BEACON FEN ENERGY PARK

Planning Inspectorate Reference: EN010151

Chapter 10 - Noise and Vibration
Document Reference: ES Vol 1 6.2.10 Chapter 10
April 2025

The Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (SI 2017/572) – Regulation 14

Quality information

Prepared by	Checked by	Verified by	Approved by
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10. NOISE AND VIBRATION

10.1 Introduction

10.1.1 This Chapter reports the assessment of the likely significant effects of the Proposed Development in terms of Noise and Vibration in the context of the Site and surrounding area. A full Glossary of Terms which apply to this chapter can be found at the front of this ES.

10.1.2 This chapter considers the likely significant effects of the following:

- The potential effects of noise and vibration from the construction and decommissioning phases of the Proposed Development on Existing Sensitive Receptors (ESR) relating to the Solar Array Area, Cable Route Corridor and the Bespoke Access Road and construction traffic; and
- The potential effects of noise from the operational use at ESRs relating to noise generated by electrical fixed plant associated with the solar array area including the photovoltaic panels (solar PV) and battery energy storage system (BESS) during the operational phase of the Proposed Development

10.1.3 The following effects have been scoped out as they are considered not to be significant:

- Noise associated with road traffic during the operational phase (**Chapter 9: Traffic and Access (Document Ref: 6.2 ES Vol.1, 6.2.9).**
- Vibration associated with road traffic and electrical fixed plant during the operational phase.

10.1.4 This Chapter (and its associated figures and appendices) is not intended to be read as a standalone assessment and reference should be made to **Chapters 1 – 5 (Document Ref: 6.2 ES Vol.1 6.2.1 to 6.2.5)** of the Environmental Statement (ES), as well as **Chapter 19: Summary of Environmental Effects (Document Ref: 6.2 ES Vol.1, 6.2.19)**.

10.1.5 This Chapter is accompanied by the following Figures and Appendices:

- **Appendix 10.1 Planning Legislation and Guidance (Document Ref: 6.3 ES Vol.2 6.3.79)** which provides details of Policy, Legislation and Guidance considered relevant and implications for the noise and vibration assessment;
- **Appendix 10.2 Noise Survey Results (Document Ref: 6.3 ES Vol.2 6.3.80)** which details the Noise Survey Results;
- **Figure 10.1** which shows the Proposed Site, Existing Noise Sensitive Receptors and Measurement Positions;
- **Figure 10.2** which shows the Bespoke Access Corridor (BAC) Receptors & Cable Route Corridor Receptors (comprised of Figure 10.2a - Bespoke Access Route Receptors + Figure 10.2b - Cable Route Corridor Receptors);
- **Figure 10.3** which shows Operational Noise Contours - Light & Darkness Periods (comprised of Figure 10.3a - Operational Noise Contours - Light Periods + Figure 10.3b - Operational Noise Contours - Darkness Periods);

- **Figure 10.4** which shows the Operational Noise Contours during periods of time where there is daylight (04:00-22:00); and
- **Figure 10.4** which shows the items of electrical fixed plant associated with the BESS and solar PV plant which require additional mitigation which forms part of the embedded mitigation.

10.1.6 This chapter has been prepared in support of the draft DCO **(Doc ref: 3.1)** Schedule 2 Part 1 Requirements regarding requirement 14 – Operational Noise.

Legislation, Policy & Guidance

10.1.7 The relevant legislation, policy and guidance are listed below, with details provided in Appendix 10.1 Planning Legislation and Guidance **(Document Ref: 6.3 ES Vol.2, 6.3.79)**.

Legislative Framework

10.1.8 The following Acts are relevant to the assessment of Noise.

- The Infrastructure Planning Regulations[1]
- The Environmental Protection Act 1990[2] (as amended by the Noise and Statutory Nuisance Act 1993[3]) (particularly Section 79) (EPA); and
- The Control of Pollution Act 1974 (particularly Sections 60 and 61) (CoPA)[4].
- The Planning Act 2008[5]
- The Environmental Noise (England) Regulations 2006 (as amended)[6]

Planning Policy

10.1.9 The applicable planning policy is summarised as follows:

- Overarching National Policy Statement for Energy[7] (EN-1) (November 2023);
- National Policy Statement for Renewable Energy Infrastructure[8] (EN-3) (November 2023);
- National Policy Statement for Electricity Networks Infrastructure[9] (EN-5) (November 2023);
- National Planning Policy Framework, 2024[10] (NPPF);
- Noise Policy Statement for England, 2010[11] (NPSE); and

1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [online]. Available at https://www.legislation.gov.uk/uksi/2017/572 [Accessed 12/03/2025]

2 The Environmental Protection Act 1990 [online]. Available at https://www.legislation.gov.uk/ukpga/1990/43/ contents/made [Accessed 09/03/2022]

3 Noise and Statutory Nuisance Act 1993 [online]. Available at https://www.legislation.gov.uk/ukpga/1993/40/ contents/made [Accessed 09/03/2022]

4 The Control of Pollution Act 1974 [online]. Available at https://www.legislation.gov.uk/ukpga/1974/40/contents/made [Accessed 09/03/2022].

5 The Planning Act 2008 [online]. Available at https://www.legislation.gov.uk/ukpga/2008/29/contents [Accessed 12/03/2025]

6 The Environmental Noise (England) Regulations 2006 [online]. Available at https://www.legislation.gov.uk/uksi/2006/2238/contents [Accessed 12/03/2025]

7 Department for Energy Security & Net Zero, 2023. Overarching National Policy Statement for Energy (EN-1)

8 Department for Energy Security & Net Zero, 2023. National Policy Statement for Renewable Energy Infrastructure (EN-3)

9 Department for Energy Security & Net Zero, 2023. National Policy Statement for Electricity Networks Infrastructure (EN-5)

10 Ministry of Housing, Communities & Local Government (2024). National Planning Policy Framework. [online] Available at: https://www.gov.uk/guidance/national-planning-policy-framework [Accessed 12/12/2024].

11 Department for Environment, Food and Rural Affairs (2010). Noise Policy Statement for England (NPSE). [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/ pb13750-noise-policy.pdf [Accessed 6/12/2023].

- Central Lincolnshire Local Plan adopted 2023[12]. Policy S14: Renewable Energy.

Guidance

10.1.10 The applicable guidance is summarised as follows:

- Planning Practice Guidance – Noise, 2019[13] (PPG);
- British Standard 4142: 2014+A1:2019 Methods for rating and assessing industrial and commercial sound[14] (BS 4142);
- British Standard 8233: 2014 Guidance on sound Insulation and noise reduction for buildings[15] (BS 8233);
- British Standard 5228 -1:2009+A1:2014 "Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise" [16] (BS 5228-1);
- British Standard 5228-2:2009+A1:2014 "Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration" [17] (BS 5228-2);
- Department for Transport (1988) Calculation of Road Traffic Noise (CRTN)[18];
- Highways England (2018) Design Manual for Roads and Bridges: LA111 - Noise and Vibration (DMRB)[19];
- Institute of Environmental Management and Assessment (IEMA) (2014) Guidelines for Environmental Noise Impact Assessment.[20];
- International Standards Organisation (ISO) 9613-2:2024 'Attenuation of sound during propagation outdoors – Part 2: Engineering methods for the prediction of sound pressure levels outdoors'[21];
- British Standard 7445-1:2003 Description and measurements of environmental noise (BS 7445-1)[22];
- The Highways Agency Research Report No. 53 Ground Vibration caused by Civil Engineering Works (1986)[23]; and
- BS 6472:2008 Guide to Evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting (BS 6472-1)[24]

12 Lincolnshire County Council, 2023. Central Lincolnshire Local Plan 2012-2036, adopted 2023. [Online] Available at: https://www.n-kesteven.gov.uk/sites/default/files/2023-04/Local%20Plan%20for%20adoption%20Approved%20by%20Committee.pdf

13 Ministry of Housing, Communities & Local Government. (2019). Planning Practice Guidance, Noise. (online). Available at: https://www.gov.uk/guidance/noise--2 (Accessed 05/12/2023)

14 British Standards Institute, 2014. BS 4142:2014:2014 + A1:2019 Methods for rating and assessing industrial and commercial sound. BSI London, UK

15 British Standards Institution (2014). BS 8223:2014, Guidance on sound insulation and noise reduction on buildings. BSI: London, UK

16 British Standards Institution, 2014. BS 5228-1:2009 + A1:2014 Code of construction practice for noise and vibration control on construction and open sites – Part 1: Noise. BSI, London.

17 British Standards Institution, 2014. BS 5228-2:2009 + A1:2014 Code of construction practice for noise and vibration control on construction and open sites – Part 2: Vibration. BSI, London.

18 Department for Transport (DfT) (1988). Calculation of Road Traffic Noise. HMSO, London.

19 Highways England (2019). Design Manual for Roads and Bridges, LA 111 – Noise and Vibration (Revision 2) [online]. Available at: https://www.standardsforhighways.co.uk/dmrb/search/cc8cfcf7-c235-4052-8d32-d5398796b364 [Accessed 22 February 2024].

20 Institute of Environmental Management and Assessment (2014). Guidelines for Environmental Noise Impact Assessment. IEMA, London.

21International Standards Organisation, 2024. ISO 9613-2:2024 'Attenuation of sound during propagation outdoors – Part 2: Engineering methods for the prediction of sound pressure levels outdoors.

22 British Standards Institution (2003). BS 7445-1:2003 Description and measurements of environmental noise. London, BSI.

23 The Highways Agency, 1986. Research Report No. 53 Ground Vibration caused by Civil Engineering Works (1986)

24 British Standards Institute, 2008. BS 6472:2008 Guide to Evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting. BSI, London.

10.2 Consultation & Scope of Assessment

Consultation Undertaken to Date

10.2.1 Table 10.1 provides a summary of the consultation activities undertaken in support of the preparation of this Chapter.

Table 10.1 – Summary of Consultation Undertaken to Date

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
EIA Scoping				
Planning Inspectorate	26th May 2023	Scoping Opinion EN010151 Ref: 3.5.1	"The Scoping Report states that noise and vibration from the cable route would only occur during construction and would be temporary in nature, and that as the cable route is not precisely known, no baseline survey has been assumed for potential receptors surrounding the Cable Route Area, and only short measurements may be undertaken to cover this topic. It is further stated that this will be reviewed as the design of the actual cable route is refined. "The Inspectorate considers that the ES should provide representative data to characterise the baseline environment and should demonstrate that construction activities associated with the cable	Monitoring methodology and locations agreed with North Kesteven District Council ('NKDC') on 6th July 2023. Effects resulting from the construction of the cable route has been assessed as part of this chapter in Section 10.5.

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
			route will not give rise to likely significant effects. The baseline information should be agreed with relevant statutory consultees."	
		Scoping Opinion EN010151 Ref: 3.5.2	"The Scoping Report states that central inverters will be assumed for the purposes of assessing a worst-case scenario. The justification provided is that this is "the larger option. Based on the location of noise sensitive receptors close to the boundaries of the panel array areas (as shown on Figures 8.1 and 8.2 of the Scoping Report) the Inspectorate considers that there is potential for string inverters to have a greater impact on the sensitive receptors due to proximity."	During the design evolution of the Proposed Development, both string and central inverters have been considered and modelled in order to identify a suitable 'worst case' scenario for consideration within the ES. It should also be noted that since the Scoping Opinion was published, buffers to the ESRs have been embedded within the design of the Proposed Development, increasing the distance between these receptors and any plant. As the detailed design layout is not yet confirmed, an indicative layout has been used for this assessment (as set in Section 10.5) which also incorporates indicative embedded mitigation measures. The assessment demonstrates that the identified reductions in noise levels required to reduce all effects to

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
				"not significant" are achievable within the inclusion of this embedded mitigation. The indicative layout used in the assessment includes central inverters. Once a detailed layout is confirmed a detailed noise assessment will be undertaken in order to identify the specific mitigation required at that time (taking into consideration advances in technology and changes in equipment specifications), in order to ensure that the noise levels within this assessment will not be exceeded (and therefore that the detailed design of the Proposed Development will not give rise to any materially new or materially worse effects as compared to the conclusions reached in this chapter.) This is considered to be the most robust and proportionate approach to provide an assessment of the likely significant effects of the

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
				Proposed Development, whilst retaining optionality and flexibility for the Applicant.
		Scoping Opinion EN010151 Ref: 3.5.3	"A 300m study area is proposed for identifying sensitive receptors. The ES should explain how the study area and sensitive receptors have been selected with reference to the extent of the likely impacts and relevant supporting evidence such as modelling. The Scoping Report states that the existing sensitive receptors comprise residential, leisure and community receptors. The ES should also consider if there are any ecological receptors that require consideration in respect of noise and vibration related impacts. The Applicant should seek agreement on any ecological receptors from relevant consultation bodies and cross-reference to the relevant chapters within the ES where relevant."	Based on professional judgment it is unlikely that receptors outside of a 300 m study area are unlikely to experience significant effects. However, if significant effects are anticipated at receptors in proximity to 300 m, additional receptors beyond this threshold may be considered. No additional receptors outside 300 m have been assessed. Noise impacts on ecological receptors (particularly wintering and ground-nesting birds) considered in **Chapter 07:Ecology (Document Ref: 6.2 ES Vol.1, 6.2.7).**
		Scoping Opinion EN010151 Ref: 3.5.4	"The Scoping Report states that a minimum of eight monitoring locations will be surveyed. Figures 8.1 and 8.2 of the Scoping Report show the suggested noise monitoring locations. The ES should explain	Noise monitoring was refined to four monitoring locations for receptors in proximity to the northern solar array. The four locations removed from the monitoring plan are

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
			how the baseline monitoring locations were chosen and how they are deemed to be representative of nearby receptors. The monitoring locations should be agreed with relevant statutory consultees."	representative of receptors located around the southern solar array, which is no longer part of this assessment. To determine change in sound levels due to construction traffic measured sound levels have been used as a proxy location for the relative receptors.
		Scoping Opinion EN010151 Ref: 3.5.5	"The Scoping Report does not refer to road traffic noise as being considered within the assessment. The ES should consider whether this alone could result in likely significant effects or do so cumulatively with other noise emissions from the Proposed Development. The ES should provide information on trip generation, traffic routing, noise emissions and distances from receptors including any measures that are to be secured to avoid or reduce likely significant effects for all phases."	Significant effects due to construction vehicle movement are assessed in section 10.5 and operational vehicle generation has been scoped out of the assessment due to the low flow vehicle movements.
		Scoping Opinion EN010151 Ref: 3.5.6	"The Inspectorate considers that the ES should provide a full justification for the proposed night-time assessment scenarios, and	A more detailed breakdown of night-time scenarios has been considered in the assessment as 'worst case'.

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
			this should be agreed with the relevant statutory consultees."	
LCC – scoping response	16th May 2023	E-mail consultation	No specific comments provided.	No action required
North Kesteven District Council (NKDC) – scoping response	18th May 2023	E-mail consultation	Wider survey area required beyond 300m proposal. Need to consider construction impacts from the cable route. Suggest baseline locations likely to change. Agree monitoring locations and period with NKDC. To consider tracking panels.	Following scoping response, details of proposed baseline survey methodology and locations were provided to NKDC on 5th July 2023. NKDC Environmental Health Office (EHO) agreed monitoring details to the Applicant by email on 6th July 2023. Tracking panels are no longer proposed as part of the Proposed Development, panels will be fixed. Construction of the Cable Route is presented in Section 10.5.
Early – non-statutory				
			Non-statutory feedback has been reviewed and does not contain any comments relevant to the noise impact assessment.	No action required.
Statutory				
NKDC	1st March 2024	Section 42 consultation response	"Paragraph 10.3.16 [of the PEIR **(Document Ref: ST19595-REP-002, Chapter 10)**] notes that as the	Addressed in Section 10.5 of this ES chapter. Additional monitoring was not undertaken

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
			positioning and route of the access road within the Access Route Corridor is yet to be confirmed, the assessment of construction traffic noise will be included within the ES. We agree with this approach however the applicant should discuss and confirm with the Council in advance whether additional sensitive receptor/background monitoring locations need be assessed along the Access Route Corridor and which are not specified on Figure 10.1. This might need to include Orchard Farm, Ewerby Road, Asgarby, Boons Cottages, 4 and 5 The Cottages, and Church Cottage Asgarby NG34 9QF."	at receptors within proximity of the access route corridor. Receptors within proximity to the access route corridor and its construction are assessed against the lowest threshold category in accordance with BS 5228-1 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. In the absence of monitored data this is a robust approach, as the lowest category threshold has been selected regardless of existing sound levels.
			"Table 10.9 – 'Existing Sensitive Receptors' states that Gashes Barn is 115m from the site boundary whereas it is actually within the broader Order Limits albeit outside of the red line. The more accurate measurement would be to refer to distance to closest panels/noise emitting plant and equipment. Can the applicant please confirm why background noise monitoring was not carried out at Gashes Barn."	The Applicant has modified Table 10.13 compared to the equivalent table in Chapter 10 of the PEIR **(Document Ref: ST19595-REP-002, Chapter 10)** to clarify the distance between Gashes Barn and the Order Limits. It is understood that equipment could not be securely deployed and prevented surveyors from installing equipment at Gashes

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				Barn. As such, ML1 was chosen as a representative proxy.
			"As noted in paragraph 10.6.7, given that the details of the Cable Route Corridor are not yet fixed, the Council will need to agree monitoring locations and NSRs to be assessed once the preferred option is finalised for the DCO application."	This is addressed in paragraph 10.5.37 of this ES chapter. Receptor locations for the construction of the cable route have not been agreed with NKDC. Additional receptors have been added recently along the cable route corridor which were not considered for the PEIR and during initial consultation with NKDC. However, receptors within 300 m of the Cable Route have been considered during the construction phase (Figure 10.2a), this distant is sufficient enough to capture receptors which are likely to experience sound levels due to construction. Additional monitoring was not undertaken at receptors within proximity of the Cable Route Corridor (Figure 2b) as the assessment does not draw a comparison with measured sound levels, but is based on threshold limits. As

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
				such, provide a robust assessment in the absence of monitored sound level data, Receptors within proximity to the Cable Route Corridor and its construction are assessed against the lowest threshold category in accordance with BS 5228-1 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*.
			"We note the overall conclusion in relation to operational noise levels set out at paragraph 10.6.34 that based on the 'worst case' Full Extents Layout, noise would exceed the background sound level at all ESRs 1-8 by between +6 to 23dB during all time periods, thereby exceeding the Lowest Observed Effect Level ('LOAEL'). The paragraph also confirms that with the exception of ESR6 Gashes Barn, Ewerby Waithe the SOAEL is exceeded both during the day and night time periods."	Further to the assessment undertaken within the **PEIR (Document Ref: ST19595-REP-002, Chapter 10**) the project design has been refined to include embedded mitigation measures. As such, impacts are predicted to be less than SOAEL at all receptors. A summary of results is presented in Table 10.28.
			"Whilst we accept that this is an indication of worst case impact prior to mitigation, we note and are	Embedded mitigation measures are proposed within this

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			concerned that this is predicted to result in a 'Substantial Adverse' effect which is Significant in EIA terms. Paragraph 10.7.3 confirms that mitigation measures will focus either on changes to equipment location and numbers or the placement of noise barriers. In the Council's opinion the next iteration of the site layout – including the size and location of the BESS and other noise-generating plant and equipment – must be worked back from achieving noise standards compliance; accounting for reasonable acoustic mitigation, at the ESRs. It cannot be assumed at this stage that the 'indicative mitigation layout' in Figure 1.5 will achieve such compliance."	assessment and are be secured through the DCO process. Embedded mitigation includes siting of the BESS and Onsite Substation centrally, and a detailed noise mitigation scheme. An indicative example of how the Proposed Development can be mitigated so as to reduce all noise effects to "not significant" at all ESRs is provided at Section 10.5. The exact form of mitigation required will be confirmed as part of detailed design post-consent. With the implementation of these measures no significant effects are anticipated.
			Mindful of these predicted exceedances the Council must be provided with details of proposed acoustic barriers and associated revised noise assessment data and ideally agree these prior to the DCO application being submitted.	No noise barriers are proposed for the Proposed Development. No significant effects are anticipated with the inclusion of embedded mitigation as described in Section 10.5. The full noise assessment is presented in Section 10.5.
			Paragraph 10.9.2 notes that there could be significant effects in-	Inter-cumulative effects are assessed in Section 10.8.

ORGANISATION	DATE	FORM OF CONSULTATION	CONSULTEE RESPONSE	HOW THIS HAS BEEN ADDRESSED
			combination with Heckington Fen, if there is overlap between construction of both cable routes. Whilst mitigation through control of timings of works in proximity to one another is proposed the applicant should still assess worse case construction noise effects for any overlapping areas mindful that control of works timings cannot be guaranteed given that one or both parties might not be prepared to delay Cable Route Corridor works pending completion of the other party's works.	Heckington Fenn has their own construction mitigation measures implemented via OCEMPs and ODMPs etc. to reduce residual effects to a "not significant" level. Therefore, it is not expected that there would be a significant cumulative effect. Moreover, such effects would only be temporary in nature, lasting only for the duration of overlap between construction works. As such, no other significant cumulative effects are considered likely in combination with other developments.
Lincolnshire County Council (LCC)	8th March 2024	Section 42 consultation response	LCC supports the comments made by NKDC in respect of noise and vibration as pollution control authority.	No action required

Scope of the Assessment

10.2.2 Noise emissions from the Proposed Development will occur during the construction, operational and maintenance and decommissioning phases. The noise levels during the construction and decommissioning phases of the BESS, Onsite Substation, solar array and ancillary equipment are likely to be similar due to the similar nature of work and equipment involved. However, it is understood that decommissioning of the Cable Route (including the Bicker Fen substation upgrade) is not similar to its construction as the 400kV cable and Bicker Fen substation extension will remain in situ, as such, the decommissioning of the Cable Route is not considered further within this chapter.

10.2.3 The activities associated with the construction and decommissioning phases of the Proposed Development have the potential to give rise to significant effects at the nearest ESRs. The potential noise impact during the construction/decommissioning phases has been assessed in accordance with the 'ABC' method presented in BS 5228-1:2009+A1:2014. The magnitude of change has been established and the significance of the effects has been determined.

10.2.4 During the construction and decommissioning phases of the Proposed Development, vibration is likely to be generated which could propagate beyond the boundary of the Site. When using equipment such as heavy plant or vibration compaction equipment close to the Site boundary, nearby sensitive receptors may experience ground-borne vibration. An assessment has been undertaken in accordance with BS 5228-2:2009+A1:2019 to determine the potential impact of construction/decommissioning vibration and whether unacceptable levels of vibration are present at ESRs. The magnitude of the impacts has been established and the significance of the effects has been determined.

10.2.5 During the operational phase, an external free-field noise rating level lower threshold of 35 dB $L_{Ar,Tr}$ has been used to represent the onset of LOAEL, with the onset of SOAEL considered to occur at noise rating levels greater 45 dB $L_{Ar,Tr}$. This applies at receptor locations in cases where the background levels are low i.e. equal to or below 35 dB L_{A90}. Where receptors experience background sound levels greater than 35 dB L_{A90}, the magnitude of change has been determined by undertaking an assessment is accordance with BS 4142.

10.2.6 This assessment has been carried out using SoundPLAN version 9.1 (SoundPLAN). SoundPLAN uses geographical information to generate a model of the study area to generate noise contours. The noise model includes all proposed onsite buildings and significant sources of noise associated with the construction and operation of the Proposed Development. SoundPLAN uses the methodology set out in ISO 9613-2:2024 ‘Attenuation of sound during propagation outdoors’.

Design Assumptions

10.2.7 The Proposed Development will cover approximately 529 ha of land and will comprise of above ground solar photovoltaic panels (solar PV) and BESS. The infrastructure will be connected by a cable route of around 13 km length

to the National Grid Bicker Fen 400 kV substation ('Bicker Fen substation'). The full project description is presented in **Chapter 2: Proposed Development (Document Ref: 6.2 ES Vol.1, 6.2.2).** It is understood that the Proposed Development will utilise a 'central inverter solution' which comprises inverters, transformers and switchgear equipment. In response to the Planning Inspectorate, as detailed in Table 10.1, the indicative layout used in the assessment includes central inverters. Once a detailed layout is confirmed a detailed noise assessment will be undertaken in order to identify the specific mitigation required at that time (taking into consideration advances in technology and changes in equipment specifications), in order to ensure that the noise levels within this assessment will not be exceeded (and therefore that the detailed design of the Proposed Development will not give rise to any materially new or materially worse effects as compared to the conclusions reached in this chapter.)

10.2.8 This is considered to be the most robust and proportionate approach to provide an assessment of the likely significant effects of the Proposed Development, whilst retaining optionality and flexibility for the Applicant.

10.2.9 The solar PV panels and Cable Route will not produce noise during the operational phase of the Proposed Development, but some of the associated infrastructure will give rise to noise emissions. The infrastructure components which emit sound are the inverters, transformers and PCUs associated with the solar PV and BESS. As such, the layout which has been assessed is considered to be the worst-case iteration.

10.2.10 Noise emissions from the solar inverters will not occur during periods of darkness. However, the BESS, which includes inverters, transformers and PCUs is required to operate at any time which may include during periods of darkness, and therefore the noise emissions from it have been assessed on their own during this period.

10.2.11 Some flexibility in the locating of plant is required. Consequently, should there be any changes in the locations of noise generating infrastructure, the Applicant commits to not exceed the predicted noise levels modelled at the sensitive receptors for the illustrative design. This may be achieved through procurement of quieter equipment than has been modelled.

10.2.12 It is assumed that during the decommissioning phase, the removal of the Bespoke Access Road will be the activity which generates the highest sound levels. It is also assumed that similar plant and equipment will be used as the construction of the Bespoke Access Road. As such effects will be broadly similar and reported as such.

Effects Not Considered within the Scope

10.2.13 Vibration levels during the operational phase are not expected to be high enough to cause any impacts on ESRs. Mitigation measures will be incorporated within the design of the Proposed Development to reduce or remove any vibration that would result from the onsite operation of the facility.

10.2.14 During the operational phase, traffic to and from the Proposed Development is expected to be minimal as the purpose of these movements will primarily be for maintenance work and equipment replacement. The volume of the additional traffic from the Proposed Development (as compared to the

baseline) is not expected to produce any significant noise or vibration effects at ESRs.

10.2.15 The proposed extension of Bicker Fen substation (comprising Work No. 5 in the Development Consent Order) is unlikely to result in any noticeable increase in noise levels at nearby ESRs, which all are over 1 km away.

Limitations & Exclusions

10.2.16 During the operational phase of the development, the only infrastructure which will emit noise will be located within the Solar Area as discussed in paragraph 10.2.9. As such, this assessment considers the impacts on the nearby ESRs from the proposed Solar Array Area (which includes the BESS and associated noise emitting electrical infrastructure) only.

10.2.17 To ensure that robust approach has been used for the assessment, it has been assumed that any ESRs near to the Bespoke Access Road and Cable Route Corridor will have low background levels and the most stringent BS 5228-1 category has been used in the construction assessment (Category A).

10.3 Assessment Methodology & Significance Criteria

Extent of the Study Area

10.3.1 A description of the Site and the Proposed Development is set out in **Chapter 2 (Document Ref: 6.2 ES Vol.1 6.2.2)**. The ESRs used in this assessment comprise the following:

- Existing residential receptors; and
- Existing ecological receptors.

  (The assessment of the anticipated noise effects on ecological receptors are contained within the **Chapter 7: Ecology (Document Ref: 6.2 ES Vol.1, 6.2.7)**.

10.3.2 A desk study has been undertaken to identify ESRs within the vicinity of the Site (as listed in Table 10.9) and a study area drawn to encompass these. The study area comprises the area of the Site and an area extending up to 300 m from the Order Limits. A 300 m distance is considered sufficient to encompass nearby ESRs, but other specific receptors located further afield have also been assessed, as required.

10.3.3 Construction vibration effects have been assessed for ESRs within 100 m of any vibration causing construction activities (such as piling).

Assessment Methodology

10.3.4 The assessment has been undertaken in accordance with the prediction methodologies set out in BS 5228-1 and BS 5228-2 for construction activity and BS 4142 for operational activity. The increase in traffic noise due to construction traffic on the local road network has been assessed in accordance with methodologies in DMRB.

10.3.5 Based on the assessment outcomes, their relationship with the magnitude of change, and the sensitivity of the receptor, the significance of effect at a

receptor can be determined. This will determine whether effects are Significant or Not Significant.

10.3.6 The assessment methodology for determining the sensitivity of the receptor, magnitude of change and significance of effect has been updated from the PEIR **(Document Ref: ST19595-REP-002, Chapter 10)** for this ES Chapter. The main reason for the change is to provide a more developed methodology that robustly assess the impacts to the nearby sensitive receptors so that significant adverse effects can be defined and mitigated if identified.

10.3.7 Table 10-3 of the PEIR **(Document Ref: ST19595-REP-002, Chapter 10)** presented the sensitivity of receptor categorisation. The changes made to the sensitivity of receptor descriptions are minor in that the sensitivity has been revised from Negligible, Low, Medium and High to Low, Medium, High and Very High. The receptor descriptions have also changed but fundamentally the category descriptions for Negligible & Low, Low & Medium, Medium & High and High & Very High are similar and can be considered comparable.

10.3.8 For the closest receptors to the Solar Array the method and location of baseline data collection and assessment has been agreed with NKDC and is in accordance with current guidance and industry best practice. For the Cable Corridor and Bespoke Access Road, receptor locations for the construction of the cable route have not been agreed with NKDC. Additional receptors have been added recently along the Cable Route Corridor which were not considered for the PEIR and during initial consultation with NKDC.

10.3.9 For the operational phase, a 3D noise model was created in SoundPLAN 9.1 which implements ISO 9613-2:2024. Each piece of noise emitting equipment has been included in the model. Noise prediction calculations have been undertaken to predict the noise levels which are likely to be generated by typical operational activities associated with the Proposed Development and the resultant noise levels at ESR locations.

10.3.10 The prediction calculations have used noise measurement information provided by the Applicant to the authors of this chapter.

10.3.11 Noise policy set out within the NPSE and the other applicable planning policy listed in paragraph 10.2.3, requires that noise and vibration assessments identify effects that would result in significant adverse impacts on health and quality of life from a proposed development.

10.3.12 Within the NPSE and PPG the effect levels in relation to adverse impacts on health and quality of life are defined by reference to the following thresholds:

- No Observed Effect Level (NOEL) – level of noise below which no effect on health and quality of life is detected;
- Lowest Observed Effect Level (LOAEL) – level of noise above which adverse effects on health and quality of life can be detected; and
- Significant Observed Effect Level (SOAEL) – level of noise above which significant adverse effects on health and quality of life occur.

10.3.13 The PPG links the different effect levels and their perception by a receptor to the action required if an effect is identified, as summarised in Table 10.2.

Table 10.2 – PPG, summary of noise exposure hierarchy

RESPONSE	EXAMPLES OF OUTCOMES	INCREASING EFFECT LEVEL	ACTION
No Observed Effect Level (NOEL)			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level (NOAEL)			
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 (LOAEL)			
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

RESPONSE	EXAMPLES OF OUTCOMES	INCREASING EFFECT LEVEL	ACTION
	Significant Observed Adverse Effect Level (SOAEL)		
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

10.3.14 In relation to the effect levels summarised in Table 10.2, the NPSE sets out 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 improvement of health and quality of life.

10.3.15 The NPSE states that it is not possible to have a 'single objective' noise or vibration-based value which can be applied to all sources and receptors that can define the on-set of LOAEL or the SOAEL. It is however possible to define threshold levels for effect levels based on the available standards and guidance.

10.3.16 The standards and technical guidance used to define the NPSE threshold levels and the reasoning, are detailed in the section below.

10.3.17 The PPG provides advice where noise effects can be partially offset if residents of affected dwellings have access to:

- a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling;
- a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects;
- a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- a relatively quiet, protected, external publicly accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5-minute walking distance).

Establishing receptor sensitivity

10.3.18 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('EIA Regulations') recognise that developments will affect the environment to differing degrees, and not all affected elements warrant detailed investigation through the EIA process. The EIA Regulations identify those elements which warrant investigation as those that are *'likely to be significantly affected by the development'.*

10.3.19 The EIA Regulations do not define significance. Therefore, it is necessary to state how this is defined for the purposes of undertaking an EIA. The significance of an effect resulting from a development during construction, operation and decommissioning is assessed by reference to both the sensitivity of a receptor and the magnitude of the impact, change or effect. This approach provides a mechanism for identifying areas where mitigation measures may be required and to identify the most appropriate measures to alleviate the risk presented by the development.

10.3.20 Table 10.3 sets out how the sensitivity of a receptor is determined. The table provides guidance based on experience, the assessment of similar facilities and professional judgment.

Table 10.3 - Establishing the sensitivity of receptors

SENSITIVITY	RECEPTOR TYPE
Low	Low importance; abundant; local importance or scale; resilient to change; potential for substitution within the local area.
Medium	Low to medium importance; relatively abundant; regional importance or scale; reasonably resilient to change; potential for substitution.

SENSITIVITY	RECEPTOR TYPE
High	Medium to high importance; relatively rare; national importance or scale; fragile and susceptible to change; limited potential for substitution.
Very High	Very high importance; extremely rare; international importance or scale; very fragile; highly susceptible to change; very limited potential for substitution.

Construction traffic methodology

10.3.21 In relation to construction traffic associated with the Proposed Development, Section 9.6 of Chapter 9: Access and Traffic **(Document Ref: 6.2 ES Vol.1, 6.2.9)**, includes an assessment of highway links that will be used for vehicular access in the construction phase. An assessment of noise level change, based on the information presented in Chapter 9: Access and Traffic **(Document Ref: 6.2 ES Vol.1, 6.2.9)**, has been undertaken in accordance with IEMA guidance.

10.3.22 For construction traffic noise the duration of the proposed construction works has been considered as a factor in the determination of significant effects.

Construction noise and vibration methodology

10.3.23 For construction activity, Table E.1 in Annex E of BS 5228-1 (reproduced in Table 10.4) has been used to determine the thresholds of significance for residential receptors. The determination of Magnitude of change for construction noise has been assessed with reference to the methodology set out in BS 5228-1.

Table 10.4 – Threshold of potential significant effect at dwellings

Assessment Category and Threshold Value Period	Threshold Value in Decibels (dB) ($L_{Aeq,T}$)		
	Category A[A])	Category B[B])	Category C[C])
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends[D])	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.
NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3dB due to site noise.
NOTE 3: Applied to residential receptors only

[A]) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
[B]) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.
[C]) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

Assessment Category and Threshold Value Period	Threshold Value in Decibels (dB) ($L_{Aeq,T}$)		
	Category A[A])	Category B[B])	Category C[C])

[D] 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

Construction and decommissioning noise – determination of magnitude of change

10.3.24 Table 10.5 presents the criteria used within the assessment to determine the construction noise magnitude of change.

Table 10.5 - Magnitude of Construction Noise Impact

MAGNITUDE	DESCRIPTION
High	Noise levels exceed the assessment category threshold level for the duration of the construction works.
Medium	Noise levels exceed the assessment category threshold level for periods of more than one month, but for significantly less than the whole duration of the construction works.
Low	Noise levels exceed the assessment category threshold level for periods of less than one month.
Negligible	Noise levels do not exceed the assessment category threshold level during any period.

10.3.25 The significance of effect on ESRs has been determined using Table 10.3 to define the receptor sensitivity and the information in Table 10.5 to determine the magnitude of change. This has then been assessed using the significance matrix in Table 10.10 to determine the significance of effect.

Construction vibration – determination of magnitude of change

10.3.26 Table 10.6 presents the criteria used within the assessment to determine the construction vibration magnitude of change.

Table 10.6 - Magnitude of Construction Vibration Impact

MAGNITUDE	CHANGE IN VIBRATION LEVEL (measured as a Peak Particle Velocity in mms^{-1})	DESCRIPTION
High	≥ 10mm/s^{-1}	Vibration likely to be intolerable for more than brief exposure. Approaching the level at which cosmetic damage may occur in light structures.
Medium	≥5mm/s^{-1} – <10mm/s^{-1}	Tolerance less likely even with warning and explanation.
Low	≥1mm/s^{-1} – <5mm/s^{-1}	Complaints are likely but can be tolerated if warning and explanation given.

MAGNITUDE	CHANGE IN VIBRATION LEVEL (measured as a Peak Particle Velocity in mms^{-1})	DESCRIPTION
Negligible	<1mm/s^{-1}	Below level at which complaints are likely.

10.3.27 The significance of effect has been determined using Table 10.3 to define the receptor sensitivity and the information in Table 10.6 to determine the Magnitude of change. This has then been assessed using the significance matrix in Table 10.10 to determine the significance of effect.

Construction traffic noise – determination of magnitude of change

10.3.28 Table 10.7 presents the criteria used within the assessment to determine the construction traffic noise magnitude of change. Professional judgement and guidance within CRTN, DMRB and IEMA have been used to determine magnitude categories.

Table 10.7 - Magnitude of Construction Traffic Noise Impact

MAGNITUDE	INCREASE IN SOUND LEVEL, dB $L_{A10,18HR}$
High	≥5.0dB.
Medium	≥3.0dB - <5.0dB
Low	≥1.0dB - <3.0dB
Negligible	<1.0dB

10.3.29 The significance of effect has been determined using Table 10.3to define the receptor sensitivity and the information in Table 10.7 to determine the Magnitude of change. This has then been assessed using the significance matrix in Table 10.10 to determine the significance of effect.

Operational noise methodology

10.3.30 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. However, BS 4142 advises that, where rating levels/background levels are low, the assessment of operational noise should take into context the absolute noise level. BS 4142 provides guidance on the initial estimate of impact from the specific sound when subtracting the measured background sound level from the rating level. These are:

10.3.31 Typically, the greater this difference, the greater the magnitude of the impact.

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

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

10.3.34 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.

10.3.35 For the operational phase, a 3D noise model has been created in SoundPLAN. All items of noise emitting equipment have been included in the model. Noise prediction calculations have been undertaken to predict the noise levels which from typical operational activity associated with the Proposed Development and resultant noise levels at ESR locations.

Determination of significance – Operational noise impact

10.3.36 For the magnitude of change, Table 10-4 of the PEIR **(Document Ref: ST19595-REP-002, Chapter 10)** presented the Magnitude of change methodology used for the preliminary assessment. This Magnitude of change methodology was based on the difference of the predicted Rating Level relative to the background sound level and absolute Rating Levels. The Magnitude of change methodology used in the PEIR **(Document Ref: ST19595-REP-002, Chapter 10)** is presented in Table 10.8;

Table 10.8 – Magnitude of change for Operational Noise Presented in the PEIR

MAGNITUDE OF CHANGE	DESCRIPTION
High	a rating level more than 10dB above the background $L_{A90,T}$; and above 45 dB. - SOAEL
Medium	a rating level more than 5dB above the background $L_{A90,T}$; and above 35 dB.
Small	a rating level more than the background LA90,T ; but below 35 dB. - LOAEL
Negligible	a rating level below the background $L_{A90,T}$

10.3.37 The methodology for determining Magnitude of change from operational noise in the PEIR **(Document Ref: ST19595-REP-002, Chapter 10)** did not allow for sufficient flexibility in determining the most appropriate Magnitude of change where only one requirement was fulfilled (i.e. exceeded background by certain threshold but not the absolute Rating Level or vice versa). Although the methodology was clear in that the Rating Level must exceed background sound levels by a certain minimum value and also by an absolute amount.

10.3.38 The magnitude of change also introduced thresholds for SOAEL and LOAEL at this stage however after reviewing the introduction of defining LOAEL and SOAEL in relation to Magnitude of change it was concluded this should have been tied to the significance of effect i.e. SOAEL would correspond to a significance of effect of Moderate Major and Major and LOAEL would correspond to Moderate.

10.3.39 Having considered the methodology further between PEIR **(Document Ref: ST19595-REP-002, Chapter 10)** and ES, it was concluded that a change in the methodology would be appropriate to align the methodology more closely to the guidance in BS 4142:2014, especially around low background sound levels.

10.3.40 The updates to the methodology introduced in this ES Chapter have been modified to consider the existing noise climate, specifically existing background sound levels and their relationship to the Magnitude of change. Consideration of the existing noise climate and background sound levels is a significant contextual factor required of a BS 4142 assessment, upon which the methodology is based. The updated methodology has split the assessment into two parts, the first part is for where background sound levels are less than 35dB $L_{A90,T}$ (low backgrounds) and the second one is for where background sound levels exceed 35dB $L_{A90,T}$.

10.3.41 For low background sound conditions, the absolute Rating Level is more important than the difference between two sound levels. Where background sound levels increase, the difference between the Rating Level and background sound level is considered more important, as a larger difference would result in louder absolute sound levels overall.

10.3.42 The low background approach is consistent with the guidance in BS 4142 and has been adopted widely by other schemes of a similar nature that have gone through Development Consent Order process, for example: Gate Burton Energy Park (PINS ref: EN010131) and West Burton Solar Project (PINS ref: EN010132). Where backgrounds exceed 35dB $L_{A90,T}$ the traditional methodology in BS4142:2014 has been used.

10.3.43 Further to the above, where Potentially Significant effects are identified a contextual assessment has been undertaken to determine likely internal sound levels. This allows the application of professional judgement to be considered in the final decision-making process. The absolute internal sound levels are based on the guidance in BS 8233. The guidance presents acceptable threshold sound levels so that sleep and rest disturbances in bedrooms during the daytime and night-time are avoided. Furthermore, threshold sound levels are presented for other parts of a building to maintain the acoustic quality for communication.

10.3.44 Where potential significant effects are identified based on either the absolute Rating Level or difference between the Rating Level and background noise level, a comparison to the recommended internal sound level criteria, as described in BS 8233, has been made. This allows the decision maker to determine whether the effect is Significant or Not Significant.

10.3.45 The updated methodology for determining Magnitude of change is as follows:

- An external free-field noise rating level lower threshold of 35 dB $L_{Ar,Tr}$ is used to represent the onset of LOAEL, with the onset of SOAEL considered to occur at noise rating levels greater 45 dB $L_{Ar,Tr}$.
- This applies at receptor locations in cases where the background levels are low i.e. equal to or below 35 dB $L_{A90,T}$. This would provide satisfactory external amenity during the daytime and during the night-time recommended internal noise levels can be achieved when a window is partially open.
- Where receptors experience background sound levels greater than 35 dB $L_{A90,T}$, the magnitude of change has been determined by undertaking an assessment is accordance with BS 4142. An assessment in accordance with BS 4142 assesses the impacts of a new or existing sound source by comparing the operational sound level (rating level) with the sound level

that is present without development (Background sound level) i.e. the existing acoustic environment. The final conclusion of the assessment is drawn based on a combination of the quantitative results, professional judgement, and contextual factors.

- To provide context, an assessment of internal ambient sound levels has been undertaken in accordance with BS 8233.

10.3.46 Table 10.9 presents the updated criteria used within the assessment to determine the operational Magnitude of change.

Table 10.9 – Magnitude of Change Operational Noise Impact

MAGNITUDE OF CHANGE	CRITERIA WHEN BACKGROUND SOUND LEVELS ARE ≤35 dB $L_{A90,T}$	CRITERIA WHEN BACKGROUND SOUND LEVELS ARE >35 dB $L_{A90,T}$	INTERNAL AMBIENT SOUND LEVEL CRITERIA
High	A rating level above 45 dB $L_{Ar,Tr}$.	BS4142 initial estimate of impact is ≥10 dB above background sound level	Living room >45 dB $L_{Aeq,16hour}$ External Amenity >60dB $L_{Aeq,16hour}$ Bedroom >40 dB $L_{Aeq,8hour}$ >55 dB L_{AFmax}
Medium	A rating level equal to or above 35 dB $L_{Ar,Tr}$ but less than or equal to 45dB $L_{Ar,Tr}$	BS4142 initial estimate of impact is between 5-9 dB above background sound level	Living room 40-45 dB $L_{Aeq,16hour}$ External Amenity <60dB $L_{Aeq,16hour}$ Bedroom 35-40 dB $L_{Aeq,8hour}$ 50-55 dB L_{AFmax}
Low	A rating level above 30 dB $L_{Ar,Tr}$ but less than or equal to 35dB $L_{Ar,Tr}$	BS4142 initial estimate of impact is between 1-4 dB above background sound level	Living room 35-40 dB $L_{Aeq,16hour}$ External Amenity <55 dB $L_{Aeq,16hour}$ Bedroom 30-35 dB $L_{Aeq,8hour}$ 45-50 dB L_{AFmax}
Negligible	A rating level equal to or below 30 dB $L_{Ar,Tr}$.	BS4142 initial estimate of impact is equal to or below background sound level	Living room <35 dB $L_{Aeq,16hour}$ External Amenity <50dB $L_{Aeq,16hour}$ Bedroom <30 dB $L_{Aeq,8hour}$ <45 dB L_{AFmax}

10.3.47 The significance of effect has been determined using Table 10.3 to define the receptor sensitivity and the information in Table 10.9 to determine the Magnitude of change. This has then been assessed using the significance matrix in Table 10.10 to determine the significance of effect.

Significance of effect evaluation methodology

10.3.48 The significance of an environmental effect for construction/decommissioning noise and operational noise is determined by the interaction of magnitude and sensitivity. The Effect Significance Matrix used in this assessment is shown in Table 10.10, below, which has been used to determine the level of effect experienced by the identified ESRs. The corresponding NPSE/Noise Hierarchy impact threshold has been mapped to the significance of effect to allow comparison with national planning policy requirements for noise.

Table 10.10 – Effect Significance Matrix

RECEPTOR SENSITIVITY	MAGNITUDE OF CHANGE			
	NEGLIGIBLE	LOW	MEDIUM	HIGH
Low	Negligible (Not Significant - NOEL)	Negligible (Not Significant - NOEL)	Minor (Not Significant - NOAEL)	Minor (Not Significant - NOAEL)
Medium	Negligible (Not Significant - NOEL)	Minor (Not Significant - NOAEL)	Moderate (Potentially Significant - LOAEL)	Moderate (Potentially Significant - LOAEL)
High	Minor (Not Significant - NOAEL)	Moderate (Potentially Significant - LOAEL)	Major (Significant – SOAEL)	Major (Significant - SOAEL)
Very High	Minor (Not Significant - NOAEL)	Moderate (Potentially Significant - LOAEL)	Major (Significant - SOAEL)	Major (Significant - SOAEL)

10.3.49 Significant effects can be both beneficial and adverse. Effects that are identified as *Major* are considered to be ***Significant*** (adverse or beneficial) in EIA terms.

10.3.50 For ***Moderate*** effects the significance is defined as ***Potentially Significant***. The final determination of whether an effect is ***Significant*** or ***Not Significant*** in EIA terms has been determined using professional judgement considering any relevant contextual factors, which include but not limited to:

- Absolute sound level;
- Character of the sound; and
- Existing acoustic environment;

10.3.51 The relevant factors to determine whether a ***Potentially Significant*** effect is ***Significant*** or ***Not Significant*** include professional judgement, the planning policy outcome and whether recommended internal sound levels in accordance with BS 8233 are exceeded. Table 10.9 presents the recommended internal ambient sound level criteria.

10.3.52 Effects that are ***Minor*** and ***Negligible*** are determined to be ***Not Significant*** in EIA terms.

10.4 Identification of Baseline Conditions

Current Baseline Conditions

10.4.1 To establish the baseline noise levels at the ESRs, a background noise survey was undertaken by Wardell Armstrong LLP on 27th July 2023 and 28th July 2023.

10.4.2 Noise measurements were carried out at four monitoring locations agreed with NKDC which are in proximity to (and therefore considered to be representative of) the eight ESRs. A 24-hour noise measurement was captured at each location. The monitoring locations are shown on Figure 10.1 and are as follows:

- ML1: Unattended noise monitoring at the northern boundary of the Proposed Development. The microphone was positioned near Gashes Barn, within the Order Limits of the Solar Array Area. Distant road traffic was audible, and bird song and aircraft noise were audible occasionally.
- ML2: Unattended noise monitoring at the western boundary of the Proposed Development. The microphone was positioned north of Ewerby Thorpe Lodge, within the Order Limits of the Solar Array Area. Distant road traffic was audible, and bird song and aircraft noise were audible occasionally.
- ML3: Unattended noise monitoring at the south-western boundary of the Proposed Development. The microphone was positioned within the Order Limits of the Solar Array Area. During the deployment of the equipment, activities from the farm yard to the west were audible, additionally very distant road traffic was audible, and bird song and aircraft noise were audible occasionally.
- ML4: Unattended noise monitoring at the southern boundary of the Proposed Development, within the Order Limits of the Solar Array Area. During the deployment of the equipment, activities from the farm yard to the south were audible, and additionally bird song and aircraft noise were audible occasionally.

10.4.3 Noise monitoring was undertaken for a sample 24-hour weekday period to reflect the continuous operational hours of the Proposed Development.

10.4.4 The noise measurements were made using Class 1, integrated sound level meters. The microphones were mounted on tripods 1.5m above the ground and more than 3.5m from any other reflecting surfaces with the diaphragms horizontal.

10.4.5 The monitoring equipment used was as follows:

Fusion SLM	SN:10717
Fusion SLM	SN:10711
Fusion SLM	SN:12639
Cube SLM	SN:12197
01dB Cal21 Calibrator	SN:34254653
Cirrus CR:515 Calibrator	SN:67438

10.4.6 The weather conditions during the survey were as follows:

Wind speeds: 0 to 5 m/s^{-1}

No precipitation

Sunny, scattered clouds

Temperature: 14˚C to 22 ˚C

10.4.7 The sound level meters were calibrated to a reference level of 94dB at 1kHz both before and on completion of the noise survey. No drift in calibration over 0.5dB was recorded during the survey.

10.4.8 A-weighted L_{eq} and L_{90} noise levels have been measured to comply with the requirements of BS 4142. A-weighted maximum sound pressure levels were also measured to provide additional information.

Existing Measured Noise Levels

10.4.9 When establishing baseline sound levels for the purpose of assessing the potential noise impact during the construction and decommissioning phases, the sound levels at each monitoring location during the 07:00 and 19:00 period have been considered.

10.4.10 For assessing operational noise impacts, the periods specified in BS 4142:2014+A1:2019 have been split further to reflect a range of appropriate scenarios depending on whether daylight is present.

10.4.11 The five assessment scenarios and time ranges have been identified in Table 10.11, below.

Table 10.11 – Operation Scenarios and Time Frames

PERIOD	DAYTIME			NIGHT-TIME	
Time	07:00 – 19:00	19:00 – 22:00	22:00 – 23:00	23:00 – 04:00	04:00 – 07:00
Battery and Energy Storage System (BESS) Operation	Yes	Yes	Yes	Yes	Yes
Solar Farm Operation	Yes	Yes	No	No	Yes

10.4.12 As a robust worst case, short duration periods of early morning (dawn) and late evening (dusk) have been included in the operational scenarios identified in Table 10.11.

10.4.13 The results of each of the monitoring locations are presented in Table 10.12 The noise monitoring results are provided in full at Appendix 10.2 – Noise Survey Results.

10.4.14 To assess the operational phase, the measured sound levels presented in Table 10.12 have been defined in 1-hour periods for daytime and the over 15-minute periods for night-time respectively, in accordance with reference periods required by BS 4142.

Table 10.12 – Measured Noise Levels

MONITORING LOCATION	TIME	AVERAGE MEASURED AMBIENT SOUND LEVEL dB $L_{Aeq,T}$	MEASURED BACKGROUND SOUND LEVEL dB $L_{A90,T}$	
			RANGE	MODAL VALUE
ML1	Daytime (07:00-19:00)	49	26-41	35
	Daytime (19:00-22:00)	36	25-37	27
	Daytime (22:00-23:00)	28	24-27	25
	Night-time (23:00-04:00)	25	20-26	21
	Night-time (04:00-07:00)	45	23-32	29
ML2	Daytime (07:00-19:00)	52	27-43	33
	Daytime (19:00-22:00)	45	26-32	28
	Daytime (22:00-23:00)	41	24-28	26
	Night-time (23:00-04:00)	41	21-27	23
	Night-time (04:00-07:00)	47	28-33	29
ML3	Daytime (07:00-19:00)	49	31-44	37
	Daytime (19:00-22:00)	50	34-48	34
	Daytime (22:00-23:00)	37	25-34	34
	Night-time (23:00-04:00)	31	22-29	25
	Night-time (04:00-07:00)	46	29-41	38

MONITORING LOCATION	TIME	AVERAGE MEASURED AMBIENT SOUND LEVEL dB $L_{Aeq,T}$	MEASURED BACKGROUND SOUND LEVEL dB $L_{A90,T}$	
			RANGE	MODAL VALUE
ML4	Daytime (07:00-19:00)	51	29-43	37
	Daytime (19:00-22:00)	47	25-37	30
	Daytime (22:00-23:00)	26	24-26	25
	Night-time (23:00-04:00)	27	23-26	24
	Night-time (04:00-07:00)	46	24-44	31

Sensitive Receptors

10.4.15 The representative ESRs nearest to the Proposed Development were identified through a desktop study of the surrounding land using available maps and aerial photography. The ESRs identified in Table 10.13 and shown on Figure 10.1 are those ESRs most likely to be affected by noise from the Proposed Development. The locations chosen for the ESRs are those likely to experience the greatest impact due to noise emissions during the construction/decommissioning and operational phase of the Proposed Development.

Table 10.13 – Existing Sensitive Receptors

RECEPTOR ID	RECEPTOR ADDRESS	GRID CO-ORDINATES		BEARING FROM ORDER LIMITS	APPROX. DISTANCE TO ODER LIMITS (M)	RECEPTOR SENSITIVITY	ASSESSMENT TYPE
		X	Y				
R1	The Farm Kitchen Limited, Thorpe Rd, Ewerby Thorpe, Sleaford NG34 9PR	513490	347676	East	70	Medium	Construction/ Operation
R2	Ewerby Thorpe Lodge	513463	347697	East	50	Medium	Construction/ Operation
R3	Austhorpe Top House, Sleaford NG34 9PR	513324	347717	East	165	Medium	Construction/ Operation
R4	Copperhill Kennels Cattery	513745	348495	North	30	Medium	Construction/ Operation
R5	Cooks Farm House, Ewerby Waithe, Sleaford NG34 9PS	513770	348809	North	125	Medium	Construction/ Operation
R6	Gashes Barn,	515262	348842	Middle	115*	Medium	Construction/ Operation

RECEPTOR ID	RECEPTOR ADDRESS	GRID CO-ORDINATES		BEARING FROM ORDER LIMITS	APPROX. DISTANCE TO ODER LIMITS (M)	RECEPTOR SENSITIVITY	ASSESSMENT TYPE
		X	Y				
	Ewerby Waithe, Sleaford, NG34 9PS						
R7	West Grange, Howell, Sleaford NG34 9PT	513632	346402	South	25	Medium	Construction/ Operation
R8	Fen Farm Sleaford NG34 9PU	515392	347262	South	30	Medium	Construction/ Operation
R9	The Old Rectory, Howell, Sleaford NG34 9PT	513551	346300	South	110	Medium	Construction/ Operation
R10	Tythe Lodge, Heckington Rd, Howell, Sleaford NG34 9PT	513553	346364	South	50	Medium	Construction/ Operation
R11	Crown Cottage Heckington Rd, Howell,	513505	346505	South	15	Medium	Construction/ Operation

RECEPTOR ID	RECEPTOR ADDRESS	GRID CO-ORDINATES		BEARING FROM ORDER LIMITS	APPROX. DISTANCE TO ODER LIMITS (M)	RECEPTOR SENSITIVITY	ASSESSMENT TYPE
		X	Y				
	Sleaford NG34 9PT						
R12	Boons Cottages, Asgarby, Sleaford, Ng34 9qf	511433	345068	South-west	150	Medium	Construction**
R13	Church Cottage, Asgarby, NG34 9QF	511660	345439	South-West	150	Medium	Construction**
R14	Orchard Farm, Asgarby Road, NG34 9PW	511940	346576	South-West	360	Medium	Construction**
R15	Star Fen Farm, Star Fen Drove, Heckington, Sleaford, Ng34 9nd	516051	345583	East	130	Medium	Construction**
R16	Cafe, Maple Cottage, Kyme Road, Heckington Fen,	515676	345197	West	240	Medium	Construction**

RECEPTOR ID	RECEPTOR ADDRESS	GRID CO-ORDINATES		BEARING FROM ORDER LIMITS	APPROX. DISTANCE TO ODER LIMITS (M)	RECEPTOR SENSITIVITY	ASSESSMENT TYPE
		X	Y				
	Sleaford, NG34 9NE						
R17	Decoy Farm, Kyme Road, Heckington Fen, Sleaford, NG34 9NE	515891	345195	West	50	Medium	Construction**
R18	Farm House, Kane Farm, Boston Road, Heckington, Sleaford, NG34 9JQ	516249	344318	South & West	400/ 500	Medium	Construction**
R19	Eastfield House, Boston Road, Heckington, Sleaford, NG34 9JD	516494	344095	West	250	Medium	Construction**
R20	Workshop, Fen House, Great Hale Drove, Great Hale,	517010	343169	North	130	Medium	Construction**

RECEPTOR ID	RECEPTOR ADDRESS	GRID CO-ORDINATES		BEARING FROM ORDER LIMITS	APPROX. DISTANCE TO ODER LIMITS (M)	RECEPTOR SENSITIVITY	ASSESSMENT TYPE
		X	Y				
	Sleaford, NG34 9LS						
R21	Bramble Cottage, Great Hale Drove, Great Hale, Sleaford, NG34 9GJ	517172	343424	East	350	Medium	Construction**
R22	Poplar Farm, Great Hale, Sleaford, NG34 9LS	517577	343283	North	500	Medium	Construction**
R23	Mastins House, Great Hale Drove, Great Hale, Sleaford, NG34 9LT	517878	342307	South	250	Medium	Construction**
R24	White House Farm, Great Hale Drove, Great Hale, Sleaford, NG34 9LT	518736	342094	South	230	Medium	Construction**

RECEPTOR ID	RECEPTOR ADDRESS	GRID CO-ORDINATES		BEARING FROM ORDER LIMITS	APPROX. DISTANCE TO ODER LIMITS (M)	RECEPTOR SENSITIVITY	ASSESSMENT TYPE
		X	Y				
R25	Woods's, Timms Drove, Low Grounds, Boston, PE20 3PG	520351	341714	East	295	Medium	Construction**
R26	Tile Barn Farm, Tilebarn Lane, Low Grounds, Boston, PE20 3PG	521271	340326	East	675	Medium	Construction**
R27	Crow Hall, North Drove, Bicker, Boston, PE20 3BQ	520763	339632	East	225	Medium	Construction**
R28	White House Farm, North Drove, Bicker, Boston, PE20 3BQ	520350	339920	West	165	Medium	Construction**

(*) – Receptor is surrounded by the order limits. This value represents the closest distance between the dwelling and the order limits.
(**) – Receptor is >300 m from the Solar Array and BESS, as such these receptors are not considered within the operational assessment.

10.4.16 Sensitive dwellings and community facilities beyond the selected ESRs could also be affected by noise from the Proposed Development. However, the impacts at the other ESRs will be less than those experienced at the ESRs identified, above. Mitigation measures during the construction / decommissioning phase are presented within Appendix 2.4 Outline Construction Environment Management Plan (OCEMP) **(Document Ref: 6.3 ES Vol.2, 6.3.7)** and Appendix 2.5 Outline Decommissioning Environment Management Plan (ODEMP) **(Document Ref: 6.3 ES Vol.2, 6.3.8)**, which have been developed to reduce impacts to acceptable levels at the above ESRs. For the operational phase, embedded design measures have been implemented to reduce and mitigate sound levels to a minimum at the ESRs.

Uncertainty

10.4.17 To reduce measurement uncertainty, the following steps have been taken:

- The background sound measurement locations were selected to be representative of the background sound levels at ESRs;
- Wind was typically from the south-west during the survey which is indicative of the prevailing wind direction[25], and is therefore inclusive of ambient road traffic noise from the A17, which is over 1.3km away.
- In accordance with BS 7445-1, the sound level meter was mounted on a tripod 1.5m above the ground. The monitoring location was also more than 3.5m from any other reflecting surfaces;
- The noise measurements were taken during dry and calm weather conditions;
- The noise measurements were undertaken during proposed operational times for the Proposed Development and are representative of the daytime and night-time periods;
- The results of each measurement period were recorded to the nearest 0.1dB; and,
- Background sound measurements were made using Class 1 integrating sound level meters.

Uncertainty in Calculations

10.4.18 Calculation methodologies for noise propagation is based on computer noise modelling algorithms which follow ISO 9613-2:2024. Calculation methodologies for the assessment follow methodology in BS 4142:2014+A1:2019.

10.4.19 Baseline noise measurements made in July 2023 are representative of the area and are not expected to significantly change so are suitable for use as future baseline.

10.5 Assessment of Effects

10.5.1 This section of the report presents the assessment of effects and includes details of mitigation measures. Embedded mitigation are measures which are incorporated into the design of and construction of the development.

[25] https://windy.app/forecast2/spot/480925/Sleaford/statistics

Secondary mitigation is required where activity will require additional measures to those embedded to achieve the anticipated outcome.

Embedded Mitigation

Construction Phase

10.5.2 In accordance with BS 5228-1, the construction phase assessment has been undertaken on the assumption that no secondary mitigation will be in place. Required mitigation is then identified and set out within Section 10.7.

10.5.3 The following embedded mitigation is secured and is set out within the OCEMP:

10.5.4 The core working hours considered in this ES will be as follows. However, these working hours may be reduced during winter months reflective of the seasonal daylight hours:

- 07:00 – 19:00 Mondays – Fridays;
- 08:00 – 13:00 Saturdays; and
- Subject to the paragraph below, no works will take place on Sundays or Bank Holidays.

10.5.5 Some activities may need to occur outside of these hours due to activities which need to be undertaken continuously (such as HDD and cable jointing). Where work outside of times is necessary, prior notification will be provided to the relevant local planning authority.

10.5.6 Additionally, no piling works will be undertaken on Sundays or bank holidays and restricted to 09:00 – 13:00 on Saturdays.

10.5.7 To manage and minimise potential impact of noise and vibration generated by the construction phase of the Proposed Development at ESR locations in the proximity of the Site, mitigation measures in the form of best practicable means (BPM) are suggested and implemented through the OCEMP. Between 5dB and 10dB attenuation is widely accepted as achievable through the implementation of the BPM.

10.5.8 BPM will be implemented during each phase of the earthworks and construction works at the Site. The construction works will follow the guidelines in accordance with BS 5228-1 and the following measures will be put in place in the OCEMP, to minimise impacts:

- All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers;
- A programme of all works will be distributed to all identified ESRs in the area and updated as the Proposed Development progresses.
- Broadband reversing alarms will be used instead of tonal alarms;
- Site staff will be made aware that they are working adjacent to a residential area and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios;
- A further measure to reduce noise levels at the ESRs will include, as far as possible, the avoidance of two noisy operations occurring simultaneously in close proximity to the same ESR;

- Adherence to the restriction of construction working hours imposed by Lincolnshire County Council;
- Ensure engines are turned off when possible;
- Should construction activities need to be carried out during night-time hours, this will be discussed with the local authority; and
- Where noise and vibration levels have the possibility to exceed the threshold of significant adverse effect, bespoke monitoring will be undertaken at the ESRs to ensure that levels are not exceeded. This will be secured through implementation of the detailed CEMP.

10.5.9 Prior to the commencement of the construction phase, a detailed CEMP (or multiple CEMPs if the authorised development is brought forward in different parts) will be produced by the Principal Contractor for the Proposed Development. In accordance with a requirement in Schedule 2 to the DCO, no part of the authorised development may commence until a CEMP (which must be substantially in accordance with this Outline CEMP) for that part has been submitted to and approved by the relevant planning authority, or, where the part falls within the administrative areas of multiple relevant planning authorities, each of the relevant planning authorities. All construction works associated with the authorised development must be carried out in accordance with the approved CEMP (or CEMPs).

Operational Phase

10.5.10 As shown on the Works Plan **(Document Ref: 2.4)** the BESS and Onsite Substation will be located within the centre of the Site to maximise the distance from ESRs; and buffers have been included to nearby ESRs, ensuring a minimum distance to any noise emitting plant.

10.5.11 As the detailed design layout is not yet confirmed, and will not be until post-consent, an indicative design has been identified and used for this assessment.

10.5.12 For the purposes of this assessment, the identified noise mitigation measures are considered to be "embedded mitigation". The exact format of these cannot be confirmed until detailed design when exact plant locations, equipment specifications and layout requirements are known. In order to demonstrate that the noise levels identified within this Chapter are achievable, indicative embedded mitigation measures have been identified and incorporated into the assessment.

10.5.13 On the basis of the above, this assessment has assumed that 23 Inverters and 45 PCUs will incorporate manufacturers silencer packs which reduce the sound level by 9 dB for the Inverters and 6 dB for the PCUs. The items of plant which are proposed to be mitigated are shown on Figure 10.4.

10.5.14 The sound levels used within the assessment, accounting for embedded mitigation, are presented in Table 10.20.

10.5.15 Once a detailed layout is confirmed a detailed noise assessment will be undertaken in order to identify the specific mitigation required at that time (taking into consideration advances in technology and changes in equipment specifications), in order to ensure that the noise levels within this assessment will not be exceeded (and therefore that the detailed design of the Proposed

Development will not give rise to any materially new or materially worse effects as compared to the conclusions reached in this chapter.)

10.5.16 This is considered to be the most robust and proportionate approach to provide an assessment of the likely significant effects of the Proposed Development, whilst retaining optionality and flexibility for the Applicant.

Decommissioning Phase

10.5.17 For the decommissioning phase, plant, equipment and methods for decommissioning are currently unknown, however, it is likely that these will be similar to those assessed during construction.

10.5.18 As such, the following embedded mitigation is secured and is set out within the ODEMP **(Document Ref: 6.3 ES Vol.2, 6.3.8)**:

10.5.19 Decommissioning activities and HGV traffic to the Energy Park shall be limited to daytime hours of 07:00 to 19:00 during Monday to Friday, and 08:00 to 13:00 on Saturdays, unless otherwise agreed with the LPA.

10.5.20 To manage and minimise potential impact of noise and vibration generated by the decommissioning phase of the Proposed Development at ESR locations in the proximity of the Site, mitigation measures in the form of best practicable means (BPM) are suggested and implemented through the ODEMP **(Document Ref: 6.3 ES Vol.2, 6.3.8)**.

10.5.21 Between 5 dB and 10 dB attenuation is widely accepted as achievable through the implementation of the BPM.

10.5.22 Best working practice will be implemented during each phase of the decommissioning works at the Site. The decommissioning works will follow the guidelines in accordance with BS 5228-1 and the following measures will be put in place in the ODEMP **(Document Ref: 6.3 ES Vol.2, 6.3.8)**, to minimise impacts:

- All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers;
- A programme of all works will be distributed to all identified ESRs in the area and updated as the Proposed Development progresses.
- Broadband reversing alarms will be used instead of tonal alarms;
- Site staff will be made aware that they are working adjacent to a residential area and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios;
- A further measure to reduce noise levels at the ESRs will include, as far as possible, the avoidance of two noisy operations occurring simultaneously in close proximity to the same ESR;
- Adherence to the restriction of construction working hours imposed by Lincolnshire County Council;
- Ensure engines are turned off when possible;
- Should construction activities need to be carried out during night-time hours, this will be discussed with the local authority; and
- Where noise and vibration levels have the possibility to exceed the threshold of significant adverse effect, bespoke monitoring will be undertaken at the ESRs to ensure that levels are not exceeded. This

will be secured through implementation of the ODEMP **(Document Ref: 6.3 ES Vol.2, 6.3.8)**.

10.5.23 Prior to the commencement of the decommissioning phase, a detailed DEMP will be produced by the Principal Decommissioning Contractor for the Proposed Development for either the part of the Proposed Development which is being decommissioned, or the Proposed Development in its entirety. Before decommissioning can commence, detailed DEMP(s) must be submitted to the relevant planning authority for approval and must be substantially in accordance with this ODEMP **(Document Ref: 6.3 ES Vol.2, 6.3.8)**.

Assessment of Effects

Construction Phase – Traffic

10.5.24 In relation to construction traffic associated with the Proposed Development, Chapter 9: Access and Traffic **(Document Ref: 6.2 ES Vol.1, 6.2.9)**, includes an assessment of highway links that will be used for vehicular access in the construction phase. These links comprise the A17, Carterplot Road, Great Hale Drove, Bicker Drove, Doubletwelves Drove and Vicarage Drove.

10.5.25 Table 9.12 within Chapter 9: Access and Traffic **(Document Ref: 6.2 ES Vol.1, 6.2.9)**, confirms that there will be no significant increase in traffic on any of the links, with no links exceeding a 10% growth in Annual Average Daily Traffic (AADT) over the duration of the construction period.

10.5.26 When considered in terms of Annual Average Weekly Traffic (AAWT), the construction traffic change from the Proposed Development will not result in a growth in overall cumulative traffic flows of greater than 25%. A growth of less than 25% will result in a change in $L_{A10,18hr}$ sound level of <1dB overall.

10.5.27 For *Medium* sensitive receptors the magnitude of change is *Negligible*, and therefore, the significance of effect is ***Negligible*** and ***Not Significant***.

10.5.28 For the Bespoke Access Corridor (BAC), a change in sound level assessment has been undertaken as the Bespoke Access Road is new and being introduced to the local highway network.

10.5.29 The assessment has been undertaken in accordance with IEMA, CRTN and DMRB to determine whether effects due to vehicles using the Bespoke Access Road are Significant or Not Significant. Summary AAWT data from Chapter 9: Access and Traffic **(Document Ref: 6.2 ES Vol.1, 6.2.9)**, presented in Table 2.2 within Chapter 2: Proposed Development **(Document Ref: 6.1 ES Vol.1, 6.2.2)**, has been used to inform the assessment.

10.5.30 Noise monitoring has not been undertaken at the nearest receptors to the Bespoke Access Road. However, in the absence of this, ambient sound levels measured at ML3 have been used as a representative proxy location.

10.5.31 Using Basic Noise Level (BNL) calculations in accordance with CRTN the change in sound level has been determined. The results of the assessment of construction vehicle noise from the BAC at the nearest ESRs is presented in Table 10.14.

Table 10.14 – Construction Traffic Noise Assessment – Bespoke Access Road

RECEPTOR LOCATION	DISTANCE TO ROAD EDGE, (METRES)	AVERAGE MEASURED DAYTIME (07:00-19:00) NOISE LEVEL dB $L_{A10,18HR}$	PREDICTED ROAD TRAFFIC NOISE dB $L_{A10,18HR}$	CUMULATIVE SOUND LEVEL DB $L_{A10.18HR}$	SOUND LEVEL CHANGE, dBA
R12	250	49	44	50	1
R13	300	49	43	50	1
R14	450	49	41	50	1

10.5.32 For receptors R12, R13 and R14 the magnitude of change is ***Low*** and the sensitivity of the receptor is *Medium*. As such, the significance of effect is **Minor *Adverse*** and ***Not Significant***.

Construction Phase – Site Works

10.5.33 Noise and vibration impacts during the construction phase will give rise to noise caused by activities associated with:

- Construction of the Bespoke Access Road
- Construction of the Onsite Substation and BESS
- Construction of the inverters and transformers
- Solar PV panel construction
- Cable installation (trenched methods)
- Trenchless methods for cable installation including Horizontal Directional Drill (HDD)

10.5.34 The above activities have the potential to generate short-term increases in noise levels above those recommended in BS 5228-1:2009+A1:2014. The levels of noise experienced at the ESRs closest to the Proposed Development depends on the sound power levels of the machines used, the distance to the ESRs, the presence of screening or reflecting surfaces and the ability of the intervening ground to absorb the propagating noise.

10.5.35 Where ambient sound levels have been measured in proximity to a receptor, the appropriate category value has been determined for each of the ESRs in accordance with BS 5228-1. Where ambient sound levels have not been measured in proximity to a receptor the lowest category threshold in accordance with BS 5228-1 has been assumed. The representative category values for all ESRs are detailed in Table 10.15. Details of the baseline noise survey undertaken at monitoring locations representative of the ESRs is set out in Section 10.5 of this Chapter.

Table 10.15 – Construction Noise Assessment Criteria

MONITORING LOCATION	EXISTING SENSITIVE RECEPTOR LOCATION	AVERAGE MEASURED DAYTIME (07:00-19:00) NOISE LEVELS DB LAEQ,T	AMBIENT NOISE LEVEL ROUNDED TO THE NEAREST 5DB LAEQ,T	APPROPRIATE CATEGORY VALUE A, B OR C IN ACCORDANCE WITH BS5228-1	NOISE LEVEL AT WHICH THE CONSTRUCTION PHASE ACTIVITIES MAY CAUSE A SIGNIFICANT EFFECT AT THE RECEPTOR DB LAEQ,T
ML1	R6	49	50	A	65
ML2	R1, R2, R3, R4, R5	52	50	A	65
ML3	R7,R9, R10, R11	49	50	A	65
ML4	R8	51	50	A	65
N/A	R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28	N/A	N/A	A	65

10.5.36 Noise generated by the earthworks and construction phases of the Proposed Development may have a short-term, adverse effect at the above ESRs. However, the construction activities would be transient as the works will progress through the Solar Array Area or along the Cable Route. Figure 10.2a and Figure 10.2b present a 65 dB contour line which represents the Category A Threshold for the construction of the Cable Route and the Bespoke Access Corridor, as described in Table 10.15. For receptors within the 65 dB contour, noise levels from construction activity may cause a significant effect. Those receptors outside the 65 dB contour are likely to experiences effects which are not significant.

10.5.37 The exact route of the Cable Route and Bespoke Access Road within the Cable Route Corridor and Bespoke Access Corridor respectively will be

determined at the detailed design phase post consent. However, to ensure that robust approach is used for the assessment, it has been assumed that any ESRs near to the Cable Route Corridor and Bespoke Access Corridor will experience low background noise levels and the most stringent BS 5228 category have been used in the assessment (Category A).

10.5.38 Likely plant that will be used to undertake the construction works are shown in Table 10.16.

Table 10.16 – Plant List

ACTIVITY	PLANT NAME	BS 5228 REFERENCE	SOUND POWER Lw (dBA)	QUANTITY
Construction of bespoke access road	Tracked excavator	C.2.2	105	2
	Dozer	C.2.10	108	2
	Roller (rolling fill)	C2.37	107	2
	Vibratory roller	C5.20	103	2
	Dump truck (tipping fill)	C.2.30	107	2
Construction of inverters and transformers	Tracked excavator	C.2.14	107	1
	Wheeled loader	C.2.27	108	1
	Wheeled mobile telescopic crane	C.4.38	112	1
	Dump truck (tipping fill)	C.2.30	107	2
	Telescopic handler	C.2.35	99	1
	Cement mixer truck (discharging)	C.4.18	103	1
Solar PV Panel Construction	Articulated dump truck	C.5.16	104	1
	Wheeled mobile telescopic crane	C.4.38	106	1
	Diesel generator	C.4.85	94	1
	Hydraulic hammer piling – Tubular steel	C.3.2	115	1
	Cement mixer truck (discharging)	C.4.18	103	1
	Dumper	C.4.9	105	1
Construction of onsite substation and BESS	Tracked excavator	C.2.14	107	2
	Lorry	C.2.34	108	4
	Telescopic handler	C.2.35	99	2

ACTIVITY	PLANT NAME	BS 5228 REFERENCE	SOUND POWER Lw (dBA)	QUANTITY
	Hydraulic hammer piling – pre-cast concrete	C.3.1	113	1
	Wheeled mobile crane	C.3.30	98	4
	Hand-held welder (welding piles)	C.3.31	101	4
	Generator for welding	C.3.32	101	4
	Gas cutter	C.3.34	96	4
	Mobile telescopic crane	C.4.41	99	2
	Lifting platform	C.4.57	95	4
	Site lift for workers	C.4.62	94	4
	Diesel generator	C.4.85	94	2
Cable Installation (Trenched)	Tracked excavator	C.4.63	105	1
	Wheeled backhoe loader	C.4.66	97	1
	Dumper	C.4.9	105	2
	Telescopic handler	C.4.55	98	1
	Vibratory roller	C.5.27	95	1
Trenchless methods for cable installation including Horizontal Directional Drill	Directional drill	C.2.44	105	1
	Water pump	C.2.45	93	1
	Tracked excavator	C.2.14	107	1
	Drilling Rig	C.3.15	110	1

10.5.39 Predicted noise levels at ESRs, which are inclusive of 5 dB attenuation for BPM, are shown in Table 10.17. ESRs which are more than 300 m from any proposed works are outside of the study area for that activity and excluded from the assessment, as significant effects are unlikely. The duration for each activity is not currently known, but it has been assumed that each activity will not take more than one month at any one location. Construction noise predictions have been undertaken to present a worst-case scenario where all plant is operational concurrently.

Table 10.17 – Construction Noise Predictions

RECEIVER	CONSTRUCTION PHASE NOISE LEVELS dB $L_{Aeq,T}$					
	CONSTRUCTION OF THE BESPOKE ACCESS ROAD	CONSTRUCTION OF INVERTERS AND TRANSFORMERS	PV MODULE CONSTRUCTION	CONSTRUCTION OF BESS AND MAIN SUBSTATION	CABLE INSTALLATION	HORIZONTAL DIRECTIONAL DRILL
R1	-	-	60	-	55	57
R2	-	-	62	-	56	59
R3	-	-	54	-	48	50
R4	-	50	59	-	52	54
R5	-	-	56	-	50	52
R6	-	48	56	-	52	54
R7	-	48	54	-	48	51
R8	-	47	58	-	51	54
R9	-	-	58	-	41	44
R10	-	-	51	-	46	48
R11	-	-	64	-	56	59
R12	54	-	-	-	-	-

RECEIVER	CONSTRUCTION PHASE NOISE LEVELS dB $L_{Aeq,T}$					
	CONSTRUCTION OF THE BESPOKE ACCESS ROAD	CONSTRUCTION OF INVERTERS AND TRANSFORMERS	PV MODULE CONSTRUCTION	CONSTRUCTION OF BESS AND MAIN SUBSTATION	CABLE INSTALLATION	HORIZONTAL DIRECTIONAL DRILL
R13	55	-	-	-	-	-
R14	45	-	-	-	-	-
R15	-	-	-	-	43	46
R16	-	-	-	-	43	46
R17	-	-	-	-	62	64
R18	-	-	-	-	-	-
R19	-	-	-	-	43	46
R20	-	-	-	-	49	51
R21	-	-	-	-	-	-
R22	-	-	-	-	-	-
R23	-	-	-	-	43	45
R24	-	-	-	-	44	46
R25	-	-	-	-	41	43

RECEIVER	CONSTRUCTION PHASE NOISE LEVELS dB $L_{Aeq,T}$					
	CONSTRUCTION OF THE BESPOKE ACCESS ROAD	CONSTRUCTION OF INVERTERS AND TRANSFORMERS	PV MODULE CONSTRUCTION	CONSTRUCTION OF BESS AND MAIN SUBSTATION	CABLE INSTALLATION	HORIZONTAL DIRECTIONAL DRILL
R26	-	-	-	-	-	-
R27	-	-	-	-	46	48
R28	-	-	-	-	47	49

10.5.40 For all receptors and for all construction activity, the magnitude of change is *Negligible*, and the sensitivity of the receptor is *Medium*. The significance of effect is ***Negligible***, and therefore the effect of construction noise is ***Not Significant***.

10.5.41 Irrespective of the impact described above; to manage and control construction related noise impact and to reduce adverse effects to a minimum, best working practice will be adopted for the duration of the construction and decommissioning phases (see Section 10.7 of this Chapter).

Vibration from Construction Phase Activities

10.5.42 BS5228-2:2009+A1:2014 indicates that the threshold of perception is generally accepted to be between a peak particle velocity (PPV) of 0.14mm/s^{-1} and 0.3mm/s^{-1}. BS 5228-2:2009+A1:2019 also indicates that it is likely that vibration of 1.0mm/s^{-1} in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents. The standard also indicates that 10mm/s^{-1} is likely to be intolerable for any more than a very brief exposure to this level.

10.5.43 The Highways Agency Research Report No. 53 Ground Vibration caused by Civil Engineering Works (1986) suggests that, when vibration levels from an unusual source exceed the human threshold of perception, complaints may occur. The onset of complaints due to continuous vibration is probable when the PPV exceeds 3mm/s^{-1}.

10.5.44 BS 6472-1 suggests that adverse comments or complaints due to continuous vibration are rare in residential situations below a PPV of 0.8mm/s^{-1}. Continuous vibration is defined as “vibration which continues uninterrupted for either a daytime period of 16 hours or a night-time period of 8 hours”. The proposed earthworks and construction work at the Site will not cause continuous vibration as defined in BS 6472-1.

10.5.45 Human perception of vibration is extremely sensitive. People can detect and be annoyed by vibration before there is any risk of structural damage. Cases where damage to a building has been attributed to vibration alone are extremely rare, even when the vibration has been deemed to be intolerable by the occupants.

10.5.46 It is not possible to establish exact vibration damage thresholds that may be applied in all situations. The likelihood of vibration induced damage, or perceived nuisance, will depend upon the nature of the source, the characteristics of the intervening solid and drift geology and the response pattern of the structures around the Site. Most of these variables are too complex to quantify accurately, and thresholds of damage, or nuisance, are therefore conservative estimates based on a knowledge of engineering.

10.5.47 BS 5228-2:2009+A1:2014 suggests that the onset of cosmetic damage is 15mm/s^{-1} (15 mm/s at 4 Hz increasing to 20 mm/s^{-1} at 15 Hz for residential or light commercial type buildings).

10.5.48 Vibration impacts may occur to buildings, structures and their occupants located within proximity to the Proposed Development. Activities that will potentially induce vibration impacts include the use of vibratory equipment; for example, percussive piling or vibratory rollers.

10.5.49 Typical construction activities are not considered to generate levels above which building damage is expected. Therefore, only human exposure at ESRs has been assessed.

10.5.50 Indicative calculations have been undertaken in accordance with guidance presented in BS 5228-2. Vibratory compaction and percussive piling will likely be the worse-case activity which may impact ESRs.

10.5.51 The calculation in BS5228-2 is based on distances up to 110 m for vibratory compaction. Therefore, receptors R3, R5, R6, R9, R12-R16 and R18-R28 have not been included within the assessment for vibratory compaction.

10.5.52 For percussive piling the calculation is based on distances up to 111 m from this activity and a pile being driven through stiff cohesive soil. Therefore, receptors R3, R5, R6, R9, R12-R16 and R18-R28 have not been included within the assessment for vibratory compaction.

10.5.53 Table 10.18 presents the results of the construction vibration assessment for vibratory compaction and Table 10.19 for percussive piling.

Table 10.18 – Construction Vibration Predictions – Vibratory Compaction

RECEPTOR	APPROX DISTANCE TO BOUNDARY, M	VIBRATORY COMPACTION START-UP/RUNDOWN	VIBRATORY COMPACTION STEADY STATE
		V_{RES} mm/s^{-1} AT RECEPTOR FROM ACTIVITY	
R1	60	1.0	0.5
R2	50	1.2	0.6
R4	20	3.7	2.3
R7	40	1.6	0.9
R8	15	5.0	3.4
R10	50	1.2	0.6
R11	15	5.0	3.4
R17	50	1.2	0.6

Table 10.19 – Construction Vibration Predictions – Percussive Piling Compaction

RECEPTOR	APPROX DISTANCE TO NEAREST SOLAR PV PANEL, M	PPV FOR PILES BEING DRIVEN THROUGH STIFF COHESIVE SOIL
		VRES MM/S-1 AT RECEPTOR FROM ACTIVITY
R1	90	0.34
R2	75	0.43
R4	105	0.28
R8	110	0.26
R11	65	0.5

10.5.54 Based on the results in Table 10.18, a maximum vibration level of 5.0mm/s^{-1} for vibratory compaction has been calculated at receptor R8. Based on these results the magnitude of change is ***Low*** for all receptors. The sensitivity of the receptors (R1-R11) is ***Medium***. As such, the significance of effect is ***Minor***

Adverse and therefore the effect from vibration due to vibratory compaction is **Not Significant**.

10.5.55 Based on the results in Table 10.19 a maximum vibration level of 0.5 mm/s^{-1} has been calculated at receptor R11. Based on these results the magnitude of change is *Negligible* for all receptors. The sensitivity of the receptors (R1-R11) is *Medium*. As such, the significance of effect is ***Negligible*** and therefore the effect from vibration due to vibratory compaction is ***Not Significant***.

10.5.56 It is unlikely that construction activity will be undertaken at the boundary of the Site based on the current locations of proposed solar plant items and therefore predicted impacts will likely be less than those presented in Table 10.18 and Table 10.19. As such, it is considered that vibration does not need to be considered further as the effects are not expected to be Significant, nor last longer than 1 month at any one location.

10.5.57 Impacts due to vibration are considered to be NOAEL when considering planning policy.

Operational Phase

Identification of the Specific Sound

10.5.58 The potential noise impact from the solar array area has been assessed using plant data provided by the Applicant.

10.5.59 Noise modelling software SoundPLAN 9.1 has been used to calculate the operational noise impacts at the ESRs. The plant locations within the BESS are based on drawing 2.6. Plant items are summarised in Table 10.20, below, and the locations of the equipment and ESRs are shown on Figure 10.1.

Table 10.20 : Operational Source Noise Levels

EQUIPMENT	TYPE	QUANTITY	TOTAL QUANTITY	SOUND POWER LEVEL dB	OPERATIONAL TIME
Solar Station Inverters and Transformers within solar array area	Base Unit	96	119	92	04:00 – 22:00
	Base Unit + Silencer Pack	23		83	
PCU within BESS compound	Base Unit	33	78	95	00:00 – 24:00
	Base Unit + Silencer Pack	45		89	
BESS Storage Containers within BESS compound	-		312	81	00:00 – 24:00
Onsite substation transformer within BESS compound	-		4	95	00:00 – 24:00
Onsite substation cooling bank within BESS compound	-		4	95	00:00 – 24:00

10.5.60 For this assessment, it has been assumed that the transformers will operate during the times of sunlight, between 04:00 hours and 22:00 hours as a worst-case scenario, representing the longest day of the year. An assumption has also been made that the BESS will operate continuously during the day and night-time.

Identification of the background sound level

10.5.61 Section 8 of BS 4142:2014+A1:2019 provides guidance on the selection of the background sound to be used in the assessment. BS 4142:2014+A1:2019 states that the background sound levels used for the assessment should be representative of the period being assessed (i.e. daytime or night-time periods) and that there is no 'single' background sound level.

10.5.62 For this assessment, a range of background sound levels during the day and night-time periods, measured at monitoring locations ML1-4, have been used to represent different periods. The data collected is considered to be representative of the $L_{A90,1hr}$ daytime and $L_{A90,15min}$ night-time, background sound levels at ESRs. The background sound levels measured throughout the daytime and night-time have been determined for each monitoring location and are summarised in Table 10.21, below.

Table 10.21 : Background Sound Levels at Existing Sensitive Receptors

MONITORING LOCATION	RECEPTOR	BACKGROUND NOISE LEVEL				
		DAYTIME $L_{A90, 1HR}$ (07:00-19:00)	DAYTIME $L_{A90, 1HR}$ (19:00-22:00)	DAYTIME $L_{A90, 1HR}$ (22:00-23:00)	NIGHT-TIME $L_{A90, 15MIN}$ (23:00-04:00)	NIGHT-TIME $L_{A90, 15MIN}$ (04:00-07:00)
ML1	R6	35	27	25	21	29
ML2	R1, R2, R3, R4, R5	33	28	26	23	29
ML3	R7, R9, R10, R11	37	34	34	25	38
ML4	R8	37	30	25	24	31

Application of Weighting for Characteristics of Specific Sound

10.5.63 BS 4142:2014+A1:2019 includes guidance on the application of additional weighting to be applied in cases where the industrial noise is either 'tonal', 'impulsive', 'intermittent' or 'other sound characteristics' at an ESR.

10.5.64 No penalty for impulsivity, intermittency or other sound characteristics has been applied, as the operation of the Proposed Development does not give rise to such characteristics.

10.5.65 The operation of the proposed development could give rise to sound which is tonal in nature. In the absence of 1/3 octave band data to determine tonality, a penalty of +4 dB has been applied for tonal characteristics which would be clearly perceptible at the receptor. This penalty has been applied in accordance with BS 4142.

Impact Assessment Results - Daylight Period

10.5.66 The impact assessment results for the daylight periods between 04:00 – 22:00 are summarised in Table 10.22 to Table 10.24 below.

Table 10.22 - Initial Estimate of Impact - Daylight between 04:00 and 07:00 (Solar Panels and BESS)

RECEPTOR	SPECIFIC SOUND LEVEL L_{Aeq} dB	ACOUSTIC FEATURE CORRECTION dB	RATING LEVEL (L_{ArTr}) dB	MEASURED BACKGROUND LEVEL L_{A90} dB	DIFFERENCE BETWEEN RATING LEVEL L_{ArTr} dB AND BACKGROUND L_{A90} DB
R1	41	4	45	29	16
R2	41	4	45	29	16
R3	40	4	44	29	15
R4	41	4	45	29	16
R5	39	4	43	29	14
R6	41	4	45	29	16
R7	38	4	42	38	4
R8	41	4	45	31	14
R9	39	4	43	38	5
R10	39	4	43	38	5
R11	41	4	45	38	7

Table 10.23 - Initial Estimate of Impact - Daylight between 07:00 and 19:00 (Solar Panels and BESS)

RECEPTOR	SPECIFIC SOUND LEVEL L_{AEQ} DB	ACOUSTIC FEATURE CORRECTION DB	RATING LEVEL (L_{ARTR}) DB	MEASURED BACKGROUND LEVEL L_{A90} DB	DIFFERENCE BETWEEN RATING LEVEL L_{ARTR} DB AND BACKGROUND L_{A90} DB
R1	41	4	45	33	12
R2	41	4	45	33	12
R3	39	4	43	33	10
R4	41	4	45	33	12
R5	39	4	43	33	10

RECEPTOR	SPECIFIC SOUND LEVEL L_{AEQ} DB	ACOUSTIC FEATURE CORRECTION DB	RATING LEVEL (L_{ARTR}) DB	MEASURED BACKGROUND LEVEL L_{A90} DB	DIFFERENCE BETWEEN RATING LEVEL L_{ARTR} DB AND BACKGROUND L_{A90} DB
R6	41	4	45	35	10
R7	38	4	42	37	5
R8	41	4	45	37	8
R9	38	4	42	37	5
R10	39	4	43	37	6
R11	41	4	45	37	8

Table 10.24 - Initial Estimate if Impact - Daylight between 19:00 and 22:00 (Solar Panels and BESS)

RECEPTOR	SPECIFIC SOUND LEVEL L_{AEQ} DB	ACOUSTIC FEATURE CORRECTION DB	RATING LEVEL (L_{ARTR}) DB	MEASURED BACKGROUND LEVEL L_{A90} DB	DIFFERENCE BETWEEN RATING LEVEL L_{ARTR} DB AND BACKGROUND L_{A90} DB
R1	41	4	45	28	17
R2	41	4	45	28	17
R3	39	4	43	28	15
R4	41	4	45	28	17
R5	39	4	43	28	15
R6	41	4	45	27	18
R7	38	4	42	34	8
R8	41	4	45	30	15
R9	38	4	42	34	8
R10	39	4	43	34	9
R11	41	4	45	34	11

10.5.67 For the daylight period between 04:00-22:00 the predicted rating levels at all receptors are equal to or below 45 dB $L_{Ar,Tr}$.

10.5.68 For receptors R1, R2, R3, R4, R5 and R6, where the background sound level is ≤35 dB L_{A90}, the worst-case magnitude of change is *Medium,* and the sensitivity of the receptor is *Medium*. As such, the significance of effect is ***Moderate Adverse*** and ***Potentially Significant***.

10.5.69 For receptors R7, R8, R9, R10, and R11, where the background sound level is >35 dB L_{A90}, the worst-case magnitude of change is *Medium,* and the sensitivity of the receptor is *Medium*. As such, the significance of effect is ***Moderate Adverse*** and ***Potentially Significant***.

10.5.70 For R7, R8, R9, R10 and R11, the rating level is equal to or below 45 dB $L_{Ar,Tr}$. As such, when considering the internal ambient sound level within an ESR, a worst-case scenario has been used. This scenario assesses internal sound levels through a partially open window, which provides approximately 15 dB attenuation. Therefore, a rating level of 45 dB $L_{Ar,Tr}$ at the façade would result in an internal sound level of 30 dB $L_{Aeq,T}$. As such, the recommended internal sound levels in accordance with BS 8233 will be achieved for habitable spaces.

10.5.71 Concluding, the Magnitude of change is *Negligible* and the sensitivity of for is *Medium*. As such, the significance of effect is ***Negligible*** and the effect from operational noise during daylight periods is ***Not Significant***.

Impact Assessment Results - Darkness Period

10.5.72 The impact assessment results for the darkness periods between 22:00 – 04:00 are summarised in Table 10.25 and Table 10.26.

Table 10.25 - Initial Estimate of Impact - Darkness between 22:00 and 23:00 (BESS only)

RECEPTOR	SPECIFIC SOUND LEVEL L_{AEQ} DB	ACOUSTIC FEATURE CORRECTION DB	RATING LEVEL (L_{ARTR}) DB	MEASURED BACKGROUND LEVEL L_{A90} DB	DIFFERENCE BETWEEN RATING LEVEL L_{ARTR} DB AND BACKGROUND L_{A90} DB
R1	38	4	42	26	16
R2	38	4	42	26	16
R3	37	4	41	26	15
R4	39	4	43	26	17
R5	37	4	41	26	15
R6	37	4	41	25	16
R7	32	4	36	34	2
R8	38	4	42	25	17
R9	34	4	38	34	4
R10	34	4	38	34	4
R11	35	4	39	34	5

Table 10.26 - Initial Estimate of Impact - Darkness between 23:00 and 04:00 (BESS only)

RECEPTOR	SPECIFIC SOUND LEVEL L_{AEQ} DB	ACOUSTIC FEATURE CORRECTION DB	RATING LEVEL (L_{ARTR}) DB	MEASURED BACKGROUND LEVEL L_{A90} DB	DIFFERENCE BETWEEN RATING LEVEL L_{ARTR} DB AND BACKGROUND L_{A90} DB
R1	38	4	42	23	19
R2	38	4	42	23	19
R3	37	4	41	23	18
R4	39	4	43	23	20
R5	37	4	41	23	18
R6	37	4	41	21	20
R7	32	4	36	25	11
R8	38	4	42	24	18
R9	34	4	38	25	13
R10	34	4	38	25	13
R11	35	4	39	25	14

10.5.73 For the darkness period between 22:00 and 04:00, the predicted rating levels at all receptors are equal to or below 45 dB $L_{Ar,Tr.}$

10.5.74 For receptors R1, R2, R3, R4, R5, R6, R7, R8, R9, R10 and R11 where the background sound level is ≤35 dB L_{A90}, the worst-case magnitude of change

is *Medium,* and the sensitivity of the receptor is *Medium*. As such, the significance of effect is ***Moderate Adverse*** and ***Potentially Significant***.

10.5.75 For receptors where the effects are ***Potentially Significant***, the internal ambient sound level has been considered. When considering the internal ambient sound level within an ESR, a worst case scenario has been used. This scenario assesses internal sound levels through a partially open window, which provides approximately 15 dB attenuation. Therefore, a rating level of 45 dB $L_{Ar,Tr}$ at the façade would result in an internal sound level of 30 dB $L_{Aeq,T}$. As such, the recommended internal sound levels in accordance with BS 8233 will be achieved for habitable spaces.

10.5.76 When considering internal sound levels for *Medium* sensitive receptors which have effects that are Potentially Significant, the magnitude of change is *Medium* and the significance of effect is ***Moderate Adverse*** and ***Not Significant***.

10.5.77 In summary, based on the above the overall impact for medium sensitivity receptors is ***Moderate Adverse*** and ***Not Significant***.

Decommissioning Phase

10.5.78 The decommissioning phase of the Proposed Development will have a similar scope and duration as the construction phase with the exception of the Cable Route (including Bicker Fen substation) as this will remain in situ. The future baseline during the year of decommissioning is considered to be likely to be broadly similar in nature and level to that measured during the 2023 baseline survey.

10.5.79 During the decommissioning phase, a detailed DEMP (or multiple DEMPs if the authorised development is brought forward in different parts which must be substantially in accordance with this Outline DEMP **(Document Ref: 6.3 ES Vol.2, 6.3.8)** will be implemented and will be the mechanism to secure BPM during this phase.

10.5.80 The activity which is likely to generate the worse-case sound levels will be removal of the Bespoke Access Road, however this will be largely similar the construction of the Bespoke Access Road.

10.5.81 As such, the sensitivity and threshold of significance will be the same and the assessment of effects mirrors those reported for the construction phase.

10.6 Secondary Mitigation

Construction Phase

10.6.1 No secondary mitigation measures in addition to the embedded mitigation measures are required during construction phase of the Proposed Development as the impact is considered to be Not Significant, as outlined above.

Operational Phase

10.6.2 No secondary mitigation measures in addition to the embedded mitigation measures are required during construction phase of the Proposed

Development as the impact is considered to be Not Significant, as outlined above.

10.6.3 As set out in Section 10.5, once a detailed layout is confirmed a detailed noise assessment will be undertaken in order to identify the specific mitigation required at that time (taking into consideration advances in technology and changes in equipment specifications), in order to ensure that the noise levels within this assessment will not be exceeded (and therefore that the detailed design of the Proposed Development will not give rise to any materially new or materially worse effects as compared to the conclusions reached in this chapter.)

Decommissioning Phase

10.6.4 No secondary mitigation measures in addition to the embedded mitigation measures are required during decommissioning phase of the Proposed Development as the impact is considered to be Not Significant, as outlined above.

10.7 Residual Effects

Construction traffic assessment

10.7.1 The CEMP **(Document Ref: 6.3 ES Vol.2, 6.3.7)** will be implemented prior to the commencement of any construction works.

10.7.2 Effects from construction traffic and the assessment outcomes will remain unchanged from those presented in Section 10.6. For all receptors for all construction traffic, the magnitude of change is assessed to be *Negligible* to *Low* and the sensitivity of all of the ESRs is *Medium*. The resultant significance of effect is ***Negligible*** to ***Minor Adverse*** and, and therefore the impact is ***Not Significant***.

10.7.3 Irrespective of the impact described above; to manage and control construction traffic related noise impact and to reduce to a minimum, best working practices will be adopted for the duration of the construction and decommissioning phases (see Section 10.6 of this Chapter, above).

Site construction works assessment

10.7.4 The CEMP **(Document Ref: 6.3 ES Vol.2, 6.3.7)** will be implemented prior to the commencement of any construction works.

10.7.5 Construction effects and assessment outcomes will remain unchanged from those presented in Table 10.5. For all receptors for all construction activity, the magnitude of change is assessed to be *Negligible* and the sensitivity of all of the ESRs is *Medium*. The resultant level of effect is ***Negligible*** and therefore the impact is ***Not Significant***.

10.7.6 Irrespective of the impact described above; to manage and control construction related noise impact and to reduce to a minimum, best working practices will be adopted for the duration of the construction and decommissioning phases (see Section 10.7 of this Chapter, above).

Operational phase assessment

10.7.7 Operational effects and assessment outcomes are the same as those set out in Table 10.23 to Table 10.26. In summary, during periods of light and dark for all ESRs, the overall Magnitude of change is *Medium* and for *Medium* sensitivity receptors the significance of effect is ***Moderate Adverse*** and ***Not Significant*** due to application of professional judgment relating to contextual factors described in Section 10.5.

Decommissioning phase assessment

10.7.8 The ODEMP **(Document Ref: 6.3 ES Vol.2, 6.3.8)** will be implemented prior to the commencement of any decommissioning works.

10.7.9 This will ensure BPM are followed and will reduce the impact of noise and vibration from earthworks and plant removal.

10.7.10 Decommissioning activity is anticipated to be similar to construction activity. As such, for receptors of *Medium* sensitivity, the Magnitude of change is assessed to be *Negligible* and the resultant significance of effect is ***Negligible*** and ***Not Significant***.

10.8 Assessment of Cumulative Effects

Inter-Cumulative Effects

10.8.1 During the operational phase, no receptors within the 300 m study area overlap with cumulative development study areas. As such, no other noise sources are in proximity to the Proposed Development for cumulative operational noise impacts to occur at the ESRs.

10.8.2 There is potential for cumulative effects in relation to construction activity in the event that construction of the Proposed Development (including the Cable Route Corridor and works at Bicker Fen Substation) overlaps with that of nearby developments as presented in Appendix 4.2, within Chapter 4: Scope and Methodology **(Document Ref: 6.2 ES Vol.1, 6.2.4)**. A summary of those developments is presented in Table 10.27.

Table 10.27 - Summary of cumulative developments

SCHEME NAME	REFERENCE	APPROX DISTANCE TO RED LINE
Triton Knoll Electrical System	EN90019	0 km
Heckington Fen Solar Farm	EN010123	2.6 km
Works to facilitate the Viking Link electrical connector	H04-0823-17	0.1 km
Land at Ewerby Thorpe	14/1034/EIASCR	Within the site boundary
Installation of High Voltage Direct Current (DC) Cables for the Viking Link Interconnector	17/1200/FUL	

SCHEME NAME	REFERENCE	APPROX DISTANCE TO RED LINE
Land at Vicarage Drove, Bicker, Boston, PE20 3BF	B/21/0121	Within the site boundary
Land at Vicarage Drove, Bicker, Boston, PE20 3BF	B/21/0443	Within the site boundary
Land at Vicarage Drove, Bicker, Boston, PE20 3BF	B/22/0198	Within the site boundary
Land at Vicarage Drove, Bicker, Boston, PE20 3BF	B/22/0356	Within the site boundary
Land at Vicarage Drove, Bicker, Boston, PE20 3BF	B/17/0340	0.4 km
Land South of Little Hale Drove, Vicarage Drove, Bicker Fen, Boston, PE20 3BF	23/1021/FUL	Within the site boundary

10.8.3 For EN90019; H04-0823-17; 17/1200/FUL; B/21/0121; B/21/0443; B/22/0198; B/22/0356, B/17/0340 and 23/1021FUL there are no receptors within the 300 m study area which overlap with the study area of the aforementioned developments. Therefore, the magnitude of change is *Negligible* and based on a *Medium* sensitivity receptor the significance of effect is ***Negligible*** and therefore **Not Significant**.

10.8.4 For EN10123, receptor R28 is within 300 m of the cable route corridor and is also within 300 m of the cable route corridor for this development. As such, there is the potential for cumulative noise effects to occur. The highest predicted sound level at R28 is 49 dBA during HDD construction activity. Should cumulative work be undertaken simultaneously, assuming both cable route corridors were implementing HDD techniques, the cumulative sound level at R28 would be 52 dBA, as such the predicted sound level is below the 65 dBA threshold in accordance with BS 5228-1. Therefore, the magnitude of change is *Negligible* and based on a *Medium* sensitivity receptor the significance of effect is ***Negligible*** and therefore **Not Significant**.

10.8.5 For 14/1034/EIASCR, the proposed development is within the Solar Array boundary. As such, should the Proposed Development within this chapter be built out, the proposal in 14/1034/EIASCR will not as it will occupy the same land. As such, there cannot be cumulative impacts associated with the two developments. Therefore, there is no cumulative magnitude of change and no cumulative effects that can be significant.

10.8.6 In any case, the residual significance of effect of construction is assessed as being between Negligible from the Proposed Development and the effect is ***Not Significant***.

10.8.7 Based on the above, it is not expected that there would be a significant cumulative effect. Moreover, such effects would only be temporary in nature, lasting only for the duration any period of overlap of construction works.

10.8.8 No other significant cumulative effects are considered likely in combination with other developments.

Intra-Cumulative Effects

10.8.9 The findings reported in this Chapter have been considered to identify potential interactions with Noise and Vibration effects upon single receptors.

10.8.10 The review identified the following other types of environmental effects, that interact with single receptors:

- Ecology: Potential ecological effects because of increased noise and vibration have been considered within Chapter 7: Ecology **(Document Ref: 6.2 ES Vol.1, 6.2.7)**, which concluded that these effects will not be significant.
- Landscape & Visual: Noise effects can impact upon landscape character, and noise mitigation can have visual impacts; however, proposed mitigation is incorporated into the noise generating equipment. The potential effects are considered in Chapter 6: Landscape and Visual **(Document Ref: 6.2 ES Vol.1, 6.2.6)**, which concludes that these effects will not be significant.
- Cultural Heritage: Potential effects on heritage assets as a result of increased noise and vibration have been considered within Chapter 8: Cultural Heritage **(Document Ref: 6.2 ES Vol.1, 6.2.8)**, which concluded that these effects will not be significant.

10.9 Summary

10.9.1 This Chapter sets out the assessment of the potential noise and vibration impacts associated with the Proposed Development.

10.9.2 To establish baseline noise levels at several ESRs, an unattended noise survey was carried out in 2023.

10.9.3 The potential noise and vibration impact upon the ESRs from construction, operation and decommissioning associated with the Proposed Development has been considered and has been assessed using relevant guidance.

10.9.4 A robust, ‘worst-case’ scenario has been considered with the Solar Array Area operating fully.

10.9.5 Embedded mitigation measures have been included within the design of the Proposed Development to reduce and minimise noise levels to a minimum.

10.9.6 A summary of the likely significant residual effects of the Proposed Development on the receptors considered within this chapter is set out in Table 10.28 at the end of this chapter.

Noise from Construction Traffic

10.9.7 For medium sensitive receptors the magnitude of change for noise from construction traffic is assessed to be Negligible to Low and Not Significant in EIA terms.

10.9.8 With the implementation of mitigation measures i.e. following BPM and measures secured through the detailed CEMP(s), all noise effects are anticipated to be of ***Low*** or ***Negligible*** magnitude, which results in a ***Minor Adverse*** effect, which is ***Not Significant***.

Noise from Construction Phase Activities

10.9.9 During the construction phase of the Proposed Development, any work carried out at the Site may generate noise that will be audible at ESRs. The affected ESRs are of medium sensitivity, in accordance with Table 10.5. It is considered that the magnitude of change will be negligible in accordance with Table 10.6. The significance of effect is Negligible, and the impact is Not Significant.

10.9.10 With the implementation of mitigation measures i.e. following best practice and measures secured through the detailed CEMP(s), all noise effects are anticipated to be Negligible magnitude, which results in a Negligible Adverse effect, which is Not Significant.

Vibration from Construction Phase Activities

10.9.11 During the construction phase, any work carried out at the Site may generate vibration that may propagate beyond the Order Limits. The nearest ESRs are of Medium sensitivity, as set out in Table 10.13. It is considered that the magnitude of vibration impact will be Negligible to Low due to the distance of the ESRs to the Proposed Development and the short duration of impacts as the works progress through the Site. Therefore, it is considered that the effect of vibration during construction would be ***Negligible*** to ***Minor Adverse*** and ***Not Significant***, in accordance with Table 10.10.

10.9.12 Mitigation implemented during construction, as secured through the OCEMP, are anticipated to result in the magnitude of any impact from vibration being ***Negligible*** to ***Low*** and ***Not Significant***.

Noise from the Operational Phase

10.9.13 Calculations have been carried out to determine the noise levels likely to be generated by the Proposed Development at each of the ESRs. Noise levels have been predicted based on data provided by the Applicant.

10.9.14 For the daylight period between 04:00-22:00, the predicted rating level at all ESRs is equal to or below 45 dB $L_{Ar,Tr.}$ For all receptors where the L_{A90} background sound level is ≤35 dB or > 35 dB, the worst-case magnitude of change is assessed to be Medium, and the sensitivity of the receptor is Medium. As such, the level of impact is assessed as ***Moderate Adverse*** and ***Potentially Significant***. The effect is considered to be Not Significant as the sound level with a partially open window is unlikely to exceed recommended internal ambient sound levels in accordance with BS 8233. The assessment outcome is LOAEL when considering planning policy.

10.9.15 For periods of darkness between 22:00-04:00, the predicted rating level at all receptors is equal to or below 45 dB $L_{Ar,Tr.}$ For all receptors where the L_{A90} background sound level is ≤35 dB and > 35 dB, the worst-case magnitude of change is Medium and the sensitivity of the receptor is assessed to be Medium. As such, the level of impact is ***Moderate Adverse*** and ***Potentially Significant.*** The effect is considered to be Not Significant as the sound level with a partially open window is unlikely to exceed recommended internal ambient sound levels in accordance with BS 8233. The assessment outcome is LOAEL when considering planning policy.

Noise from the Decommissioning Phase

10.9.16 Noise impacts during the decommissioning phase have been assessed to be similar in scope and duration to those defined in the Construction Phase with the exception of that the Cable Route (including Bicker Fen substation) will remain in-situ.

10.9.17 With the implementation of mitigation measures, i.e. following best practice and measures secured through the detailed CEMP(s), all noise impacts ae assessed to be Low or Negligible magnitude which are a ***Minor Adverse*** and therefore ***Not Significant***.

Table 10.28 - Noise & Vibration - Summary Assessment Matrix

Issue	Description of Impact	Geographical Significance							Significance of Effect	Nature	Significance	Mitigation Measures
		I	N	R	C	D	P	L				
Construction/ Decommissioning Traffic Noise												
Effect of increased noise levels from the construction traffic	Construction traffic: Short term impact on the nearby ESRs during the day during the construction phase due to construction related activity.							X	Negligible - Minor Adverse	St, R	Not Significant (NOEL - NOAEL)	Implementation of a OCEMP/ODEMP to reduce and minimise sound levels to a minimum.
Construction/ Decommissioning Noise												
Effect of increased noise levels from the construction of the Proposed Development	Construction: Short term impact on the nearby ESRs during the day during the construction phase due to construction related activity.							X	Negligible Adverse	St, R	Not Significant (NOEL)	Implementation of a OCEMP/ ODEMP to reduce and minimise sound levels to a minimum.
Construction/ Decommissioning Vibration												
Effect of increased vibration levels from the construction of the Proposed Development	Construction: Short term impact on the nearby ESRs during the day during the construction phase due to construction related activity.							X	Negligible - Minor Adverse	St, R	Not Significant (NOEL – NOAEL)	Implementation of a OCEMP/ ODEMP to reduce and minimise vibration levels to a minimum.
Operational Noise												
Effect of increased noise levels from the operation of the Proposed Development	Operation: Long term impact on the nearby noise sensitive receptors during the day and night during the operational phase due to industrial noise from electrical components installed.	-						X	Moderate Adverse	Lt, R	Not Significant – (LOAEL)	Use of embedded mitigation – implementing sound reduction equipment on targeted equipment to reduce and minimise sound levels to a minimum along with layout and separation distances .

Key:
Geographical Significance: I = International N = National R = Regional C = County D = District P = Parish L = Low to Local
Nature: St = Short Term Mt = Medium Term Lt = Long Term R = Reversible Ir = Irreversible

BFEP Appendices