periods when limited activities take place or at farther distances. Consequently, noise predictions may overestimate construction

noise levels and are therefore be considered to be a reasonable likely worst case.

- 11.3.6 Noise effects during the decommissioning phase of the Scheme will be similar or less than noise effects during the construction phase. The noise assessment presented for the construction phase is therefore considered representative (or an overestimate) of the decommissioning phase. As such a separate assessment for noise from the decommissioning phase is not included.
- 11.3.7 Noise predictions of construction vehicle movements have been undertaken using CadnaA®, which implements the calculation procedures of Calculation of Road Traffic Noise (1988) (Ref 11-16). **Chapter 13: Transport and Access** advises that the AM and PM Scheme peak hours during construction has been assessed as 06:00 to 07:00 and 19:00 to 20:00 respectively which reflects the arrival and departure times of the staff. **Chapter 13: Transport and Access** concludes that the residual effects of construction traffic would result in no increase in traffic on the surrounding road network during the highway peak hours; with regards to noise this indicates that there will be no associated noise level increases with construction traffic limited to AM and PM peak hours only. In order to provide a worst-case assessment of construction traffic noise effects, changes in noise levels due to construction traffic has been considered during non-peak hours (i.e. between 07:00 and 19:00 hours) when existing road traffic noise levels would be lower and construction traffic noise more noticeable.
- 11.3.8 Noise predictions of the operational Scheme have been undertaken using CadnaA®, which implements the calculation procedures of ISO 9613 'Acoustics – Attenuation of Sound During Propagation Outdoors' (Ref 11-17), 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.
- 11.3.9 A series of assumptions were made for the generation of the construction and operation noise models which are discussed below.
- Digital noise modelling of the operational Scheme has been based on the parameters set out in the drawings, plans, and construction and operation details as set out in **Chapter 3: Scheme Description**;
 - Sound level data for construction plant has been based on BS 5228-1 example data and AECOM library data;
 - Vehicle movements on access routes to the Sunnica East Site A, Sunnica East Site B, Sunnica West Site A, Sunnica West Site B, and Burwell National Grid Substation Extension as described in **Chapter 3: Scheme Description** have assumed a 30 km/h speed with up to 40 heavy goods vehicles (HGVs) and approximately 240 light vehicles accessing and egressing each Site (equivalent 560 movements per day in total) for a representative worst case day during the construction stage (noting that operational traffic noise and vibration has been scoped out).

- Sound level data for operational noise-producing plant (i.e. inverters, transformers and BESS units, but not solar panels or overhead cables) has been based on industry sound pressure level measurement data (see **PEI Report Volume 2: Appendix 11D**);
- All plant items have been modelled as point sources with sound propagating uniformly in all directions, at a standard height of 1m above local ground level;
- Surrounding ground conditions have been modelled as soft (G=1.0);
- Air temperature was assumed to be 10 degrees and humidity 70%;
- One order of reflection was modelled;
- Land topography has been incorporated into the noise modelling;
- All receptor points have been set at a standard height of 1m above local ground levels; and
- Building massing in the surrounding area outside of the DCO Site boundary has been sourced from Ordnance Survey Open Map (Ref 11-18) and modelled with a standard height of 6m.

Table 11-2 Construction plant per site – Sunnica West Sites A and B

<i>Plant</i>	<i>Site preparation</i>	<i>Civil works</i>	<i>Structures</i>	<i>Panels</i>	<i>Electrical works</i>	<i>CCTV</i>	<i>Internal Substations</i>
Compact excavator	-	2	7	7	3	2	-
Mobile crane	1	-	-	-	3	-	1
Crawled Dozer	1	1	-	-	-	-	1
Excavator	1	7	-	-	-	-	1
Mini Excavator	-	1	-	-	-	1	1
Push press piling rig	-	-	12	-	-	-	-
Power generator	3	-	-	-	-	-	1
Telehandler	-	-	7	7	-	2	1
Truck	-	12	-	-	-	-	3
Vibrating roller	1	3	-	-	-	-	-

<i>Plant</i>	<i>Site preparation</i>	<i>Civil works</i>	<i>Structures</i>	<i>Panels</i>	<i>Electrical works</i>	<i>CCTV</i>	<i>Internal Substations</i>
Wheeled Excavator	-	3	-	-	-	-	1
Compact excavator	-	2	7	7	3	2	-

Table 11-3 Construction plant per site – Sunnica East Sites A and B

<i>Plant</i>	<i>Site preparation</i>	<i>Civil works</i>	<i>Structures</i>	<i>Panels</i>	<i>Electrical works</i>	<i>CCTV</i>	<i>Internal Substations</i>
Compact excavator		2	7	7	3	2	
Mobile crane	2				3		2
Crawled Dozer	2	2					2
Excavator	2	7					2
Mini Excavator		1				1	2
Push press piling rig			12				
Power generator	4						2
Telehandler			7	7		2	2
Truck		12					6
Vibrating roller	2	3					
Wheeled Excavator		3					2
Compact excavator		2	7	7	3	2	

Table 11-4 Construction plant – Cable routes

<i>Plant</i>	<i>Burwell to Sunnica West A</i>	<i>Sunnica West A to Sunnica East B</i>
360 Excavator	3	4
Dumpers	2	4
Sand Hopper and Plough	1	2
Small plant and Cable Winch	2	4

- 11.3.10 An updated assessment of construction and operational phase noise will be undertaken as part of the EIA process and will be reported in the ES that will be submitted with the DCO submission. This will incorporate any changes to Scheme information as presented in this PEI Report.
- 11.3.11 Construction phase vibration has been assessed based on historic vibration measurement data from relevant guidance documents. No predictions of ground-borne vibration propagation have been undertaken.
- 11.3.12 Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 - HD 213/11- Revision 1: Noise And Vibration (2011) (Ref 11-25) states that: *“A change in noise level of 1 dB $L_{A10,18h}$ is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged, and a change in noise level of 3 dB $L_{A10,18h}$ is equivalent to a 100% increase or a 50% decrease in traffic flow”*. It is generally accepted that changes in noise levels of 1 dB(A) or less are imperceptible. Due to the low level of trips associated with the operational phase of the Scheme (refer to **Chapter 13: Transport and Access**) it is anticipated that operational traffic will result in no perceptible changes to overall road traffic noise levels across the study area. As such no further assessment of operational traffic is included in this PEI Report.
- 11.3.13 No major vibration sources are envisaged to be introduced as part of the Scheme and as such there will be no associated operational vibration effects. No further assessment of operational vibration is included in this PEI Report.

11.4 Assessment Methodology

Study Area and Sensitive Receptors

- 11.4.1 For the purposes of providing an assessment of likely significant noise effects the Study Area for the PEI Report has been determined by receptors within 500 m of the DCO Site Boundary. The distance of 500 m has been determined based on feedback from the scoping process.
- 11.4.2 The nearest identified noise-sensitive receptors to the Scheme (and approximate distances from the DCO Site boundary) are presented in Figure 11-1 and summarised in Table 11-5. These receptors have been

determined through the scoping process and agreed with officers from East Cambridgeshire and West Suffolk councils as part of the noise monitoring survey plans.

11.4.3 The locations of these receptors have been considered in both the construction and operational noise assessments and are considered representative of adjacent properties.

Table 11-5 Sensitive receptor locations

<i>Reference</i>	<i>Location</i>	<i>Description</i>	<i>Approx. distance from Scheme boundary</i>
R1	Weirs Grove / Hythe Ln, Burwell, Cambridge CB25 0EH	Residential properties	400 m
R2	Fuller KW & Son farmhouse, Ness Farm, Ness Road B1102, Cambridge CB25 0DB	Residential properties	15 m
R3	Biggin Stud farmhouse, Newmarket Road A142, Fordham, Ely CB7 5WW	Residential properties	100 m
R4	The Green, Snailwell, Newmarket CB8 7LT	Residential properties	300 m
R5	Arran House Stud Bed & Breakfast, Norwich Road, Kennett, Newmarket CB8 7RQ	Hotel, Residential properties	120 m
R6	RF Tillbrook & Sons farmhouse, La Hogue Hall, Ely CB7 5PZ	Residential properties	300 m
R7	Dane Hill Farm, Newmarket, CB8 7QX	Residential properties	120 m
R8	Acacia Close, Red Lodge, Bury Saint Edmunds, IP28 8WS	Residential properties	450 m
R9	Badlingham Road, Ely CB7 5QQ	Residential properties	300 m
R10	Beck Rd, Isleham, Ely CB7 5QP	Residential properties	500 m
R11	East View, Freckenham. Bury Saint Edmunds, IP28 8Hj	Residential properties	30 m
R12	Walnut Grove, Freckenham Road B1102, Worlington, Bury Saint Edmunds IP28 8SJ	Residential properties	20 m

Baseline noise surveys

- 11.4.4 Baseline noise monitoring has been carried out to establish the existing noise climate in the area. The monitoring procedures followed guidance from BS 7445-1:2003 'Description and environment of environmental noise – Part 1: Guide to quantities and procedures' (Ref 11-19) and BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (Ref 11-20). All noise measurements included $L_{Aeq,T}$ and $L_{A90,T}$ sound level indicators.
- 11.4.5 Long-term (LT) unattended noise measurements were undertaken between the 5th to 19th November 2019. Short-term (ST) attended noise measurements were undertaken during the setup of the long-term monitors on the 5th and 12th November 2019. A weather station was set up at LT1 and LT5 for the duration of the noise survey so any periods of adverse weather conditions could be identified and omitted from noise data.
- 11.4.6 Monitoring locations are shown in Figure 11-1 and summarised in Table 11-6 and have been agreed with officers from East Cambridgeshire and West Suffolk councils. Based on their surroundings and relative distance to nearby sound sources (in particular road traffic), the monitoring locations have been allocated as representative of the local noise environment at each of the various noise-sensitive receptors (from Table 11-5).

Table 11-6 Noise monitoring locations

Reference	Measurement Type	Dates	Representative of receptor
LT1	Long-term unattended noise (including frequency spectrum data) and weather (wind, temperature, rainfall)	05/11/2019-12/11/2019	R1
LT2	Long-term unattended noise	05/11/2019-08/11/2019 <i>Measurement finished early due to equipment damage although suitable data collected to establish noise climate at this location.</i>	R3
LT3	Long-term unattended noise	05/11/2019-12/11/2019	R4
LT4	Long-term unattended noise	05/11/2019-12/11/2019	R5, R6, R7
LT5	Long-term unattended noise and weather (wind, temperature, rainfall)	12/11/2019-19/11/2019	R8
LT6	Long-term unattended noise	12/11/2019-19/11/2019	R10
LT7	Long-term unattended noise	12/11/2019-14/11/2019	R9, R11

<i>Reference</i>	<i>Measurement Type</i>	<i>Dates</i>	<i>Representative of receptor</i>
		<i>Measurement finished early due to resident request although suitable data collected to establish noise climate at this location.</i>	
LT8	Long-term unattended noise	05/11/2019-12/11/2019	R12
ST1	Short-term attended noise, daytime <i>Evening/night time measurements not taken as cable works not taking place during those periods and no associated operational effects with the cable route.</i>	05/11/2019 12:00-15:00	R2
ST2	Short-term attended noise, daytime <i>Taken in lieu of a long-term measurement as no safe/secure locations to leave equipment available. LT7 has been used as a representation location for ST2 and receptor R9.</i>	12/11/2019 12:00-15:00	R9

Receptor Sensitivity

11.4.7 Sensitive receptors as listed in Table 11-5 have been classed depending on their use and subsequent sensitivity to noise and vibration. The sensitivity of receptors to noise and vibration has been defined in Table 11-7.

Table 11-7 Receptor Sensitivity

<i>Sensitivity</i>	<i>Description</i>	<i>Examples of receptor usage</i>
Very High	Receptors where noise will significantly affect the function of a receptor.	<ul style="list-style-type: none"> • Auditoria/studios; • Specialist medical/teaching centres; and • Libraries.
High	Receptors where people or operations are particularly susceptible to noise.	<ul style="list-style-type: none"> • Residential and student accommodation; • Hotels; • Places of worship; • Conference facilities; • Schools in daytime; and • Hospitals/residential care homes.

<i>Sensitivity</i>	<i>Description</i>	<i>Examples of receptor usage</i>
Medium	Receptors of low sensitivity to noise, where it may cause some distraction or disturbance.	<ul style="list-style-type: none"> • Liveries, stables and racing schools; • Offices; • Restaurants; and • Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf).
Low	Receptors where distraction or disturbance from noise is minimal.	<ul style="list-style-type: none"> • Residences and other buildings not occupied during working hours; • Factories and working environments with existing high noise levels; and • Sports grounds when spectator or noise is a normal part of the event.

11.4.8 Receptors R1 to R12 comprise a hotel and residential properties; as such they are of high sensitivity.

11.4.9 Users of Public Rights of Way (PROW) have not been considered as sensitive receptors due to the transient nature of users and that they will not be subject to long-term noise exposure. Any noise experienced by PROW users will be limited to when they are in proximity to the Scheme and, for the majority of the tie, PROW users will not be affected by noise.

11.4.10 Note that, as discussed in section 11.4.3, the assessment of noise effects on ecological or built heritage receptors is outside the scope of this chapter.

Construction and Decommissioning Noise

11.4.11 Annex E of BS 5228-1 provides example methods for the assessment of the significance of construction noise effects. Assessment criteria for magnitude of impact due to construction noise is presented in Table 11-8. For assessment purposes, the LOAEL has been set as 65 dB $L_{Aeq,T}$ during the daytime which is equal to the lowest daytime threshold level set out in the BS 5228-1 Annex E.3.2 example 'ABC method' and Annex E.3.3 example '5dB change method'. The SOAEL has been set as 75 dB $L_{Aeq,T}$ during the daytime which is equal to the highest daytime threshold level set out in the ABC method as well as the trigger level at which noise insulation may be offered per Annex BS 5228-1 Annex E.4 'Example of thresholds used to determine the eligibility for noise insulation and temporary rehousing'.

Table 11-8 Criteria for of magnitude impacts for construction and decommissioning noise

<i>Magnitude of Impact</i>	<i>Daytime construction noise level at façade of receptor, $L_{Aeq,T}$</i>
Very Low	< 65 dB
Low	≥ 65 dB to < 70 dB
Medium	≥ 70 dB to < 75 dB
High	≥ 75 dB

Construction and Decommissioning Vibration

- 11.4.12 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, which has been considered for plant items and vehicle movements.
- 11.4.13 Table 11-9 details Peak Particle Velocity (PPV) levels (a standard measure of vibration effects) and their potential effect on humans and provides a semantic scale for description of construction and demolition vibration impacts on human receptors. For assessment purposes, and further to BS 5228, the LOAEL has been set at 0.3 mm/s and the SOAEL at 1.0 mm/s during the daytime. Due to construction working hours being daytime only, evening and night-time disturbance is not likely.

Table 11-9 Criteria for of magnitude impacts for construction and decommissioning vibration (human response)

<i>Magnitude of Impact</i>	<i>PPV Vibration Level</i>	<i>BS 5228-2 Description of Impact</i>
Very Low	< 0.3 mm/s	<i>“Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.”</i>
Low	≥ 0.3 to < 1.0 mm/s	<i>“Vibration might be just perceptible in residential environments.” *</i>
Medium	≥ 1.0 to < 10 mm/s	<i>“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.”</i>
High	≥ 10 mm/s	<i>“Vibration is likely to be intolerable for any more than a very brief exposure to this level.”</i>

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

11.4.14 The recommended PPV vibration limits for transient vibration, above which cosmetic damage could occur for different types of buildings are provided in BS 5228-2 and presented in Table 11-10. For these limits, 'minor damage' is possible at vibration magnitudes that are greater than twice those given in Table 11-10, 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 11-10 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

<i>Type of building</i>	<i>4 Hz to 15 Hz</i>	<i>15 Hz and above</i>
Reinforced or framed structures, Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures, Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz 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.

11.4.15 Given that criteria in Table 11-10 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.

Construction and Decommissioning Traffic Noise

11.4.16 Construction and decommissioning traffic noise have been assessed for a representative worst case day during the construction stage (as discussed in section 11.3.9). Predicted construction traffic noise has been added to measured ambient noise levels at each receptor location so a potential change in noise can be derived.

11.4.17 The temporary changes in road traffic noise levels along the local road network due to construction traffic have been assessed based on guidance from the Institute of Environmental Management and Assessment (IEMA) Guidelines for environmental noise impact assessment (2014) (Ref 11-22).

Assessment criteria are presented in Table 11-11. For assessment purposes the LOAEL has been set as an increase of 1 dB and the SOAEL as an increase of 3 dB.

Table 11-11 Criteria for of magnitude impacts for construction and decommissioning traffic noise

<i>Magnitude of Impact</i>	<i>Difference between pre-baseline and construction traffic noise levels, $L_{Aeq,T}$</i>
Very Low	≥ 0 dB and < 1 dB
Low	≥ 1 dB and < 3 dB
Medium	≥ 3 dB and < 5 dB
High	≥ 5 dB

Operational Noise

11.4.18 Operational noise from fixed plant associated with the Scheme (source data for operational noise emissions is presented in **PEI Report Volume 2: Appendix 11D**) 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. The relevant parameters in this instance are as follows:

- 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 time weighting F and quoted to the nearest whole number of decibels;
- 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
- Rating level – $L_{Ar,Tr}$ – the specific sound level plus any adjustment made for the characteristic features of the noise.

11.4.19 BS 4142 recommends that the specific sound is evaluated during a daytime period (from 07:00 to 23:00 hours) and during a night-time period (from 23:00 to 07:00 hours).

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

- "Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

- 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."

11.4.21 The assessment criteria for noise from fixed plant installations are presented in Table 11-12, following guidance from BS 4142. This applies to daytime and night-time periods. For assessment purposes, the LOAEL has been set as a rating level equal to the background level and the SOAEL as a rating level 10 dB above the background level.

Table 11-12 Criteria for of magnitude impacts for fixed plant noise

<i>Magnitude of Impact</i>	<i>Difference between rating level¹ and background level²</i>
Very Low	< 0 dB
Low	≥ 0 dB and < 5 dB
Medium	≥ 5 dB and < 10 dB
High	≥ 10 dB

1 - The rating level is the noise level attributable to the new source(s), plus penalties if the new source has tonal or intermittent characteristics;

2 - The background level is taken as the L_{A90} ; this is the ambient noise level in the absence of the source which is exceeded for 90% of the time.

Significance Criteria

11.4.22 The following terminology has been used to define noise and vibration effects:

- Adverse - detrimental or negative effects to an environmental resource or receptor;
- Negligible - imperceptible effects to an environmental resource or receptor; or
- Beneficial - advantageous or positive effects to an environmental resource or receptor.

11.4.23 Where adverse or beneficial noise and vibration effects have been identified, these are described using the following scale:

- Minor - slight, very short or highly localised effect;
- Moderate - limited effect (by extent, duration or magnitude), which may be important at a local scale; or
- Major - considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

11.4.24 The duration of noise and vibration effects is defined as follows:

- Short-term - period lasting for no longer than 1 months;

- Medium-term - period lasting for no longer than 6 months; or
- Long-term - period lasting for longer than 6 months.

11.4.25 The magnitude of impact for each receptor is considered against its sensitivity to determine the significance of effect in accordance with the matrix presented in Table 11-13. This aligns with the methodology in **Chapter 5: EIA Methodology** of this PEI Report.

Table 11-13 Classification of effects

<i>Sensitivity of receptor</i>	<i>Magnitude of impact</i>			
	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>Very Low</i>
Very High	Major	Major	Moderate	Minor
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible

11.4.26 Generally, effects determined to be negligible or minor are considered to be not significant, whereas effects classed from moderate to major adverse are considered to be significant.

11.5 Stakeholder Engagement

11.5.1 Key comments relevant to noise and vibration are outlined in Table 11-14.

Table 11-14 Key consultation responses to main matters

<i>Consultee</i>	<i>Matter raised</i>	<i>Response</i>
East Cambridgeshire District Council Suffolk County Council / West Suffolk Council	Construction traffic noise should be duly considered.	Construction traffic has been further reviewed as information made available, and assessment has been included in this PEI Report; see section 11.8.15 to 11.8.18.
Suffolk County Council / West Suffolk Council	A 500m limit for the Burwell Substation Extension construction noise study area may be more appropriate.	This has been adopted in the noise study area for this PEI Report; see section 11.4.1.
Suffolk County Council / West Suffolk Council	Confirmation is required that noise and vibration from construction traffic has been scoped out and justification for this decision.	Construction traffic has been further reviewed as information made available, and assessment of traffic noise has been included in the PEI Report; see section 11.8.15 to 11.8.18. Assessment of construction traffic vibration has

<i>Consultee</i>	<i>Matter raised</i>	<i>Response</i>
		been included in section 11.8.7 to 11.8.14.
Suffolk County Council / West Suffolk Council	I agree with the proposed study areas and identified noise sensitive receptors.	Noted
Suffolk County Council / West Suffolk Council	The construction period is expected to last up to 2 years with the majority of construction works completed in 2023. There is potential for construction to last 3 years if a slower phased construction plan is implemented.	The assessment of likely significant construction noise and vibration effects is based on the best available information and is considered to represent a reasonable worst-case scenario. Any changes to the construction programme will be assessed in the ES.
Suffolk County Council / West Suffolk Council	During the construction stage, the applicant proposes a Construction Environment Management Plan (CEMP) in part to reduce nuisance due to noise and vibration during the construction of the site(s). This will include best practicable means measures such as temporary noise barriers or localised enclosures.	The Framework CEMP (see PEI Report Volume 2: Appendix 16C) covers mitigation measures representing Best Practicable Means.
Suffolk County Council / West Suffolk Council	The applicant proposes to assess noise and vibration from construction using the methods given in BS 5228:2009 parts 1 and 2. I agree that this is an appropriate assessment method. The noise limits recommended in Annex E of BS 5228-1 should be adopted for general construction noise. The ABC method described in section E.3.2 is appropriate. Alternatively, the limits given as "trigger levels" in Table E.2 could be adopted as upper limits for construction noise.	Construction and decommissioning noise assessment criteria is set out in Table 11-8. These have considered example threshold levels from BS 5228-1 Annex E.3.2 example 'ABC method', Annex E.3.3 example '5dB change method', and Annex E.4 'Example of thresholds used to determine the eligibility for noise insulation and temporary rehousing'.
Suffolk County Council / West Suffolk Council	Construction vibration should be assessed where it may be perceptible at receptors close to works, following guidance from Table B.1 of BS 5228-2.	Vibration effects during construction or decommissioning stages have been assessed following BS 5228-2 guidance, see section 11.8.7 to 11.8.14.
Suffolk County Council / West Suffolk Council	It shall be a requirement in the CEMP for vibration levels to be monitored at agreed sensitive locations for compliance with guidance levels in BS 5228 and, if required, appropriate mitigation adopted.	Significant vibration effects during construction or decommissioning stages are not expected (see section 11.8.7 to 11.8.14) and no additional mitigation, enhancement or monitoring measures are considered to be required.

<i>Consultee</i>	<i>Matter raised</i>	<i>Response</i>
Suffolk County Council / West Suffolk Council	Noise from proposed permanent plant must be assessed using methods given in BS4142:2014.	Operational plant noise has been assessed following BS4142:2014+A1:2019 guidance; see section 11.8.19 to 11.8.28.
Suffolk County Council / West Suffolk Council	A baseline noise survey is required to establish the existing noise levels at all identified receptors.	A baseline noise survey has been undertaken, and methodology has been agreed with the environmental health officers for West Suffolk Council and East Cambridgeshire Council.
Suffolk County Council / West Suffolk Council	As construction is expected to occur during day-time periods only, survey work close to cabling routes could be done by attended short term measurements during proposed construction periods. A minimum of 3 representative measurements must be taken at each receptor (in consecutive hours for assessment periods longer than 1 hour) to represent the proposed assessment period.	Long-term noise monitoring has been carried out at positions representative of surrounding noise-sensitive receptors (R1, R3-R12) which may be affected by construction and operational phase noise. Short-term attended noise monitoring was carried out a receptor R2 which would only be affected by cable route construction noise; see sections 11.4.4 to 11.4.6 and 11.6.
Suffolk County Council / West Suffolk Council	For receptors close to sites where operational noise may be expected (i.e. near Sunnica East, Sunnica West and near the Substation Extension at Burwell), long term measurements are preferable. As plant will operate 24 hours a day, 7 days a week, unattended noise loggers may be best suited to establish background noise levels during day and night-time periods over both weekdays and weekends. If sample measurements are used, they must establish the typical lowest background noise levels at each receptor and include at least 3 representative measurements at each receptor during each assessment period.	
East Cambridgeshire District Council (District Councillor for Burwell)	Local residents regularly complain of significant background noise pollution associated with the Burwell substation.	Complaint history and the results of subsequent investigations of noise from the Burwell substation have been discussed with the health officer for West Suffolk Council and East Cambridgeshire Council. The baseline noise survey has been tailored to consider existing noise from the Burwell substation, which has been considered in the BS4142 assessment; see sections 11.4.4 to 11.4.6, 11.6 and 11.8.19 to 11.8.28.

<i>Consultee</i>	<i>Matter raised</i>	<i>Response</i>
East Cambridgeshire District Council (District Councillor for Burwell)	From my understanding of solar farms they produce very little noise once operational. The Environmental Impact Scoping Report does mention potential noise from inverters and transformers as well as battery storage plant but does not specifically say how this will be mitigated. I am aware that other sites appear to house these units which would be one effective way of controlling any noise. I would expect the most substantial noise to occur during the construction and decommissioning of the site.	At this stage of the PEI assessment no specific noise mitigation measures have been included for operational plant. As the design is progressed and where necessary, appropriate mitigation measures will be identified where significant effects are identified due to noise emissions from operational plant.
East Cambridgeshire District Council (District Councillor for Burwell)	The report advises that a noise impact assessment will be produced and a CEMP will be prepared and implemented by the selected Principal Contractor to include a range of best practice construction measures. I would welcome this.	Noted
East Cambridgeshire District Council (Environmental Health Technical Officer (Domestic))	Construction times and deliveries during the construction phase should be restricted daytime hours Monday-Saturday and no working on Sundays or bank holidays.	Working hours onsite will run from 7am until 7pm Monday to Saturday. Working days will be one 12-hour shift. This is set out in the Framework CEMP, which will be secured through the DCO. Management of traffic (including deliveries) within the site and being let onto the highway network will be managed through a Construction Traffic Management Plan (CTMP) and secured in a requirement attached to the DCO..
Planning Inspectorate	Applicant's proposed matters to scope out: Road traffic noise during construction, operational and decommissioning stages of the scheme The Scoping Report chapter does not address these matters in detail and therefore does not provide sufficient justification for the approach. With details such as construction traffic routes and operational traffic routes still to be determined, the Inspectorate cannot agree to these matters being scoped out. Any significant	It is not expected that operational development traffic would result in significant increases in local road traffic noise levels as there would be a very low number of staff required to visit site for maintenance purposes; see section 11.3.12. Construction and decommissioning traffic has been further reviewed as information made available, and assessment of traffic noise has been included

<i>Consultee</i>	<i>Matter raised</i>	<i>Response</i>
	effects associated with these matters should be assessed in the ES.	in this PEI Report; see section 11.8.15 to 11.8.18.
Planning Inspectorate	<p>Applicant's proposed matters to scope out: Ground-borne vibration from the construction, operation and decommissioning of the scheme</p> <p>The Scoping Report chapter does not clearly set out the intention of scoping out these matters. Paragraph 11.2.4 of the Scoping Report explains that there are no operational vibration effects associated with the Sunnica East Site, the Sunnica West Site, or the Burwell substation extension. As such, the Inspectorate agrees that vibration in relation to operation may be scoped out at this stage. The Scoping Report, however, does not set out reasoning for the scoping out of vibration relating to construction and decommissioning of the Proposed Development. The Inspectorate notes the need for horizontal directional drilling among other construction techniques which may culminate in vibration effects. Therefore, the Inspectorate is unable to agree to the scoping out of these matters out of the ES. The ES should assess significant effects associated with these matters.</p>	<p>No major vibration sources are envisaged to be introduced as part of the Scheme and as such there will be no associated operational vibration effects, see section 11.3.13.</p> <p>Vibration effects during construction or decommissioning stages have been assessed following BS 5228-2 guidance, and included in section 11.8.7 to 11.8.14.</p>
Planning Inspectorate	<p>Clarification</p> <p>The assessment study area should be defined according to the extent of the likely impact. The ES should explain where the receptor locations are and identify these on a suitably detailed figure.</p>	<p>The Study Area and receptor locations have been defined in section 11.4.1 to 11.4.3. Assessment receptor locations are shown in Figure 11-1.</p>
Planning Inspectorate	<p>Study Area</p> <p>The Inspectorate notes from the description of the study area that the Burwell substation construction is to have a study area of 100m, the same as the cable corridor. The Inspectorate considers that noise and vibration impacts during construction of the substation may differ from those associated with a</p>	<p>A 500 m study area has been included in the construction noise study area for this PEI Report and agreed with East Cambridgeshire Council; see section 11.4.1</p>

<i>Consultee</i>	<i>Matter raised</i>	<i>Response</i>
	<p>cable corridor. Therefore, the Inspectorate recommends that a wider study area (e.g. 500m) is applied and takes into account the extent of the likely impact. This is a view that is also expressed by East Cambridgeshire Council. The Applicant should make effort to agree the study area with the relevant consultation bodies.</p>	
<p>Planning Inspectorate</p>	<p>Monitoring locations</p> <p>The ES should identify the 'representative' receptors. It should also explain how monitoring locations were chosen with reference to relevant information including noise contour mapping.</p>	<p>Noise monitoring locations have been agreed with officers from East Cambridgeshire District Council and West Suffolk District Council.</p> <p>The methodology for selection of assessment receptor positions and monitoring locations is discussed in sections 11.4.1 to 11.4.6.</p>
<p>Planning Inspectorate</p>	<p>Assessment of vibration effects during construction and decommissioning</p> <p>The Scoping Report references the assessment of noise during construction and decommissioning but omits the mention of vibration. Vibration should be assessed alongside noise (noting that operational vibration is to be scoped out).</p>	<p>Vibration effects during construction or decommissioning stages have been assessed following BS 5228-2 guidance, see section 11.8.7 to 11.8.14.</p>
<p>Planning Inspectorate</p>	<p>Methodology</p> <p>The noise assessment in the ES should assess significant effects to ecological receptors as well as human. As such, consideration should be given to the findings of the biodiversity and ecological surveys in terms of identifying sensitive receptors. The Applicant should make effort to engage with relevant consultation bodies on this matter.</p>	<p>An assessment of noise on ecological receptors will be presented in Chapter 8: Ecology. Noise effects on wildlife have been assessed in conjunction with other effects on wildlife as part of the ecological assessments.</p>
<p>Planning Inspectorate</p>	<p>Methodology</p> <p>The Scoping Report sets out the National Planning Policy and includes Noise Policy Statement England. However, the Scoping Report does not reference how significance of effect will be determined. The Applicant should ensure that the ES methodology is</p>	<p>The ES methodology is set out in Section 11.4 and is based on the latest UK policy and guidance on noise and vibration.</p>

<i>Consultee</i>	<i>Matter raised</i>	<i>Response</i>
	consistent with up-to-date guidance and policy.	
Planning Inspectorate	<p>Impacts</p> <p>The ES should provide details of the anticipated construction working hours (including any night time working required) and incorporate this into the assessment of likely significant effects. This should be consistent with the working hours specified in the DCO.</p>	<p>Working hours onsite will run from 7am until 7pm Monday to Saturday.</p> <p>Working days will be one 12-hour shift. This is set out in the Framework CEMP, which will be secured through the DCO.</p>
Planning Inspectorate	<p>Monitoring</p> <p>The Inspectorate notes that weather and time can influence monitoring results for noise (and vibration). However, the Scoping Report does not indicate if this information will be collated and presented in the ES. For the avoidance of doubt this information should be included within the ES along with an explanation about the extent to which this affects the findings in the assessment</p>	<p>Weather conditions (wind, rain) was monitored during baseline surveys. Surveys were planned to avoid any adverse weather conditions (e.g. periods of rain, wind speeds >5m/s); any data affected by adverse weather will be excluded from data analysis, as explained in section 11.6.</p>

11.6 Baseline Conditions

- 11.6.1 During the surveys the dominant noise source at the majority of the locations was observed to be road traffic from the surrounding road network. During site attendance, it was observed that LT1 was also influenced by occasional aircraft noise and ST2 was influenced by leaves blowing in the wind. Aircraft noise was also noted at LT3, LT6 and ST2. While these intermittent sound sources are audible in the area, the typical background noise environment is considered to be dominated by road traffic noise.
- 11.6.2 Noise from the existing Burwell Substation was not audible above road traffic noise during daytime site visits at LT1 / R1. Analysis of the frequency spectrum data from LT1 (see **PEI Report Volume 2: Appendix 11B**, Table 11B-4) does not identify any tonal features in the local noise environment which may have been attributed to the existing Burwell Substation.
- 11.6.3 A weather station was set up to measure the meteorological conditions during the survey. Periods that were not conducive to environmental noise measurements as per guidance in BS 4142 (i.e. wind speeds greater than 5m/s and/or precipitation) were removed from further data analysis.
- 11.6.4 A summary of the noise monitoring results is presented in Table 11-15 (long-term measurements) and Table 11-16 (short-term measurements). Night-time noise levels are considered to be representative of evening and

early morning periods. Further details of the baseline noise surveys are provided in **PEI Report Volume 2: Appendix 11B**.

Table 11-15 Summary of long-term noise monitoring results

<i>Reference</i>	<i>Daytime 07:00-23:00</i>		<i>Night-time 23:00-07:00</i>	
	<i>Average Ambient $L_{Aeq,16h}$ dB</i>	<i>Typical Background $L_{A90,15min}$ dB</i>	<i>Average Ambient $L_{Aeq,16h}$ dB</i>	<i>Typical Background $L_{A90,15min}$ dB</i>
LT1	49	36	40	29
LT2	75	62	70	46
LT3	58	46	54	40
LT4	66	58	59	48
LT5	60	54	54	40
LT6	67	38	57	30
LT7	69	43	62	35
LT8	60	45	54	35

Table 11-16 Summary of short-term noise monitoring results

<i>Reference</i>	<i>Ambient $L_{Aeq,T}$ dB</i>	<i>Background $L_{A90,T}$ dB</i>
ST1	70	48
ST2	60	47

11.7 Design Measures and Impact Avoidance

11.7.1 The way that potential environmental impacts have been or will be avoided, prevented, reduced, or off-set through design and / or management of the Scheme are outlined below and will be taken into account as part of the assessment of the potential effects. Proposed environmental enhancements are also described where relevant. The mitigation measures for both the construction/decommissioning and operational phases, are outlined below.

Construction and Decommissioning Phase

11.7.2 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 measures represent BPM and are included within the Framework CEMP (see **PEI Report Volume 2:**

Appendix 16C) and a Decommissioning Environmental Management Plan which will be prepared prior to the decommissioning phase as outlined in **Chapter 3: Scheme Description**, to manage noise and vibration emissions from construction activities. Examples of BPM that will be implemented during construction works are presented below:

- Unnecessary revving of engines will be avoided, and equipment will be switched off when not in use;
- Appropriate routing of construction traffic on public roads and along access tracks;
- Drop heights of materials will be minimised;
- Plant and vehicles will be sequentially started up rather than all together;
- 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; and
- Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturer's specifications.

11.7.3 A construction noise monitoring scheme shall be developed and agreed with appropriate stakeholders prior to commencement of construction works as part of the Section 61 consent application. Requirements for monitoring during the decommissioning stages will be outlined in the Decommissioning Environmental Management Plan.

11.7.4 Consideration will also be given to traffic routing, timing and access points to the Sites to minimise noise impacts at existing receptors following appointment of a principal contractor, and as construction working methods are developed. Contractors will issue a project route map and delivery schedule to control construction traffic. Management of HGVs within the site and being let onto the highway network will be managed through a CTMP and secured in a requirement attached to the DCO.

Operational Phase

11.7.5 At this stage of the assessment no specific noise mitigation measures have been included for operational plant. However, based on the proposed plant installations it is assumed that plant will be designed to have no tonal, impulsive or intermittent features.

11.7.6 As the plant design is progressed, the specification of plant machinery with low noise emission and properly attenuated supply and extract terminations will help to minimise noise emissions. The use of enclosures, local screening, mufflers, and silencers will also be used as appropriate. Should the noise exhibit any such acoustic features then the relevant penalty/correction should be applied in accordance with BS 4142 and assessed accordingly.

11.8 Assessment of Likely Impacts and Effects

11.8.1 The impacts and effects associated with the construction/decommissioning and operational phases of the Scheme are outlined in the sections below. The assessments have been assessed following consideration of the embedded mitigation measures as described in section 11.7.

Construction and Decommissioning Noise

11.8.2 The assessment of predicted construction noise levels at surrounding receptors from construction plant during various stages of the works is summarised in Table 11-17. Highest construction noise levels are predicted during civil works and the lowest levels of noise during both panel construction and electrical works phases. Details of the plant and associated sound data for each construction phase are provided in **PEI Report Volume 2: Appendix 11C** and a noise contour plot is presented in Figure 11-2.

Table 11-17 Construction noise assessment

<i>Receptor</i>	<i>Sensitivity</i>	<i>Range of predicted L_{Aeq,T} dB construction noise</i>	<i>Magnitude of Impact</i>	<i>Significance of Effect</i>
R1	High	36 – 45	Very low	Negligible
R2	High	46 – 55	Very low	Negligible
R3	High	53 – 62	Very low	Negligible
R4	High	37 – 46	Very low	Negligible
R5	High	47 – 56	Very low	Negligible
R6	High	47 – 56	Very low	Negligible
R7	High	35 – 44	Very low	Negligible
R8	High	33 – 42	Very low	Negligible
R9	High	38 – 47	Very low	Negligible
R10	High	30 – 39	Very low	Negligible
R11	High	27 – 36	Very low	Negligible
R12	High	42 – 51	Very low	Negligible

11.8.3 The higher range of noise levels is predicted to occur during site preparation and civil phases of works which include heavy ground works and piling activities.

- 11.8.4 Predicted noise levels at all receptors are below 65 dB (i.e. the LOAEL), which per the criteria in Table 11-8 indicates a 'very low' magnitude impact. For receptors of high sensitivity, this equates to a **negligible** effect which is not significant. No excesses of the SOAEL (75 dB) are expected.
- 11.8.5 Due to the variation in works locations across the duration of the construction programme, it is considered that any periods of regular high construction noise levels experienced at a receptor would not exceed one month. As such, the duration of any construction noise effects is considered to be temporary, short-term, with no permanent residual effect once works are completed.
- 11.8.6 It is considered that noise impacts are likely to be greatest during the early stages of the works programme, where ground works are required as heavier plant is likely to be used. In practice, works noise levels and resulting impacts are likely to vary during the different construction phases. The nature of construction work means that the highest levels of noise may exist for only a matter of days or even hours and there would be regular periods, even during the course of a single day, when the assumed noisy plant will not be in operation during breaks or changes of working routine.

Construction and Decommissioning Vibration

- 11.8.7 BS 5228-2 makes reference to the Transport Research Laboratory (TRL) report 429 'Groundborne Vibration Caused by Mechanised Construction Works' (2000) (Ref 11-21). Figure 50 of the TRL report indicates that ground vibration from miscellaneous vehicle operations on construction sites (including scrapers, rollers, dumpers, breakers, dozers and HGVs) are in the region of 1 mm/s PPV at approximately 10 m, decreasing to the region of 0.1 mm/s PPV at approximately 50 m.
- 11.8.8 Actual vibration levels from works are dependent on a number of factors including ground conditions, plant or vehicle size, the nature of the works (in particular piling methods), the speed of HGV movements and the quality of surface of haul or other temporary roads. Based on the assumed HGV speeds on access routes and regular maintenance of access route road surfaces, vibration from vehicles on the access roads will be minimised.
- 11.8.9 BS 5228-2 indicates that vibration levels from drilling activities (applicable to any horizontal directional drilling activities associated with the cable route) are below 1 mm/s PPV at 10 m and below 0.5 mm/s PPV at 20 m.
- 11.8.10 BS 5228-2 indicates that impact or vibratory piling activities generally only generate vibration impacts when they are located less than 20 m from sensitive locations. The impact depends on the type of piling, ground conditions, and receptor distance. Vibration from smaller scale push piling techniques, which are proposed be used for the installation of solar module mounting structures, are generally limited to 1 mm/s for distances up to 10 m.
- 11.8.11 Based on the distances between the Scheme boundary and surrounding receptors (15 m to 500 m) to locations where heavy ground works (excavation, push piling) may take place, it is considered that vibration from construction works (including HGV movements on access roads)

experienced at sensitive receptors will be limited to very low adverse magnitude impacts as per the criteria in Table 11-9. For receptors of high sensitivity this would be equivalent to a **negligible** effect, which is not significant (see Table 11-13). The exception to this would be receptors R2 and R12, which may be close enough to experience low adverse magnitude impacts, equivalent to a **minor adverse** effect which is not significant.

11.8.12 Construction and decommissioning vibration is considered to result in a **negligible** effect at receptors R1 and R3-R11 and a **minor adverse** effects at receptor R2 and R12, which is not significant. No excesses of the SOAEL (1 mm/s PPV) are expected.

11.8.13 Vibration levels from activities are below the level at which there is any potential for cosmetic damage to structures (see Table 11-10) and as such is a **negligible** effect which is not significant.

11.8.14 The construction programme is 24 months duration with varying works locations although consistent levels of associated traffic movements throughout the programme. As such, the duration of any construction vibration effects is considered to be temporary, short-term (other than at R1 which is located near to the Burwell Substation access road and as such considered to be long-term), with no permanent residual effect once works are completed.

Construction and Decommissioning Traffic Noise

11.8.15 The assessment of construction traffic noise at surrounding receptors is presented in Table 11-18. A noise contour plot is presented in Figure 11-3.

Table 11-18 Construction traffic noise assessment

Receptor	Sensitivity	<i>L_{Aeq,1hr} dB noise level</i>				Magnitude of Impact	Significance of Effect
		Measured Ambient	Predicted Construction Traffic	Combined	Difference		
R1	High	49	42	50	+1	Low	Minor Adverse
R2	High	70	15	70	0	Very low	Negligible
R3	High	75	5	75	0	Very low	Negligible
R4	High	58	9	58	0	Very low	Negligible
R5	High	66	34	66	0	Very low	Negligible
R6	High	66	24	66	0	Very low	Negligible
R7	High	66	22	66	0	Very low	Negligible
R8	High	60	34	60	0	Very low	Negligible

L_{Aeq,1hr} dB noise level

<i>Receptor</i>	<i>Sensitivity</i>	<i>Measured Ambient</i>	<i>Predicted Construction Traffic</i>	<i>Combined</i>	<i>Difference</i>	<i>Magnitude of Impact</i>	<i>Significance of Effect</i>
R9	High	60	30	60	0	Very low	Negligible
R10	High	67	19	67	0	Very low	Negligible
R11	High	69	33	69	0	Very low	Negligible
R12	High	60	21	60	0	Very low	Negligible

11.8.16 Predicted noise levels from construction traffic along access routes are not predicted to result in an increase in ambient noise levels. As per the criteria in Table 11-11 this indicates a ‘very low’ magnitude impact. For receptors of high sensitivity, this equates to a **negligible** effect which is not significant. The exception to this is at R1 where an increase in noise of 1 dB is predicted, which is equivalent to a **minor adverse** effect.

11.8.17 Changes in noise due to construction traffic are predicted to result in a **minor adverse** effect at worst and not significant. No excesses of the SOAEL (3 dB increase) are predicted.

11.8.18 The construction programme is 24 months duration and with consistent levels of associated traffic movements throughout the programme. As such, the duration of any construction noise effects is considered to be temporary, long-term, with no permanent residual effect once works are completed.

Operational Noise

11.8.19 The assessment of predicted operational noise levels at surrounding receptors from operational plant during various stages of the works is summarised in Table 11-19 (daytime periods) and Table 11-20 (night/early morning/late evening periods). Details of the calculations are provided in **PEI Report Volume 2: Appendix 11D** and a noise contour plot is presented in Figure 11-4.

11.8.20 As plant will be designed to have no tonal, impulsive or intermittent features, no penalty/correction has been applied to the predicted level in the determination of the rating level.

11.8.21 Due to its separation distance from the Sunnica West Sites A and B, Sunnica East Sites A and B, and Burwell Substation Extension, operational noise has not been assessed for receptor R2. Operational noise effects at this receptor will be negligible and not significant.

11.8.22 The assessment for receptor R1 has considered noise from the Burwell Substation Extension only, whereas the assessment for receptors R3 to R12 considers noise emissions from plant at Sunnica West Sites A and B

and Sunnica East Sites A and B. To account for the plant operating 24/7, the assessment has been undertaken for both day and night-time periods.

Table 11-19 Operational noise assessment – Daytime periods

Receptor	Sensitivity	dB Noise Level			Magnitude of Impact	Significance of Effect
		Background <i>L_{A90,15min}</i>	Rating <i>L_{A,r,Tr}</i>	Difference		
R1	High	36	34	-2	Very low	Negligible
R3	High	62	16	-46	Very low	Negligible
R4	High	46	21	-25	Very low	Negligible
R5	High	58	30	-28	Very low	Negligible
R6	High	58	29	-29	Very low	Negligible
R7	High	58	24	-34	Very low	Negligible
R8	High	54	26	-28	Very low	Negligible
R9	High	43	26	-17	Very low	Negligible
R10	High	38	20	-18	Very low	Negligible
R11	High	43	22	-21	Very low	Negligible
R12	High	45	22	-23	Very low	Negligible

Table 11-20 Operational noise assessment – Night/Early morning/Late evening periods

Receptor	Sensitivity	dB Noise Level			Magnitude of Impact	Significance of Effect
		Background <i>L_{A90}</i>	Rating <i>L_{A,r,Tr}</i>	Difference		
R1	High	29	34	+5	Medium	Moderate Adverse
R3	High	46	16	-30	Very low	Negligible
R4	High	40	21	-19	Very low	Negligible
R5	High	48	30	-18	Very low	Negligible
R6	High	48	29	-19	Very low	Negligible

Receptor	Sensitivity	dB Noise Level			Magnitude of Impact	Significance of Effect
		Background <i>L_{A90}</i>	Rating <i>L_{Ar,Tr}</i>	Difference		
R7	High	48	24	-24	Very low	Negligible
R8	High	40	26	-14	Very low	Negligible
R9	High	35	26	-9	Very low	Negligible
R10	High	30	20	-10	Very low	Negligible
R11	High	35	22	-13	Very low	Negligible
R12	High	35	22	-13	Very low	Negligible

11.8.23 Predicted rating levels of operational solar plant at receptors R3 to R12 are below the existing background levels. As per the criteria in Table 11-12, this indicates a ‘very low’ magnitude impact. For receptors of high sensitivity, this equates to a **negligible** effect, which is not significant. Excesses of the SOAEL (rating level 10 dB above background levels) are not predicted for these receptors.

11.8.24 Noise from the Burwell Substation Expansion is predicted to be 31 dB at the nearest receptor (R1), which is below background levels during the day but exceeds the night-time background noise level by 5 dB. The exceedance of the night-time background noise level is equivalent to a moderate adverse effect, which is significant. Operational noise levels at R1 approach but are not predicted to exceed the SOAEL (rating level 10 dB above background levels).

11.8.25 The assessment of operational noise should take into context the absolute noise level. Assuming that, at night, residents will be inside their property, they would benefit from noise attenuation from the building envelope. A building envelope with a partially open window is generally accepted to attenuate noise by at least 10 dB (BS 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’ (Ref 11-24) suggests up to 15 dB). Consequently, the predicted internal noise level is, at highest, 26 dB *L_{Ar,Tr}*. Whilst noise may be audible inside the property, the absolute noise level is considered not to be of sufficient magnitude to warrant a significant noise effect. Consequently, night-time noise at R1 is considered to be **minor adverse** and not significant.

11.8.26 It should be noted that the location of the proposed Burwell Substation Expansion is the preferred location and there are two other alternative locations that may be brought forward into the DCO design. The alternative locations are to the northwest and so located further away from R1 than the preferred location. Consequently, should either of the alternative options be brought forward, noise at R1 is likely to be lower than the predicted 36 dB *L_{Ar,Tr}*.

- 11.8.27 Measurements of the existing noise environment at R1 at monitoring location LT1 have not identified any tonal features in the local noise environment which may have been attributed to the existing Burwell Substation. While the expansion may result in an audible change to absolute levels of noise at the nearest receptors, it is not expected that the expansion would result in any noticeable changes to the character of existing noise environment in this area.
- 11.8.28 Operational noise is a permanent and long-term duration effect but, considered as an absolute noise level, is predicted to be minor adverse at worst and therefore not significant.

Summary of Effects

- 11.8.29 Table 11-21 outlines the likely magnitude of impacts and significance of effects for the construction/decommissioning and operation phase.

Table 11-21 Summary of Magnitude of Impact and Significance of Effect

<i>Receptor</i>	<i>Sensitivity (Value)</i>	<i>Description of Impact</i>	<i>Magnitude of Impact</i>	<i>Significance of Effect</i>	<i>Significant effect (Yes / No)</i>
R1-R12 (residential properties and hotel)	High	Construction and decommissioning works noise	Very low, adverse, temporary (short-term)	Negligible	No
R1 (residential properties)	High	Construction and decommissioning works vibration	Very low, adverse, temporary (long-term)	Negligible	No
R3-R11 (residential properties and hotel)	High	Construction and decommissioning works vibration	Very low, adverse, temporary (short-term)	Negligible	No
R2 and R12 (residential properties)	High	Construction and decommissioning works vibration	Low, adverse, temporary (short-term)	Minor Adverse	No
R1 (residential properties)	High	Construction and decommissioning traffic noise	Low, adverse, temporary (long-term)	Minor Adverse	No
R2-R12 (residential properties and hotel)	High	Construction and decommissioning traffic noise	Very low, adverse, temporary (long-term)	Negligible	No

<i>Receptor</i>	<i>Sensitivity (Value)</i>	<i>Description of Impact</i>	<i>Magnitude of Impact</i>	<i>Significance of Effect</i>	<i>Significant effect (Yes / No)</i>
R1 (residential properties)	High	Operational noise	Very low to Medium, adverse, permanent (long-term)	Negligible to Minor Adverse	No
R3-R12 (residential properties and hotel)	High	Operational noise	Very low , adverse, permanent (long-term)	Negligible	No

11.9 Additional Mitigation and Enhancement Measures

11.9.1 At this stage no additional mitigation, enhancement or monitoring measures for the construction/decommissioning and operational phases are considered to be required given that no significant adverse impacts that have been predicted. However, this will be further investigated in the ES.

11.10 Residual Effects

11.10.1 Taking into account the embedded mitigation measures, noise effects during the construction/decommissioning and operational phases are predicted to be negligible to minor adverse and therefore not considered significant.

11.10.2 Table 11-22 outlines the likely residual construction/decommissioning phase noise effects.

Table 11-22 Summary of Residual Effects during Construction and Decommissioning

<i>Receptor</i>	<i>Description of impact</i>	<i>Significance of effect without mitigation</i>	<i>Mitigation/Enhancement measure</i>	<i>Residual effect after mitigation</i>
All (residential properties and hotel)	Construction and decommissioning works noise	Negligible	None beyond embedded measures	Negligible
All (residential properties and hotel)	Construction and decommissioning vibration	Negligible to Minor Adverse	None beyond embedded measures	Negligible to Minor Adverse
All (residential properties and hotel)	Construction and decommissioning traffic noise	Negligible to Minor Adverse	None beyond embedded measures	Negligible to Minor Adverse

11.10.3 Table 11-23 outlines the likely residual operational phase noise effects.

Table 11-23 Summary of Residual Effects during Operation

<i>Receptor</i>	<i>Description of impact</i>	<i>Significance of effect without mitigation</i>	<i>Mitigation/Enhancement measure</i>	<i>Residual effect after mitigation</i>
All (residential properties and hotel)	Operational noise	Negligible to Minor Adverse	None beyond embedded measures	Negligible to Minor Adverse

11.11 Cumulative Effects

11.11.1 Cumulative noise effects during construction and operation phases may occur when developments are within 500m of each other. At greater distances, any noise emissions would be attenuated such that there would normally be no combined effect.

11.11.2 The following developments in Table 11-24 have been identified to be within 500 m of the Scheme. Further information is provided in **Chapter 5: EIA Methodology**.

Table 11-24 Cumulative Developments within 500m of the Scheme

<i>Application reference</i>	<i>Applicant for 'other development' and brief description</i>	<i>County</i>	<i>District</i>	<i>Distance from Scheme Boundary</i>
17/02205/FUL	Development of a 49.9MW battery storage facility, bridge and associated infrastructure	CCC	ECDC	50 m South of the Burwell sub-station
19/00155/FUL	Application for the construction and operation of a 49.9MW battery storage facility, fencing, landscape planting and site access on land adjacent to the operational Burwell 400kV substation	CCC	ECDC	50 m South of the Burwell sub-station
18/00383/VARM	To Vary Condition 3 (operational life) of previously approved Application Reference Number: 15/00723/ESF for Installation and operation of a solar farm and associated infrastructure	CCC	ECDC	500 m north of Burwell sub-station

11.11.3 It is considered that any overlapping of construction phases between the Scheme and the other nearby development schemes has the potential to contribute to in-combination cumulative effects at common noise-sensitive

receptors i.e. R1. Predicted construction noise effects from the Scheme are predicted to be negligible, such that any increase in construction effect would be due to the other developments outlined in Table 11-24.

Furthermore, due to their scale none of these developments are anticipated to result in any adverse significant effects on R1. As such, cumulative effects from construction noise are considered to be **negligible**.

- 11.11.4 It is expected that any operational noise emissions from nearby developments will be designed to achieve appropriate operational noise limits so as not to contribute additional noise to the area (i.e. 'background creep', which could avoid any adverse effects to noise-sensitive receptors in the area). The control and mitigation of noise effects from surrounding development will be the responsibility of the individual operator. Predicted operational noise effects from the Scheme are predicted to be negligible and substantially below existing background levels, such that any increase in operational effect would be due to the other developments outlined in Table 11-24. Furthermore, due to their nature of development, none of these developments are anticipated to result in any adverse significant effects on common noise-sensitive receptors. As such, cumulative effects from operational noise are considered to be **negligible**.

11.12 References

- Ref 11-1 Her Majesty's Stationery Office (1974); Control of Pollution Act
- Ref 11-2 Her Majesty's Stationery Office (1995); Environmental Protection Act
- Ref 11-3 Department of Energy and Climate Change (2011) Overarching National Policy Statement for Energy (EN-1)
- Ref 11-4 Department of Energy and Climate Change (2011) National Policy Statement for Electricity Networks Infrastructure (EN-5)
- Ref 11-5 Department of Energy and Climate Change (2011) National Policy Statement for Renewable Energy Infrastructure (EN-3)
- Ref 11-6 Department for Environment Food and Rural Affairs (Defra) (2010); Noise Policy Statement for England
- Ref 11-7 Ministry of Housing, Communities & Local Government (MHCLG) (2019) National Planning Policy Framework
- Ref 11-8 Department for Communities and Local Government; Planning Practice Guidance
- Ref 11-9 East Cambridgeshire District Council (2015) Local Plan
- Ref 11-10 East Cambridgeshire District Council (2017) Local Plan Proposed Submission November 2017
- Ref 11-11 East Cambridgeshire District Council (2014) Supplementary Planning Document Renewable Energy Development (Commercial Scale) October 2014
- Ref 11-12 Forest Heath District Council (2010) Forest Heath Local Development Framework – Core Strategy Development Plan Document 2001-2026 (with housing projected to 2031) Adopted May 2010
- Ref 11-13 Forest Heath and St Edmundsbury Councils (2015) Forest Heath and St Edmundsbury Local Plan: Joint Development Management Policies Document (February 2015)
- Ref 11-14 CadnaA®, registered trademark of Datakustik GmbH (Munich, Germany). (www.datakustik.com)
- Ref 11-15 British Standards Institute (2014 with 2019 amendments) BS 5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites. Noise, BSi, London.
- Ref 11-16 Department of Transport/Welsh Office (1988); Calculation of Road Traffic Noise
- Ref 11-17 International Standards Organization (Part 1: 1993, Part 2: 1996) ISO 9613 – Acoustics – Attenuation of sound during propagation outdoors, ISO
- Ref 11-18 Ordnance Survey Open Map – <https://www.ordnancesurvey.co.uk/opendatadownload/products.html>
- Ref 11-19 British Standards Institute (2003); BS 7445 – Description and environment of environmental noise – Part 1: Guide to quantities and procedures, BSi, London.
- Ref 11-20 British Standards Institute (2014 with 2019 amendments); BS 4142 – Methods for rating and assessing industrial and commercial sound, BSi, London
- Ref 11-21 Hiller, D. M., and G. I. Crabb, (2000); Groundborne Vibration Caused by Mechanised Construction Works. TRL Report 429
- Ref 11-22 Institute of Environmental Management and Assessment (2014); Guidelines for environmental noise impact assessment

- Ref 11-23 European Commission Directive 200/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701
- Ref 11-24 British Standards Institute (2014); BS 8233 – Guidance on sound insulation and noise reduction for buildings, BSi, London
- Ref 11-25 Highways Agency (2011) Design Manual for Road and Bridges Volume 11 Section 3 Part 7-Traffic Noise and Vibration.

