Green Hill Solar Farm
EN010170

Environmental Statement
Chapter 14: Noise and Vibration

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Contents

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Chapter 14: Noise and Vibration

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14 Noise and Vibration

14.1 Introduction

14.1.1 This chapter presents the findings of the Environmental Impact Assessment (EIA) concerning the potential noise and vibration impacts of the Scheme during the construction, operation and maintenance, and decommissioning phases.

14.1.2 The following aspects have been considered within the noise and vibration assessment:

- Effects arising from noise and vibration emitted by construction traffic, equipment, and plant during the construction and decommissioning phases. These effects would be temporary and short-term; and,
- Operational effects from noise generated by substations, inverters, transformers and battery units. These effects would end completely when operation of the Scheme ceases and are therefore long-term and reversible.

14.1.3 For project description details, please refer to Chapter 4: Scheme Description [**EN010170/APP/GH6.2.4**] of this Environmental Statement (ES).

14.1.4 This chapter has been prepared by Tetra Tech (see Statement of Competence [**EN010170/APP/GH6.3.1.1**]).

14.1.5 This chapter is supported by the following standalone figures:

- Figure 14.1 Monitoring Locations at Green Hill A [**EN010170/APP/GH6.4.14.1**]
- Figure 14.2 Monitoring Locations at Green Hill B [**EN010170/APP/GH6.4.14.2**]
- Figure 14.3 Monitoring Locations at Green Hill C to E [**EN010170/APP/GH6.4.14.3**]
- Figure 14.4 Monitoring Locations at Green Hill F and Green Hill BESS [**EN010170/APP/GH6.4.14.4**]
- Figure 14.5 Monitoring Locations at Green Hill G [**EN010170/APP/GH6.4.14.5**]
- Figure 14.6 Sensitive Receptor Locations at Green Hill A [**EN010170/APP/GH6.4.14.6**]
- Figure 14.7 Sensitive Receptor Locations at Green Hill B [**EN010170/APP/GH6.4.14.7**]
- Figure 14.8 Sensitive Receptor Locations Green Hill C to E [**EN010170/APP/GH6.4.14.8**]
- Figure 14.9 Sensitive Receptor Locations at Green Hill F and Green Hill BESS [**EN010170/APP/GH6.4.14.9**]
- Figure 14.10 Sensitive Receptor Locations at Green Hill G [**EN010170/APP/GH6.4.14.10**]

14.1.6 This chapter contains the following tables:

- **Table 14.1: Relevant Scoping Opinion Comments**
- **Table 14.2: Statutory Consultation Comments**
- **Table 14.3: Example Thresholds of Potential Significant Effect at Dwellings (Table E.1 of BS5228-1)**
- **Table 14.4: Construction Time Period - LOAEL and SOAEL**
- **Table 14.5: Magnitude of Impact for Construction Noise**
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- **Table 14.7: Construction Vibration LOAELs and SOAELs (DMRB LA 111)**
- **Table 14.8: Magnitude of Impact for Construction Vibration**
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- **Table 14.32: Cumulative Operational Effects from Grendon Lakes BESS and Green Hill**
- **Table 14.33: Summary of Residual Effects for Noise and Vibration**

14.2 Consultation

Scoping Opinion

14.2.1 An EIA Scoping Report was submitted to the Planning Inspectorate (PINS) in July 2024 [**EN010170/APP/GH6.3.2.1**] (Ref 14.1), with a formal request for a Scoping Opinion [**EN010170/APP/GH6.3.2.2**]. PINS subsequently issued the Scoping Opinion on 30 August 2024.

Table 14.1: Relevant Scoping Opinion Comments

Consultee and Date (Scoping Opinion ID)	Comment	How has the comment been addressed	Location of response in chapter
The Planning Inspectorate, Scoping Opinion 30 August 2024 (ID 3.9.1)	The SR [scoping report] states that the type of equipment present during the operational phase is of a type that does not generate a significant level of vibration. On this basis, the Inspectorate is in agreement that an assessment of operational vibration can be scoped out of further assessment.	No action – all in agreement to scope out.	Not Applicable
The Planning Inspectorate, Scoping Opinion 30 August 2024 (ID 3.9.2)	The SR proposes to scope out an assessment of noise and vibration associated with operational traffic on the basis that	The increase of traffic associated with the 2028 scenario has been considered to be all construction	Construction phase traffic has been assessed at: Paragraphs 14.8.8 to 14.8.15.

Consultee and Date (Scoping Opinion ID)	Comment	How has the comment been addressed	Location of response in chapter
	the traffic movements would be limited to occasional maintenance visits only. Considering the characteristics of the Proposed Development, the Inspectorate is content that this matter can be scoped out of further assessment. However, the ES project description should confirm the anticipated trip generation (including number and type of vehicles) required for occasional maintenance visits during operation to justify this, as the number and/ or type of vehicle required or frequency of maintenance visits is not specified within the SR.	related and assessed in the construction phase section of this chapter. The noise and vibration associated with the replacement works have also been assessed in this chapter and are likely to be considerably higher than that arising from occasional traffic movements.	Noise and vibration from maintenance works is assessed at: Paragraphs 14.8.53 to 14.8.60.
The Planning Inspectorate, Scoping Opinion 30 August 2024 (ID 3.9.3)	The Inspectorate notes that vibration from the construction phase is scoped into the ES. However, vibration from construction traffic has not been included in the list of activities therein that would potentially generate vibration. The	Construction traffic is assessed in this noise and vibration chapter of the ES, vibration from construction traffic is assessed within the construction vibration assessment including along	The assessment of construction traffic noise for each site is presented below. Table 14.23 details the predicted construction traffic noise and Paragraph 14.8.33 refers to the vibration from construction traffic.

Consultee and Date (Scoping Opinion ID)	Comment	How has the comment been addressed	Location of response in chapter
	condition of the roads have not been assessed, nor have the anticipated number and type of vehicles been provided to justify why vibration from construction traffic should be scoped out. The ES should provide evidence to confirm that ground-borne vibration generated from HGV movements (including along access routes) during construction and decommissioning would not result in significant effects on sensitive receptors or include an assessment of the LSE, unless otherwise agreed with relevant consultation bodies.	the access routes and construction and decommissioning phases.	
The Planning Inspectorate, Scoping Opinion 30 August 2024 (ID 3.9.4)	A 500m study area has been proposed in the SR for the purposes of providing an assessment of LSE. This has not been justified within the text and will need to be agreed with the relevant consultation bodies, as well as justified within the	Justification of the study area is presented within this noise and vibration chapter of the ES.	Section 14.4 sets out the assessment criteria, with Paragraphs 14.4.2 and 14.4.3 detailing the selection of the study area, and Figures 14.6 to 14.11 displaying the sensitive receptor locations within the study area.

Consultee and Date (Scoping Opinion ID)	Comment	How has the comment been addressed	Location of response in chapter
	ES according to relevant standards and guidance.		
The Planning Inspectorate, Scoping Opinion 30 August 2024 (ID 3.9.5)	These figures show the location of long term monitoring locations, most of which focus on the solar array areas rather than the Cable Route Search Area. The Inspectorate assumes that baseline noise monitoring will be carried out for the Cable Corridor, once refined, to support the ES.		The baseline noise environment has been established following noise surveys undertaken across the Study Area. Given the length of the Cable Route Corridor, it would not be practicable or proportionate to quantify the baseline noise environment along the entire corridor, therefore noise levels were measured at and around the Green Hill A-G and BESS sites at representative locations of the nearby noise sensitive receptors to the sites and the cable route corridor.

Statutory Consultation

14.2.2 A period of statutory consultation took place between 7 November and 19 December 2024 wherein consultees were able to respond to preliminary environmental information set out in the Preliminary Environmental Information Report (PEIR). **Table 14.2** outlines the statutory consultation responses relating to noise and vibration and how these have been addressed through the ES.

14.2.3 Responses to the Statutory Consultation are outlined in the Consultation Report **[EN010170/APP/GH5.1].**

Table 14.2: Statutory Consultation Comments

Consultee and Date	Comments	How has this comment been addressed	Location of response in the ES
West Northamptonshire Council 19 December 2024	The noise modelling completed suggests that levels of noise at night in some locations will be +4dB above background. This will be a perceptible difference and is a concern given it's nighttime. It's hard to see on the plans if this will be in our area as several sites across Northants, West and North, so more clarification will be needed on this aspect. Either way I'd be likely to recommend conditions on : Site working hours including construction. Construction Management Plan (CMP) to include noise, dust and mud control. Noise assessment and reduction	Paragraphs 14.8.50 to 14.8.52 refer to the significance of the operational noise levels, including the +4dB above background at one sensitive receptor in the night, and provide further context to the significance of these noise levels. The construction environmental management plan (CEMP) will include a construction noise management plan (CNMP) incorporating measures embedded in the design and construction of the project that will minimise noise impacts, including site working hours. A CNMP has been included as embedded mitigation within the development design.	This is presented in Sections 14.7 and 14.8 of this chapter. The CEMP, including the CNMP, is secured by a Requirement in the draft DCO.
Wilby Parsh Council 16 December 2024	Construction is proposed to be on-going for two	The significance of the construction	The significance of the construction noise and vibration

Consultee and Date	Comments	How has this comment been addressed	Location of response in the ES
	years. Excavators, cranes, lorries, earth moving machinery will cause continuous noise, vibration, dust and mud on roads which will adversely affect local businesses (particularly equestrian), residents, visitors and travellers.	noise and vibration is assessed and discussed in this chapter. The construction environmental management plan (CEMP) will also include a construction noise management plan (CNMP) incorporating measures embedded in the design and construction of the project that will minimise noise impacts, including site working hours and selection and maintenance of machinery. A CNMP has been included as embedded mitigation within the development design and will be part of the CEMP, Decommissioning Statement and CTMP to minimise noise impacts during the construction and decommisioning phases	effects is discussed in Section 14.8 of this chapter. The CEMP is discussed as part of the embedded mitigation in Section 14.7 of this chapter and is secured by a Requirement in the draft DCO.
Mears Ashby Parish Council 13 December 2024	Construction is proposed to be on-going for two years. Excavators,	The significance of the construction noise and	The significance of the construction noise and vibration effects is discussed

Consultee and Date	Comments	How has this comment been addressed	Location of response in the ES
	cranes, lorries, earth moving machinery will cause continuous noise, vibration, dust and mud on roads which will adversely affect local businesses (particularly equestrian) residents, visitors and travellers.	vibration is assessed and discussed in this chapter. The construction environmental management plan (CEMP) will also include a construction noise management plan (CNMP) incorporating measures embedded in the design and construction of the project that will minimise noise impacts, including site working hours and selection and maintenance of machinery. A CNMP has been included as embedded mitigation within the development design.	in Section 14.8 of this chapter. The CEMP is discussed as part of the embedded mitigation in Section 14.7 of this chapter.
Holcot Parish Council 17 December 2024	For instance, the construction process is going to be impossible to manage with minimal impact on affected communities - nature of sites, access, cabling, vehicle movements, noise etc	The construction environmental management plan (CEMP) will also include a construction noise management plan (CNMP) incorporating measures embedded in the design and construction of the project that will minimise	The significance of the construction noise and vibration effects is discussed in Section 14.8 of this chapter. The CEMP is discussed as part of the embedded mitigation in Section 14.7 of this chapter.

Consultee and Date	Comments	How has this comment been addressed	Location of response in the ES
		noise impacts, including site working hours and selection and maintenance of machinery. A CNMP has been included as embedded mitigation within the Scheme.	

14.3 Legislation, Planning Policy and Guidance

14.3.1 This section provides an overview of the legislation, planning policy and guidance, which the Scheme has had regard to in relation to noise and vibration.

Legislation

The Control of Pollution Act 1974 (Ref 14.2)

14.3.2 The Control of Pollution Act 1974 (CoPA) requires that Best Practicable Means (BPM), as defined in Section 72 of the CoPA, are adopted to control construction noise on any given site. Sections 60 and 61 of the CoPA provide the main legislation regarding enabling works and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the Local Authority with instructions to cease work until specific conditions to reduce noise have been adopted. Section 61 of the CoPA provides a means to apply for prior consent to carry out noise generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained onsite.

The Environmental Protection Act 1990 (Ref 14.3)

14.3.3 The Environmental Protection Act 1990 describes a statutory nuisance as noise (and vibration) emitted from premises (including land) that is prejudicial to health or a nuisance. Local Authorities are required to investigate any public complaints of noise, and if they are satisfied that a statutory nuisance exists, or is likely to occur or recur, they must serve a noise abatement notice. A notice is served on the person responsible for the nuisance. It requires either simply the abatement of the nuisance or works to abate the nuisance to be carried out, or it prohibits or restricts the activity.

Planning Policy

National Planning Policy

National Policy Statement (NPS) for Energy EN-1 (Updated January 2024) (Ref 14.4)

14.3.4 Relevant parts of EN-1 Section 5.12 states:

"*5.12.1 Excessive noise can have wide-ranging impacts on the quality of human life and health such as annoyance, sleep disturbance, cardiovascular disease and mental ill-health. It can also have an impact on the environment and the use and enjoyment of areas of value such as quiet places and areas with high landscape quality.*

5.12.2 The Government's policy on noise is set out in the Noise Policy Statement for England. It promotes good health and good quality of life through effective noise management. Similar considerations apply to vibration, which can also cause damage to buildings. In this section, in line with current legislation, references to "noise" below apply equally to the assessment of impacts of vibration.

5.12.4 Noise resulting from a proposed development can also have adverse impacts on wildlife and biodiversity. Noise effects of the proposed development on ecological receptors should be assessed by the Secretary of State in accordance with the Biodiversity and Geological Conservation section of this NPS at Section 5.4. This should consider underwater noise and vibration especially for marine developments. Underwater noise can be a significant issue in the marine environment, particularly in regard to energy production.

5.12.5 Factors that will determine the likely noise impact of a proposed development include:

- *The inherent operational noise from the proposed development, and its characteristics.*
- *The proximity of the proposed development to noise sensitive premises (including residential properties, schools and hospitals) and noise sensitive areas (including certain parks and open spaces).*
- *The proximity of the proposed development to quiet places and other areas that are particularly valued for their soundscape or landscape quality.*
- *The proximity of the proposed development to sites where noise may have an adverse impact on protected species or other wildlife, including migratory species.*
- *The potential presence of unexploded ordnance on the seabed.*

Applicant Assessment

5.12.6 Where noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment:

- *A description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive tonal characteristics, if the noise is impulsive, whether the noise contains particular high or low frequency content or any temporal characteristics of the noise*
- *Identification of noise sensitive receptors and noise sensitive areas that may be affected*
- *The characteristics of the existing noise environment*
- *A prediction of how the noise environment will change with the proposed development o in the shorter term, such as during the construction period or in the longer term, during the operating life of the infrastructure or at particular times of the day, evening and night (and weekends) as appropriate, and at different times of year*
- *An assessment of the effect of predicted changes in the noise environment on any noise-sensitive receptors, including an assessment of any likely impact on health and quality of life / well-being where appropriate, particularly among those disadvantaged by other factors who are often disproportionately affected by noise-sensitive areas*
- *If likely to cause disturbance, an assessment of the effect of underwater or subterranean noise*
- *All reasonable steps taken to mitigate and minimise potential adverse effects on health and quality of life*

5.12.7 The nature and extent of the noise assessment should be proportionate to the likely noise impact.

5.12.8 Applicants should consider the noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation.

Secretary of State decision making

5.12.17 The Secretary of State should not grant development consent unless they are satisfied that the proposals will meet the following aims, through the effective management and control of noise:

- *Avoid significant adverse impacts on health and quality of life from noise*
- *Mitigate and minimise other adverse impacts on health and quality of life from noise*
- *Where possible, contribute to improvements to health and quality of life through the effective management and control of noise*"

National Policy Statement (NPS) for Energy EN-3 (Updated January 2024) (Ref 14.5)

14.3.5 NPS for Energy EN-3 does not have a specific section for noise generated by the continued operation of solar projects, however noise and vibration generated by

the construction (including traffic and transport) is covered in Section 3.10.131, which states:

"*In some cases, the local highway authority may request that the Secretary of State impose controls on the number of vehicle movements to and from the solar farm site in a specified period during its construction and, possibly, on the routeing of such movements particularly by heavy vehicles*"

14.3.6 The document goes on to state, in Section 3.10.153:

"*The Secretary of State is unlikely to give any more than limited weight to traffic and transport noise and vibration impacts from the operational phase of a project.*"

National Policy Statement (NPS) for Energy EN-5 (Updated January 2024) (Ref 14.6)

14.3.7 Relevant parts of EN5 Section 2.9 states:

"*2.9.36 Noise may also arise from discharges on overhead line fittings such as spacers, insulators and clamps. Such noise should be mitigated through good design.*

2.9.37 Audible noise effects can also arise from substation equipment such as transformers, quadrature boosters and mechanically switched capacitors.

2.9.38 Transformers are installed at many substations, and generate low frequency hum. Whether the noise can be heard outside a substation depends on a number of factors, including transformer type and the level of noise attenuation present (either engineered intentionally or provided by other structures).

2.9.39 For the assessment of noise from substations, standard methods of assessment and interpretation using the principles of the relevant British Standards [For example, BS4142] are satisfactory.

2.9.40 For the assessment of noise from overhead lines, the applicant must use an appropriate method to determine the sound level produced by the line in both dry and wet weather conditions, in addition to assessing the impact on noise-sensitive receptors.

2.9.41 For instance, the applicant may use an appropriate noise modelling tool or tools for the prediction of overhead line noise and its propagation over distance, such as an ISO 9613-2 or Technical Report TR(T)94.

2.9.42 When assessing the impact of noise generated by overhead lines in wet weather relative to existing background sound levels, the applicant should consider the effect of varying background sound levels due to rainfall.

2.9.43 The Secretary of State is likely to regard it as acceptable for the applicant to use a methodology that demonstrably addresses these criteria."

National Planning Policy Framework (NPPF) (Updated December 2024) (Ref 14.7)

14.3.8 With regard to noise and planning, the National Planning Policy Framework (NPPF) contains the following:

"***15. Conserving and enhancing the natural environment***

187. Planning policies and decisions should contribute to and enhance the natural and local environment by:

a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);

b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;

c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;

d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures and incorporating features which support priority or threatened species such as swifts, bats and hedgehogs;

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

"198. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason […]"

"200. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

201. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

National Planning Policy Guidance (PPG) (Updated February 2024) (Ref 14.8)

14.3.9 National Planning Policy Guidance (PPG) : Noise addresses at Paragraph: 010 Reference ID: 30-010-20190722 'How planning can address the adverse effects of noise sources, including where the 'agent of change' needs to put mitigation in place':

"This will depend on the type of development being considered the type of noise involved and the nature of the proposed location. In general, for developments that are likely to generate noise, there are 4 broad types of mitigation:

- *engineering: reducing the noise generated at source and/or containing the noise generated;*
- *layout: where possible, optimising the distance between the source and noise-sensitive receptors and/or incorporating good design to minimise noise transmission through the use of screening by natural or purpose built barriers, or other buildings;*
- *using planning conditions/obligations to restrict activities allowed on the site at certain times and/or specifying permissible noise levels differentiating as appropriate between different times of day, such as evenings and late at night, and;*
- *mitigating the impact on areas likely to be affected by noise including through noise insulation when the impact is on a building.*

For noise sensitive developments, mitigation measures can include avoiding noisy locations in the first place; designing the development to reduce the impact of noise from adjoining activities or the local environment; incorporating noise barriers; and optimising the sound insulation provided by the building envelope. It may also be possible to work with the owners/operators of existing businesses or other activities in the vicinity, to explore whether potential adverse effects could be mitigated at source. Where this is the case, it may be necessary to ensure that these source-control measures are in place prior to the occupation / operation of the new development. Where multiple development sites would benefit from such source control measures, developers are encouraged to work collaboratively to spread this cost. Examples of source control measures could include increased sound proofing on a building (e.g. a music venue) or enclosing an outdoor activity (e.g. waste sorting) within a building to contain emissions.

Care should be taken when considering mitigation to ensure the envisaged measures do not make for an unsatisfactory development."

The Noise Policy Statement for England (NPSE) (March 2010) (Ref 14.9)

14.3.10 The Noise Policy Statement for England (NPSE) is a core guidance document informing the assessment methodology below (the details of which will follow). The NPSE's general aims are:

"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"*

Local Planning Policy

North Northamptonshire Local Plan 2011 – 2031 (adopted July 2016) (Ref 14.10)

14.3.11 The document outlines the regional strategy to ensure that any potential pollution, such as noise, arising from proposed developments is managed so that nearby residential dwellings and/or businesses are not significantly affected. Policy 26 relates directly to the development of renewable and low carbon energy and the following policy states:

"Proposals for sensitively located renewable and low carbon energy generation will be supported where it can be demonstrated that the proposal meets all of the following criteria:

- *… d) The siting of development does not significantly adversely affect the amenity of existing, or proposed, residential dwellings and/or businesses, either in isolation or cumulatively, by reason of noise, odour intrusion, dust, traffic generation, visual impact or shadow flicker;*
- *… g) The development does not create a significant adverse cumulative noise or visual impact when considered in conjunction with other developments planned within North Northamptonshire and adjoining local authority areas;"*

West Northamptonshire Joint Core Strategy Local Plan (Version 1.0, adopted December 2014) (Ref 14.11)

14.3.12 The West Northamptonshire Joint Core Strategy Local Plan (Part 1) references noise as an impact to ensure it is minimised, mainly in Policy S10 – Sustainable Development Principles, Policy S11 - Low Carbon and Renewable Energy and Policy BN9 – Planning for Pollution Control. The policies state:

"*Policy S10 – Sustainable Development Principle*

Development will:

… k) minimise pollution from noise, air and run off."

"Policy S11 – Low Carbon And Renewable Energy

Proposals should be sensitively located and designed to minimise potential adverse impacts on people, the natural environment, biodiversity, historic assets and should mitigate pollution…

Policy BN9 – Planning for Pollution Control

Proposals for new development which are likely to cause pollution or likely to result in exposure to sources of pollution or risks to safety will need to demonstrate that they provide opportunities to minimise and where possible reduce pollution issues that are a barrier to achieving sustainable development and healthy communities including:

… e) reducing the adverse impacts of noise."

Milton Keynes City Plan 2016 – 2031 (adopted March 2019) (Ref 14.12)

14.3.13 Section 12 of the Milton Keynes City Plan discusses noise in detail, outlining criteria and best practices for proposed developments to utilise. The noise and vibration section states:

"12.37 Noise and vibration can have a detrimental effect on health and the natural environment. National planning policy requires local policies to avoid giving rise to unacceptable noise impacts and give careful consideration to proposals that would have significant adverse effects. Planning Practice Guidance provides further information on how noise and vibration should be taken into account in the planning process, and Policy NE6 reflects this approach.

12.38 The siting, layout, landscaping and detailed building design of proposals, coupled with other noise-specific mitigation measures, should seek to avoid and minimise the adverse impacts of noise and vibration rather than rely upon expensive and ineffective retrospective measures. The Council will also seek to ensure that new development with a potential for causing noise nuisance are sited away from noise-sensitive land uses, both existing and known proposed developments. British Standard 6472-1:2008 Evaluation of human exposure to vibration within buildings will be used to evaluate exposure to vibration.

12.39 In considering noise and vibration aspects of proposals, the Council will take into account:

- *Possible future increases in noise levels*
- *The introduction of noisy activities into some residential and rural areas that have very low background noise levels.*
- *The nature of noise sources…*
- *That whilst design measures such as orientation, layout and double glazing can reduce noise within buildings, such measures are less effective in reducing the level of noise experienced in external amenity areas. As far as possible residents should have access to a peaceful (below 50dBA Leq) external amenity space.*
- *Traffic associated with 24 hour warehousing and distribution, and other uses which give rise to significant HGV and other traffic generation.*

- *Noise issues created by the use and operation of development itself, such as plant and services.*
- *The effects on sensitive species and habitats e.g. bats that rely on sound to feed and travel."*

Bedford Borough Council Local Plan 2030 (adopted January 2020) (Ref 14.13)

14.3.14 The Bedford Borough Council Local Plan 2030 makes reference to noise pollution from proposed developments, with Policy 47S – Pollution, disturbance and contaminated land as well as Policy 57 – Renewable Energy-general impact being the most applicable. While the reference to noise in Policy 57 specifically relates to wind farms, it is worth keeping the policy in mind and applying the good practices to other renewables developments. The policies state:

"Policy 47S – Pollution, disturbance and contaminated land

All development proposals will be required to:

- *…ii) Avoid noise giving rise to significant adverse impacts on health and quality of life or, where appropriate, mitigate and reduce its impact*
- *…v) Be appropriate for their location, having regard to the existing noise, air quality, ground stability or pollution environment, including the proximity of pollutants, hazardous substances and noise generating or disruptive uses,*

Policy 57 – Renewable Energy – General Impact

Proposals for development involving the provision of renewable and/or low carbon energy generation, including community energy projects, will be supported, subject to the acceptability of their wider impacts. As part of such proposals it shall be demonstrated that all of the following potential impacts (including cumulative impacts) have been fully addressed in consultation with affected local communities.

… Additional impacts for wind energy schemes

- *Vii) Amenity impacts – disturbance, noise, electromagnetic transmissions, shadow flicker, reflected light"*

Guidance

14.3.15 A summary of guidance which has informed the assessment is provided below.

- The British Standards Institution (BSI) - BS 4142:2014+A1:2019 Methods for rating and assessing Industrial and commercial sound (BS 4142) (June 2019) (Ref 14.14).
- The British Standards Institution (BSI) - BS 8233:2014 Guidance on sound Insulation and noise reduction for buildings (BS 8233:2014) (Feb 2014) (Ref 14.15).
- The British Standards Institution (BSI) - BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 (Noise) (January 2009) (Ref 14.16).

- The British Standards Institution (BSI) - BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 2 (Vibration) (January 2009) (Ref 14.17).
- Department of Transport, Welsh Office - Calculation of Road Traffic Noise (CRTN) (1988) (Ref 14.18).
- The Standards for Highways - Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration Revision 2 (May 2022) (Ref 14.19).
- World Health Organization (WHO) - Guidelines for Community Noise (WHO Guidelines for Community Noise) (1999) (Ref 14.20).
- BRE (various) - BRE Controlling particles, vapour and noise pollution from construction sites, Parts 1 to 5, (November 2003) (Ref 14.21).

14.4 Assessment Methodology and Significance Criteria

14.4.1 The methodologies described in the following section have been developed in line with the relevant planning policy and appropriate industry guidance for assessing potential effects from the Scheme on noise and vibration.

Study Area

14.4.2 The Study Area for the noise and vibration assessment includes the Order Limits for the Scheme and any noise and vibration sensitive receptors within 500m from the order limits.

14.4.3 By including noise sensitive receptors within 500m from the order limits, it is considered that all relevant receptors which could be impacted by the Scheme will be included, as the noise level beyond this distance will be sufficiently low as a result of distance attenuation and likely screening effects (e.g. from buildings, barriers etc.) that any effects above negligible are unlikely to occur.

14.4.4 The Study Area is therefore defined by the Order Limits and the Noise Sensitive Receptors.

14.4.5 The selected Noise Sensitive Receptors are illustrated in Figures 14.6 to 14.11 [**EN010170/APP/GH6.4.14.16-11]**.

Sources of Information

14.4.6 The relevant information sources used for the assessment are as follows:

- Noise surveys undertaken September 2023 and February 2024 as detailed within the Baseline Conditions section at 14.6.

Impact Assessment Methodology

14.4.7 The NPSE introduced three concepts to the assessment of noise and vibration, as follows:

14.4.7.1 NOEL *– No Observed Effect Level*

This is the noise level below which no effect can be detected and below which there is no detectable effect on the health and quality of life due to noise.

14.4.7.2 LOAEL *– Lowest Observed Adverse Effect Level*

This is the noise level above which adverse effects on health and quality of life can be detected.

14.4.7.3 *SOAEL – Significant Observed Adverse Effect Level*

This is the noise level above which significant adverse effects on health and quality of life can occur.

14.4.8 The specific noise level at which the above observed effect levels occur depends on the type of noise as well as the context.

14.4.9 These effect levels have been defined and used in the assessment of noise and vibration impacts of the Scheme for the Construction and Decommissioning phases and Operational phases below.

Thresholds for Assessing the Magnitude of Noise and Vibration Impacts

Construction, Replacement and Decommissioning Noise

14.4.10 Noise associated with the construction, replacement and decommissioning phases has been assessed at the identified sensitive receptors using the methodology outlined in BS 5228-1, as detailed below, and will be based on plant noise emission levels, distance to receptors and plant 'on-time' (the amount of time the plant is switched on), as detailed in the relevant assessment sections (i.e. **Table 14.24** and **Table 14.30**).

14.4.11 Annex E.3.2 of BS 5228-1 outlines the ABC method of defining the potential significant effects at nearby noise sensitive receptors based on the measured ambient noise levels in the area:

*"**E.3.2 Example method 1 – The ABC method***

Table E.1 shows an example of the threshold of potential significant effect at dwellings when the site noise level, rounded to the nearest decibel, exceeds the listed value. The table can be used as follows: for the appropriate period (night, evening/weekends or day), the ambient noise level is determined and rounded to the nearest 5 dB. This is then compared with the site noise level. If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect."

14.4.12 The Example thresholds of potential significant effect at dwellings (Table E.1 of BS5228-1) is reproduced below.

Table 14.3: Example Thresholds of Potential Significant Effect at Dwellings (Table E.1 of BS5228-1)

Assessment category and threshold value period	Threshold value, in decibels (dB) $L_{Aeq,T}$		
	Category A (A)	Category B (B)	Category C (C)
Night (23:00-07:00) hours	45	50	55

Assessment category and threshold value period	Threshold value, in decibels (dB) $L_{Aeq,T}$		
	Category A (A)	Category B (B)	Category C (C)
Evening 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 3 dB due to site noise.* NOTE 3 *Applied to residential receptors only.*			
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. (D) 19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00-23:00 Sundays			

14.4.12.1 The construction noise impact threshold levels used in this assessment are based on the ABC method of assessment described in **Table 14.3**, and are summarised in **Table 14.4**. Note that the specific threshold level at each receptor will depend on the ambient noise at the receptor for each time period, which is determined from the baseline sound survey as detailed in the Baseline Conditions section at 14.6. Therefore, the Threshold Level is given as a range in the table below for each time period.

Table 14.4: Construction Time Period - LOAEL and SOAEL

Time Period	LOAEL	SOAEL	Threshold Level $L_{Aeq,1hr}$ dB
Day (07:00-19:00 hours Weekday and 07:00-13:00 Saturdays)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	65 - 75
Night (23:00-07:00) hours	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per	45 - 55

Time Period	LOAEL	SOAEL	Threshold Level $L_{Aeq,1hr}$ dB
		BS 5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	
Evening and weekends (time periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	55 - 65

14.4.13 The magnitude of impact for construction noise as defined In DRMB LA 111 are reproduced in **Table 14.5**.

Table 14.5: Magnitude of Impact for Construction Noise

Magnitude of Impact	Construction Noise Level
Neutral	No increase
Negligible	Below LOAEL
Low	Above or equal to LOAEL and below SOAEL
Medium	Above or equal to SOAEL and below SOAEL + 5 dB
High	Above or equal to SOAEL + 5 dB

Construction and Decommissioning Traffic Noise

14.4.14 Baseline traffic noise levels at the identified sensitive receptors have been assessed based on the methodology in Calculation of Road Traffic Noise (Ref 14.18), utilising baseline traffic flows along the construction traffic route for the proposed years of the construction phase. The percentage increase in all traffic and Heavy Duty Vehicles (HDVs) has been used to calculate the likely change in traffic noise due to construction traffic during the construction phase.

14.4.15 The magnitude of effects for construction traffic noise, as defined in DRMB LA 111 are presented in **Table 14.6**.

Table 14.6: Magnitude of Impact for Construction Road Traffic Noise

Magnitude of impact	Increase in basic noise level of closest public road used for construction traffic (dB)
Neutral	No increase
Negligible	Less than 1.0
Low	Greater than or equal to 1.0 and less than 3.0
Medium	Greater than or equal to 3.0 and less than 5.0
High	Greater than or equal to 5.0

Construction Vibration (Including Construction Traffic)

14.4.16 For construction phase vibration the LOAEL and SOAEL is set out In DMRB LA 111 in terms of Peak Particle Velocity (PPV) and is provided in **Table 14.7**.

Table 14.7: Construction Vibration LOAELs and SOAELs (DMRB LA 111)

Time Period	LOAEL	SOAEL
All time periods	0.3 mm/s PPV	1.0 mm/s PPV

14.4.17 The magnitude of Impact for construction vibration is therefore determined in accordance with **Table 14.8**, as defined in DMRB LA 111.

Table 14.8: Magnitude of Impact for Construction Vibration

Magnitude of Impact	Vibration Level
Neutral	No increase
Negligible	Below LOAEL
Low	Above or equal to LOAEL and below SOAEL
Medium	Above or equal to SOAEL and below 10 mm/s PPV
High	Above or equal to 10 mm/s PPV

Operational Noise

14.4.18 The assessment of operational noise effects will be undertaken according to the methodology set out in BS 4142.

14.4.19 The BS 4142 methodology is summarised as follows:

1. Measure or predict the existing background noise level at the location of the nearby noise sensitive receptors (without the commercial or industrial noise) – $L_{A90,T;}$
2. Measure or predict the level of industrial noise at the location of the nearby noise sensitive receptors – $L_{Aeq,T;}$
3. Apply any relevant character corrections at the location of each receptor to account for audible characteristics of the industrial noise e.g. tonality, impulsivity, intermittency etc. and add these to the level calculated in step 2 above. This is referred to as the 'rating noise level' – $L_{Ar,Tr;}$ and
4. Compare the rating noise level from step 4 with the relevant background noise level from step 1 for a relevant time period that the industrial noise will operate (e.g. daytime and night-time).

14.4.20 The difference from step 4 (between the background and rating noise levels) forms the basis for assessing the likelihood of adverse impact as follows:

a) Typically, the greater this *difference*, the greater the magnitude of the impact;

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

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

d) 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.

14.4.21 BS4142 also states that the following factors should be taken into account:

"The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

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

14.4.22 The current BS4142 does not give any specific guidance on what might constitute a 'low' background noise level or rating level. It is therefore relevant to refer to other standards that provide absolute thresholds for suitable noise levels. BS 8233:2014 specifies 30 dB $L_{Aeq,T}$ as a suitable internal noise level in bedrooms in the night-time, for instance.

14.4.23 In addition, the previous BS4142:1997 'Method for Rating industrial noise affecting mixed residential and industrial areas' states:

"For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low."

14.4.24 The above levels are reiterated in the Association of Noise Consultants' (ANC) Technical Note on BS 4142:2014+A1:2019, stating:

"BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB L_{A90}, and low rating levels as being less than about 35 dB $L_{Ar,Tr}$. The WG [ANC working group] suggest that similar values would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate."

14.4.25 In this case, it is therefore considered that where rating levels are 35 dB $L_{Ar,Tr}$ or lower, that they would fall into the No Observed Adverse Effect Level (NOAEL) as they would constitute 'very low' rating levels. Similarly, that 35 dB should be considered the relevant criteria to compare the calculated rating level against for other adverse effect levels when the background levels are below 35 dB $L_{A90,T}$.

14.4.26 Also, as BS 4142 refers to absolute noise level criteria being relevant in some contexts, the relevant absolute noise level criteria for residential dwellings have been reproduced below. Suitable absolute noise level criteria for residential dwellings are given in BS 8233:2014 Table 4.

Table 14.9: Indoor Ambient Noise Levels for Dwellings (Table 4 from BS 8233:2014)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 $dBL_{Aeq,16hours}$	-
Dining	Dining room/area	40 $dBL_{Aeq,16hours}$	-
Sleeping (daytime resting)	Bedroom	35 $dBL_{Aeq,16hours}$	30 $dBL_{Aeq,16hours}$

"NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

14.4.27 WHO Guidelines for Community Noise provides a specific criterion for individual noise events that might cause sleep disturbance (i.e. for individual noise events affecting bedrooms during the night). This is reproduced below:

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night"

14.4.28 The baseline noise measurements, as set out in the Baseline Conditions section at 14.6, have been used to determine representative daytime and night-time background noise levels at the identified sensitive receptors.

14.4.29 Noise from operational plant such as substations, inverters, transformers and battery storage units will be predicted using noise modelling software and plant emission data provided by the Applicant.

14.4.30 The assessment has considered the level by which the Scheme's BS 4142 rating level exceeds the prevailing representative background noise levels, as well as the context in which the sound will occur.

Based on the methodology outlined above, **Table 14.10** below presents the operational noise magnitude of impacts.

Table 14.10: Method for Assessing the Magnitude of Impact

Magnitude of Impact	Effect Level	Noise Level Criteria	Justification for Effect Level- Action Typically Required
Negligible	No Observed Effect Level (NOEL) and No Observed Adverse Effect Level (NOAEL)	Where background levels are 35 dB LA90,T or above: the difference between Rating Level (LAr,T) dB and existing background level LA90,T dB is less than or equal to 0dB depending on context Where background levels are below 35 dB LA90,T: the difference between Rating Level (LAr,T) dB and 35 dB is less than or equal to 0dB depending on context	Justification for Effect Level: Below low impact threshold in BS4142 or below 'very low' levels Action Typically Required: None
		Noise levels are below: Living Rooms: 35 dBLAeq,16hours Kitchens, Dining Rooms, and Studies: 40 dBLAeq,16hours Bedrooms Rooms: 35 dBLAeq,16hours 30dB LAeq,8hr LAFmax,2min noise levels do not exceed: 45dB LAFmax based on 10th highest LAFmax,2min sample)	Justification for Effect Level: Less than threshold values in Table 4 in BS8233:2014 and Table 1 in World Health Organisation (1999) Guidelines on Community Noise Action Typically Required: None
Low	Lowest Observed Adverse Effect Level (LOAEL)	Where background levels are 35 dB LA90,T or above: the difference between Rating Level (LAr,T) dB and existing background sound level LA90,T dB is above 0dB and below 5dB, depending on context. Where background levels are below 35 dB LA90,T: the difference between Rating	Justification for Effect Level: Within less likely for adverse or significant adverse impact to occur low impact threshold in BS4142 Action Typically Required: Mitigate and reduce to a minimum the exceedance over 0dB above background threshold

Magnitude of Impact	Effect Level	Noise Level Criteria	Justification for Effect Level- Action Typically Required
		Level (LAr,T) dB and 35 dB is above 0dB and below 5dB, depending on context	
		Noise levels are between: Living Rooms: 35-40 dBLAeq,16hours Kitchens, Dining Rooms, and Studies: 40-45 dBLAeq,16hours Bedrooms Rooms: 35-40 dBLAeq,16hours 30-35dB LAeq,8hr LAFmax,2min noise levels do not exceed 45dB LAFmax based on 10th highest LAFmax,2min sample)	Justification for Effect Level: Exceed threshold guidelines in Table 4 of BS8233:2014 and World Health Organisation (1999) Guidelines on Community Noise by no greater than 5dB to achieve reasonable internal conditions as defined by Note 7 to Table 1 in BS8233:2014 Action Typically Required: Mitigate and reduce to a minimum the exceedance over the threshold
Medium	Significant Observed Adverse Effect Level (SOAEL)	Where background levels are 35 dB LA90,T or above: the difference between Rating Level (LAr,T) dB and existing background sound level LA90,T dB is equal to or above 5 and below 9dB, depending on context Where background levels are below 35 dB LA90,T: the difference between Rating Level (LAr,T) dB and 35 dB is equal to or above 5 and below 9dB, depending on context	Justification for Effect Level: Within adverse impact threshold in BS4142. Action Typically Required Additional mitigation required to achieve effect of LOAEL or less.
		Noise levels are between: Living Rooms: 40-45 dBLAeq,16hours Kitchens, Dining Rooms, and Studies: 45-50 dBLAeq,16hours Bedrooms Rooms: 40-45 dBLAeq,16hours 35-40dB LAeq,8hr 45-55dB LAFmax,2min based on 10th highest LAFmax,2min sample)	Justification for Effect Level: Exceeds BS8233:2014 LAeq,T reasonable criteria by 5dB or exceeds LAFmax,2min (10th highest sample) Action Typically Required: Additional mitigation required to achieve effect of LOAEL or less.

Magnitude of Impact	Effect Level	Noise Level Criteria	Justification for Effect Level- Action Typically Required
High	Unacceptable Observed Adverse Effect Level (UOAEL)	Where background levels are 35 dB LA90,T or above: the difference between Rating Level (LAr,T) dB and existing background sound level LA90,T dB is equal to or greater than 10dB, depending on context Where background levels are below 35 dB LA90,T: the difference between Rating Level (LAr,T) dB and 35 dB is equal to or greater than 10dB, depending on context	Justification for Effect Level: Within significant adverse impact threshold in BS4142 Action Typically Required: Additional mitigation required to achieve effect of LOAEL or less.
		Noise levels exceed: Living Rooms: 45 dBLAeq,16hours Kitchens, Dining Rooms, and Studies: 50 dBLAeq,16hours Bedrooms Rooms: 45 dBLAeq,16hours 40dB LAeq,8hr LAFmax,2min noise levels exceeds 55dB LAFmax based on 10th highest LAFmax,2min sample)	Justification for Effect Level: Exceeds BS8233:2014 LAeq,T reasonable criteria by 10dB or exceeds LAFmax,2min (10th highest sample) by 10dB or more. Action Typically Required: Additional mitigation required to achieve effect of LOAEL or less.

14.4.31 Whilst the noise descriptors and categories presented in **Table 14.10** have been established through reference to relevant guidance documents, there are other factors (predominantly '*the context in which the sound occurs/will occur*' in accordance with BS4142) which need to be taken into account when assessing the noise impact.

14.4.32 Therefore, a flexible approach to these categories will be undertaken in the context of how specific impacts associated with the Scheme interact with the identified sensitive receptors.

Sensitivity of Receptors

14.4.33 The sensitivity of likely impacted receptors will be assessed in line with **Table 14.11** below.

Table 14.11: Receptor Sensitivity

Sensitivity of Receptor	Definition
High	Residential dwellings, schools and hospitals
Medium	Offices, internal teaching/training spaces
Low	Commercial premises

14.4.34 Based on an initial desk-based study, the closest (and therefore worst case) receptors are residential and are therefore of High sensitivity. As such, where noise and vibration effects are assessed to be not significant at the closest receptors, effects at all other receptors will also be not significant, regardless of sensitivity.

Assessment of Likely Significance

14.4.35 The sensitivity of the receptor and the magnitude of the predicted effects will be used, in addition to professional judgement, to assess the likely significance of the determined effects. **Table 14.12** summarises guideline criteria for assessing the likely significance of noise and vibration effects.

Table 14.12: Significance of Effects Matrix

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

14.4.36 Effects assessed to be of major or major/moderate significance are considered to be significant in the context of the EIA. Where a departure from this approach has been taken this will be justified accordingly.

Identified Sensitive Receptors

14.4.37 The above magnitude of impacts and significance of effects have been assessed at the relevant sensitive receptors. The relevant sensitive receptors have been identified as per the methodology below.

14.4.38 Residential properties located closest to the Scheme have been identified using the information and drawings presented in Chapter 4: Scheme Description [**EN010170/APP/GH6.2.4**] of this Environmental Statement. Chapter 4: Scheme Description splits the Scheme into various Sites which have been used throughout this chapter (e.g. to refer to noise emanating from that part of the Scheme, and the noise level at the receptors surrounding that part of the

Scheme). Additional noise sensitive receptors surrounding the cable route corridor that are not already defined by another site have also been identified as per the methodology outlined below.

14.4.39 The closest residential properties to each site are defined below along with the approximate minimum distance to the nearest red line boundary (RLB) i.e. the red line boundary of the associated site / cable routing. These receptors are considered to be the most noise sensitive, as effects from the Scheme will be higher at these locations than at receptors located further from the Scheme. Background sound levels measured at the nearby residential properties listed in **Tables 14.13 to 14.18** are considered to be representative of the background noise environments at other properties in similar nearby locations. On this basis, should the predicted noise levels from the Scheme comply with limits at these assessed residential property receptors, predicted noise levels at receptors further from the Scheme will also comply.

14.4.40 The following tables below (**Table 14.13 to Table 14.18**) present the identified sensitive receptors nearest to each of the Sites within the Scheme.

Table 14.13: Sensitive Noise Receptors – Green Hill A and A.2

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
A001	A	Residential	Glebe Farm, Broughton Rd, NN6 9TY	200
A002	A	Residential	Red Lodge, Broughton Road, NN6 9TY	300
A003	A	Residential	White Lodge, NN6 9PY	315
A004	A	Residential	Pheasant Dr, Walgrave, NN6 9RY	380
A005	A	Residential	Jubilee Dr, Walgrave, NN6 9PR	450
A006	A	Residential	Little Acorn Farm, Newland Road, Walgrave, NN6 9PZ	80
A007	A	Residential	Townsend Rd, Walgrave, NN6 9QU	390
A008	A	Residential	Walgrave Road, Old, NN6 9EN	330
A009	A	Residential	The Old Corner House, Broughton Rd, NN6 9RH	70
A010	A	Residential	Walgrave Lodge, Newland Rd, NN6 9PZ	40
A011	A	Residential	Polly's Cottage, Newland Rd, NN6 9PZ	15
A012	A	Residential	Bales Barn, Broughton Rd, Old, NN6 9RH	270

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
A015	A2	Residential	Gibb Wood, Kettering Road, NN6 9PU	30
A016	A2	Residential	Rectory Farm, Northampton NN6 9PS	15
A017	A2	Residential	New Lodge Farmhouse, Kettering Road, NN6 9PJ	50

Table 14.14: Sensitive Noise Receptors – Green Hill B

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
B020	B	Residential	Moulton Rd, Holcot, NN6 9SH	175
B021	B	Residential	Sywell Road, NN6 9SQ	430
B022	B	Residential	Rectory Farm, Kettering Rd, NN3 7XA	335
B023	B	Residential	Overstone Old Rectory, Kettering Rd, NN3 7XA	265
B024	B	Residential	Overstone Grange Farm, Kettering Rd, NN3 7XA	420
B025	B	Residential	Holcot Rd, Moulton, NN3 7QN	610
B026	B	Residential	Slade House, Holcot Road, Moulton, NN3 7QN	525
B027	B	Residential	Moulton Lodge, Moulton Rd, Holcot, NN6 9SH	270

Table 14.15: Sensitive Noise Receptors – Green Hill C, D and E

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
C030	C	Residential	Ashby Furse Farms, 280 Sywell Rd, NN6 0FL	125
C031	C	Residential	120-140 Glebe Rd, NN6 0DL	40
C032	C	Residential	Wood Lodge Farm, 10 Wellingborough Road, NN6 0BW	25

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
D040	D	Residential	Highfield Lodge, Highfield Road, NN6 0EA	15
D041	D	Residential	Highfield Road, NN6 0EA	20
D042	D	Residential	Highfield Road, NN6 0EA	25
D043	D	Residential	Highfield Road, NN6 0EA	30
D044	D	Residential	1, Highfield Road, NN6 0EA	25
D045	D	Residential	Ashby Furse Farms, 280 Sywell Rd, NN6 0FL	95
E050	E	Residential	Wilby Hall, Highfield Road, NN6 0EA	200
E051	E	Residential	111 Mears Ahsby Road, NN8 2FH	120
E052	E	Residential	Hockerill Farm, NN8 2UF	15
E053	E	Residential	36-38 Main Road, NN6 0TW	160
E054	E	Residential	47 Packwood Crescent, NN6 0FA	210
E055	E	Residential	Main Road Farm, Main Road, NN6 0HJ	155
E056	E	Residential	1, Packwood Crescent, NN6 0FA	65
E057	E	Residential	90 Main Road, NN6 0HJ	190
E058	E	Residential	67 Mears Ashby Road, NN6 0HQ	200
E059	E	Residential	Northampton, NN6 0DY	10
E060	E	Residential	7 Hill Court Farm, NN6 0ER	200
E061	E	Residential	The Hall, Wilby Road, NN6 0DY	180
E062	E	Residential	7 Duchess End, NN6 0EB	155
E063	E	Residential	5 Duchess End, NN6 0EB	80
E064	E	Residential	63 Wilby Road, NN6 0DX	5

Table 14.16: Sensitive Noise Receptors – Green Hill F

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
F070	F	Residential	44, Wollaston Road, NN29 7LT	275
F071	F	Residential	1, Fullwell Road, NN29 7LX	300
F072	F	Residential	Slype Farm, Easton Lane, NN29 7NH	15

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
F073	F	Residential	80, Easton Lane, NN29 7NH	5
F074	F	Residential	75, Easton Lane, NN29 7NN	60
F075	F	Residential	75A, Easton Lane, NN29 7NN	70
F076	F	Residential	Low Farm Cottage, Easton Maudit, NN29 7NR	80
F077	F	Residential	Stoken Hollow Farm, London Road, NN29 7NP	120
F078	F	Residential	Easton Lodge, Easton Maudit, NN29 7NP	480
F079	F	Residential	Home Farmhouse, Easton Maudit, NN29 7NR	25
F080	F	Residential	11 Easton Maudit, NN29 7NR	70
F081	F	Residential	40 Easton Maudit, NN29 7NR	260
F082	F	Residential	2 Easton Maudit, NN29 7NR	215
F083	F	Residential	39 Easton Maudit, NN29 7NR	25
F084	F	Residential	185 Easton Way, NN7 1JN	150

Table 14.17: Sensitive Noise Receptors – Green Hill G

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
G090	G	Residential	Northey Farm, London Road, NN29 7NP	50
G091	G	Residential	Lower Farm, Castle Road, MK46 4JG	15
G092	G	Residential	Nest Farm, Lavendon, MK46 4HP	180

Table 14.18: Sensitive Noise Receptors – Green Hill BESS

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from RLB (m)
BESS001	BESS	Residential	Pastures Farm, Station Rd, Grendon, Northampton NN7 1JD	170
BESS002	BESS	Residential	Porters Lodge, Station Rd, Northampton NN7 1JD	180
BESS003	BESS	Residential	710 Station Rd, Grendon, Northampton NN7 1JB	380
BESS004	BESS	Residential	Church Way, Grendon, Northampton NN7 1JE	550
BESS005	BESS	Residential	Grendon Hall, 67 Main Rd, Grendon, Northampton NN7 1JW	575
BESS006	BESS	Residential	Grendon Lakes, Main Rd, Northampton NN7 1JW	450

Cable Route Corridor

14.4.41 The Cable Route Corridor is approximately 31km in length and, therefore, there are a large number of receptors within the Study Area for the construction and decommissioning works. As such, it would not be practicable or proportionate to assess the noise and vibration levels from construction works at every receptor along the Cable Route Corridor.

14.4.42 This Cable Route Corridor will generally be 50m in width (but varying at certain locations to accommodate construction access or temporary working areas in a limited number of locations), within which are the cables connecting the various solar array sites to the Point of Connection (POC).

14.4.43 The construction noise and vibration assessment method therefore identifies the closest receptors to the Cable Route Corridor which could be impacted by noise and vibration from the construction of the cables. Receptors located further away than the identified receptors may not experience the predicted magnitude of impact due to the decrease of noise over distance and are therefore not assessed for impacts. This assessment method is considered to be a reasonable worst-case in this regard, and consequently robust.

Table 14.19: Additional Sensitive Noise Receptors – Along Cable Route Corridor

Ref	Associated Site	Land Use Classification	Address	Approx. Distance from Cable Route (m)
CR01	Cable	Residential	Brookside House, Brookside Farm, Red House Lane, NN6 9SZ	17
CR02	Cable	Residential	Yeoman Farm, Kettering Road, NN6 9TE	155
CR03	Cable	Residential	White House, Sywell Road, NN6 9SN	260
CR04	Cable	Residential	110 Holcot Lane, NN6 0BE	370
CR05	Cable	Residential	188 Main Road NN8 2UE	105
CR06	Cable	Residential	200 Main Road NN8 2UF	190
CR07	Cable	Residential	132 Doddington Road NN6 0NS	100
CR08	Cable	Residential	44 Holdenby Lane, NN6 0RN	180
CR09	Cable	Residential	31 Station Road, NN7 1NP	130
CR10	Cable	Residential	7 The Knoll, NN7 1JG	170
CR11	Cable	Residential	New Pastures Farm, Bedford Road, MK46 4HW	360
CR12	Cable	Residential	Bridge Field Farm, Kettering Road, NN6 9PH	55

14.5 Assessment Assumptions and Limitations

14.5.1 The methodology for noise and vibration has considered the following assumptions:

- The noise measurement locations were selected to be representative of the noise levels at the closest point of proposed receptors;
- All noise sources measured during the survey are considered to be typical of the surrounding noise environment;
- The distance between the source and nearest receptors has been measured from scale plans;
- Road traffic noise at existing and proposed receptors have been predicted using the CadnaA software, taking into account 1st order reflections from buildings and other large surfaces;
- For the operational noise assessment, the BESS Inverters and Substation Transformers will be operating simultaneously at full capacity;

- Noise measurements were undertaken during suitable weather conditions (i.e. no significant rain and medium-low wind speeds i.e. typically <5m/s); and,
- Noise measurements were made using Class 1, integrating sound level meters, which are accurate to 0.1dB.

14.6 Baseline Conditions

14.6.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to noise and vibration.

Existing Baseline

14.6.2 The baseline noise environment has been established following noise surveys undertaken across the Study Area. Given the length of the Cable Route Corridor, it would not be practicable or proportionate to quantify the baseline noise environment along the entire corridor, therefore noise levels were measured at and around the Green Hill A-G and BESS sites at representative locations of the nearby noise sensitive receptors to the sites and the cable route corridor. A logging weather station was installed onsite during the surveys so any periods of adverse weather conditions can be identified and omitted from further analysis, in accordance with BS 4142.

14.6.0 Figures 14.1 to 14.5 present the monitoring locations in Appendix 14.1 **[EN010170/APP/GH6.3.14.1]**.

- **Figure 14.1** Monitoring Locations at Green Hill A and A2;
- **Figure 14.2** Monitoring Locations at Green Hill B;
- **Figure 14.3** Monitoring Locations at Green Hill C to E;
- **Figure 14.4** Monitoring Locations at Green Hill F; and
- **Figure 14.5** Monitoring Locations at Green Hill G.

Noise Survey Results

The results of the noise measurements for monitoring positions LT1 to LT25 are presented in **Table 14.20**.

Table 14.20: Noise Survey Results

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekday Daytime 07:00 - 23:00	21/09/2023 – 28/09/2023	LT1	0	66.2	103.3	18.2	62.3	36
Weekday Night-time 23:00 – 07:00	21/09/2023 – 28/09/2023			56.5	90.9	17.4	39.8	20

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	23/09/2023 – 24/09/2023			64.4	102.2	21.6	60.9	32
Weekend Night-time 23:00 – 07:00	23/09/2023 – 25/09/2023			56.0	89.1	21.0	49.4	34
Weekday Daytime 07:00 - 23:00	28/09/2023 – 3/10/2023	LT2	0	51.5	96.4	20.7	47.6	42
Weekday Night-time 23:00 – 07:00	28/09/2023 – 3/10/2023			38.6	73.3	19.4	34.6	32
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			49.7	88.1	20.2	44.1	29
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			36.6	69.1	18.2	33.9	36
Weekday Daytime 07:00 - 23:00	21/09/2023 – 22/09/2023	LT3	0	60.3	91.0	22.9	57.7	38
Weekday Night-time 23:00 – 07:00	21/09/2023 – 23/09/2023			51.3	82.5	20.7	37.1	24
Weekend Daytime 07:00 - 23:00	23/09/2023 – 24/09/2023			58.6	90.5	23.0	55.9	32
Weekend Night-time 23:00 – 07:00	23/09/2023 – 24/09/2023			46.8	80.6	28.4	44.3	33
Weekday Daytime 07:00 - 23:00	21/09/2023 – 27/09/2023	LT4	0	63.0	96.9	21.8	59.5	40
Weekday Night-time 23:00 – 07:00	21/09/2023 – 27/09/2023			51.4	85.4	17.0	36.6	24

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	23/09/2023 – 24/09/2023			60.3	85.3	26.8	56.6	32
Weekend Night-time 23:00 – 07:00	23/09/2023 – 25/09/2023			50.1	84.5	22.6	44.4	32
Weekday Daytime 07:00 - 23:00	21/09/2023 – 27/09/2023	LT5	0	57.1	89.0	22.8	56.4	54
Weekday Night-time 23:00 – 07:00	21/09/2023 – 27/09/2023			47.6	82.0	20.1	42.3	36
Weekend Daytime 07:00 - 23:00	23/09/2023 – 24/09/2023			62.0	95.8	36.7	62.1	42
Weekend Night-time 23:00 – 07:00	23/09/2023 – 25/09/2023			49.7	76.2	29.9	50.7	38
Weekday Daytime 07:00 - 23:00	28/09/2023 – 3/10/2023	LT6	100	49.8	78.6	21.0	49.2	39
Weekday Night-time 23:00 – 07:00	28/09/2023 – 3/10/2023			42.3	73.0	17.5	40.5	40
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			43.7	82.5	23.8	45.4	31
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			39.6	69.9	18.1	38.0	36
Weekday Daytime 07:00 - 23:00	21/09/2023 – 28/09/2023	LT7	0	62.5	92.0	24.5	65.9	51
Weekday Night-time 23:00 – 07:00	21/09/2023 – 28/09/2023			54.6	80.8	16.6	48.0	24

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	23/09/2023 – 24/09/2023			61.7	91.3	29.9	64.5	44
Weekend Night-time 23:00 – 07:00	23/09/2023 – 25/09/2023			52.9	86.2	24.1	47.7	34
Weekday Daytime 07:00 - 23:00	21/09/2023 – 28/09/2023	LT8	0	51.9	85.6	25.9	49.7	37
Weekday Night-time 23:00 – 07:00	21/09/2023 – 28/09/2023			49.6	74.6	18.4	43.6	34
Weekend Daytime 07:00 - 23:00	23/09/2023 – 24/09/2023			53.7	77.3	29.8	51.5	32
Weekend Night-time 23:00 – 07:00	23/09/2023 – 25/09/2023			50.4	69.9	28.4	51.0	40
Weekday Daytime 07:00 - 23:00	28/09/2023 – 3/10/2023	LT9	500	52.6	95.5	19.6	48.1	38
Weekday Night-time 23:00 – 07:00	28/09/2023 – 3/10/2023			41.2	70.9	16.9	36.8	41
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			49.9	90.1	20.4	45.7	29
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			40.0	73.0	17.1	36.7	36
Weekday Daytime 07:00 - 23:00	28/09/2023 – 3/10/2023	LT10	0	55.8	91.6	24.2	54.7	44
Weekday Night-time 23:00 – 07:00	28/09/2023 – 3/10/2023			46.9	88.3	21.1	43.1	32

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			53.5	89.5	23.4	51.4	35
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			46.7	88.6	18.5	42.7	36
Weekday Daytime 07:00 - 23:00	3/10/2023 – 10/10/2023	LT11	0	53.6	94.3	24.3	49.9	46
Weekday Night-time 23:00 – 07:00	3/10/2023 – 10/10/2023			43.0	76.8	20.3	37.8	30
Weekend Daytime 07:00 - 23:00	7/10/2023 – 8/10/2023			52.8	83.8	24.1	47.1	36
Weekend Night-time 23:00 – 07:00	7/10/2023 – 9/10/2023			41.8	77.7	20.1	33.7	31
Weekday Daytime 07:00 - 23:00	28/09/2023 – 29/09/2023	LT12	0	44.0	74.9	22.1	43.5	36
Weekday Night-time 23:00 – 07:00	28/09/2023 – 30/09/2023			36.1	68.5	21.1	35.3	39
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			43.3	83.2	26.1	44.5	30
Weekend Night-time 23:00 – 07:00	30/09/2023 – 1/10/2023			42.9	66.7	29.2	44.1	37
Weekday Daytime 07:00 - 23:00	28/09/2023 – 3/10/2023	LT13	0	59.0	95.9	25.4	58.1	37
Weekday Night-time 23:00 – 07:00	28/09/2023 – 3/10/2023			48.9	79.2	20.6	37.5	31

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			57.5	93.0	25.0	55.0	32
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			47.1	75.8	19.8	36.1	34
Weekday Daytime 07:00 - 23:00	3/10/2023 – 10/10/2023	LT14	0	45.6	76.0	27.1	46.5	41
Weekday Night-time 23:00 – 07:00	3/10/2023 – 10/10/2023			38.5	83.4	22.4	38.5	34
Weekend Daytime 07:00 - 23:00	7/10/2023 – 8/10/2023			43.6	72.8	27.3	44.7	39
Weekend Night-time 23:00 – 07:00	7/10/2023 – 9/10/2023			37.3	70.0	22.5	35.6	34
Weekday Daytime 07:00 - 23:00	3/10/2023 – 10/10/2023	LT15	0	62.4	97.7	28.8	65.9	48
Weekday Night-time 23:00 – 07:00	3/10/2023 – 10/10/2023			54.3	89.4	23.7	48.6	35
Weekend Daytime 07:00 - 23:00	7/10/2023 – 8/10/2023			60.7	97.4	30.5	64.1	41
Weekend Night-time 23:00 – 07:00	7/10/2023 – 9/10/2023			53.5	82.4	22.5	47.9	37
Weekday Daytime 07:00 - 23:00	28/09/2023 – 3/10/2023	LT16	750	62.0	102.9	26.3	59.1	42
Weekday Night-time 23:00 – 07:00	28/09/2023 – 3/10/2023			52.8	87.4	19.7	42.0	37

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			60.7	102.7	25.4	55.5	33
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			50.6	82.1	19.6	40.2	38
Weekday Daytime 07:00 - 23:00	30/09/2023 – 3/10/2023	LT17	0	48.3	78.0	27.0	49.8	39
Weekday Night-time 23:00 – 07:00	30/09/2023 – 3/10/2023			42.5	74.9	25.6	42.1	34
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			46.6	72.6	26.7	49.1	41
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			40.5	75.9	22.6	37.0	37
Weekday Daytime 07:00 - 23:00	3/10/2023 – 10/10/2023	LT18	225	47.3	77.0	29.9	47.0	46
Weekday Night-time 23:00 – 07:00	3/10/2023 – 10/10/2023			41.5	79.4	29.6	41.5	37
Weekend Daytime 07:00 - 23:00	7/10/2023 – 8/10/2023			44.4	75.8	33.1	44.9	42
Weekend Night-time 23:00 – 07:00	7/10/2023 – 9/10/2023			40.8	73.1	29.1	41.3	38
Weekday Daytime 07:00 - 23:00	28/09/2023 – 3/10/2023	LT19	0	42.5	83.2	25.7	42.9	36
Weekday Night-time 23:00 – 07:00	28/09/2023 – 3/10/2023			38.1	58.4	22.9	38.3	28

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	30/09/2023 – 1/10/2023			39.9	70.5	25.8	41.6	36
Weekend Night-time 23:00 – 07:00	30/09/2023 – 2/10/2023			35.5	68.3	23.0	34.5	35
Weekday Daytime 07:00 - 23:00	20/02/2024 – 27/02/2024	LT20	0	57.0	93.3	34.4	54.2	38
Weekday Night-time 23:00 – 07:00	20/02/2024 – 27/02/2024			49.7	87.3	33.6	44.1	36
Weekend Daytime 07:00 - 23:00	24/02/2024 – 25/02/2024			55.4	86.8	32.8	51.9	36
Weekend Night-time 23:00 – 07:00	24/02/2024 – 25/02/2024			46.2	79.0	34.0	39.7	35
Weekday Daytime 07:00 - 23:00	20/02/2024 – 23/02/2024	LT21	0	49.4	94.6	32.4	47.7	38
Weekday Night-time 23:00 – 07:00	20/02/2024 – 23/02/2024			43.8	78.8	29.7	43.8	40
Weekend Daytime 07:00 - 23:00	24/02/2024			43.7	82.7	30.6	41.0	33
Weekend Night-time 23:00 – 07:00	24/02/2024 – 25/02/2024			36.9	68.6	28.2	36.8	35
Weekday Daytime 07:00 - 23:00	20/02/2024 – 27/02/2024	LT22	0	56.3	89.2	27.6	56.0	42
Weekday Night-time 23:00 – 07:00	20/02/2024 – 27/02/2024			48.9	85.3	20.5	47.6	39

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	24/02/2024 – 25/02/2024			54.7	90.8	25.7	54.6	38
Weekend Night-time 23:00 – 07:00	24/02/2024 – 25/02/2024			45.0	73.5	20.5	44.6	28
Weekday Daytime 07:00 - 23:00	08/05/2024 – 11/05/2024	LT23	0	63.5	102.7	23.8	67.0	42
Weekday Night-time 23:00 – 07:00	08/05/2024 – 11/05/2024			58.1	89.5	18.8	56.1	26
Weekend Daytime 07:00 - 23:00	08/05/2024 – 11/05/2024			63.1	94.5	30.8	66.8	44
Weekend Night-time 23:00 – 07:00	08/05/2024 – 11/05/2024			55.4	84.7	18.7	52.6	22
Weekday Daytime 07:00 - 23:00	08/05/2024 – 14/05/2024	LT24	0	65.4	101.2	25.4	69.0	42
Weekday Night-time 23:00 – 07:00	08/05/2024 – 14/05/2024			60.4	89.5	20.7	55.9	32
Weekend Daytime 07:00 - 23:00	08/05/2024 – 14/05/2024			64.0	93.0	26.8	68.2	44
Weekend Night-time 23:00 – 07:00	08/05/2024 – 14/05/2024			57.5	87.7	21.4	55.2	31
Weekday Daytime 07:00 - 23:00	08/05/2024 – 15/05/2024	LT25	0	50.5	89.1	19.2	49.1	38
Weekday Night-time 23:00 – 07:00	08/05/2024 – 15/05/2024			52.1	89.3	18.3	40.9	24

Period	Monitoring Date and Times	Location	Distance from Order Limits (m)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekend Daytime 07:00 - 23:00	08/05/2024 – 15/05/2024			53.3	86.0	21.6	51.4	36
Weekend Night-time 23:00 – 07:00	08/05/2024 – 15/05/2024			54.1	81.6	19.9	40.1	22

Future Baseline

14.6.1 This section considers changes to the baseline conditions, described above, that might occur in the absence of the Scheme and during the time period over which the Scheme would be in place. The future baseline scenarios are set out in Chapter 2: EIA Process and Methodology **[EN010170/APP/GH6.2.2]**.

14.6.2 In the absence of the Scheme, it is anticipated that the only factor that would change the noise levels is the road traffic.

14.6.3 In the absence of the Scheme, it is considered there will be no change to the future baseline for noise and vibration. The baseline details as presented above (including road traffic noise) are not anticipated to change in the absence of the Scheme. In any case, this is considered a 'worst-case' assumption as any noticeable increase in baseline levels (e.g. from road traffic) would reduce the magnitude by which the proposed development exceeds the baseline levels and therefore reduce the likelihood of adverse effects.

14.7 Embedded Mitigation Measures

14.7.1 The way that likely significant environmental impacts have been or will be avoided, minimised or offset is outlined in this section and will be taken into account as part of the assessment of the likely significance of effects. Proposed environmental enhancements are also described where relevant.

14.7.2 The following mitigation measures for the construction/operation/decommissioning phases have been incorporated into the Scheme's design and are considered embedded as described in Chapter 2 EIA Process and Methodology **[EN010170/APP/GH6.2.2].**

Embedded Construction Mitigation Measures

Noise from Earthworks and Construction

14.7.3 In order to reduce the potential impact of noise generated by the construction phase of the Scheme mitigation measures would be required. The construction works would follow the guidelines in BS5228-1 and the guidance in BRE Controlling particles, vapour and noise pollution from construction sites, Parts 1 to 5, (2003) (Ref 14.21). The following measures form part of the Best Practicable

Means (BPM) and would be put in place to minimise noise emissions and implemented via a Construction Environmental Management Plan (CEMP), which will be created in accordance with the Outline Construction Environmental Management Plan (oCEMP) to be secured by the DCO:

- When works are taking place within close proximity (e.g. <20m) to the sensitive receptors identified, the screening of noise sources via the erection of temporary screens would be employed;
- All machinery would be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers;
- Site staff would be made aware that they are working adjacent to a sensitive area and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios;
- As far as possible, the avoidance of two noisy operations occurring simultaneously in close proximity to the same sensitive receptor;
- Adherence to any time limits imposed on noisy works by the local authority;
- Implement set working hours during the week and at weekends;
- Ensure engines are turned off when possible;
- Should earthworks and construction activities need to be carried out during night-time hours, the oCEMP requires advance notice and details of any night working to provided; and
- Notices and/or communication with nearby residents to inform them of the works and anticipated construction periods, as occupants of nearby sensitive receptors are likely to be more tolerable of the construction if they are provided with timings and duration of high noise generating events.

14.7.4 Application of the above embedded mitigation measures will ensure that construction noise and vibration effects are minimised as far as reasonably practicable.

Vibration from Earthworks and Construction

- BS5228-2 indicates that mitigation might include the use of alternative methods, removal of obstructions, provision of cut-off trenches, reduction of energy input per blow, reduction of resistance to penetration; and
- An oCEMP will be secured by the DCO. As the construction programme and methodologies become more defined, earthworks and construction vibration will be reviewed and a detailed strategy for control would be devised and implemented via the CEMP in accordance with the oCEMP. This would include the measures in BS5228-2, as outlined above, as appropriate.

Embedded Operational Mitigation Measures

Noise from Operational Phase

14.7.5 The assessment of operational noise was undertaken based on worst-case assessment criteria, for example, all plant noise sources operating simultaneously at maximum capacity, 24 hours a day. The results of these assessments have been used to inform the design of development layouts, as follows:

- Where practicable, the distance from the nearest residential receptors to the substation and energy storage facility and onsite transformers and inverters has been maximised;
- Where practicable, noise-emitting equipment has been placed away from sensitive receptors;
- Where required, manufacturer-supplied noise mitigation will be installed;
- Where practicable, quieter items of plant have been selected;
- Where required, noise generating equipment will be enclosed / containerised; and
- Where required, louvres and/or acoustic barriers will be included around inverters and BESS cooling fans.

14.7.6 Green Hill BESS site layout includes a 1.5m high bund with a 2.4m high acoustic barrier on top. The location of these is to the north of the site (i.e. between Green Hill BESS and sensitive receptor BESS001) as shown in more detail on the layouts presented in Volume 2, ES Figures 4.16.1 and 4.16.2 Landscape and Ecology Mitigation Plan BESS Option A and Option B **[ENV01070/APPGH6.4.4.16.1 and 16.2]**. The acoustic barrier will have a minimum surface mass of 12 kg/m^2 and be imperforate (i.e. no gaps or holes).

14.7.7 An Operational Environmental Management Plan (OEMP) will be used during the operational phase of the development. The OEMP will be in accordance with the outline OEMP submitted with the application and secured by a Requirements in the draft DCO.

Embedded Decommissioning Mitigation Measures

14.7.8 An Outline Decommissioning Statement (ODS) **[EN010170/APP/GH7.3]** is included within the DCO application with measures to reduce noise impacts during the decommissioning phase. Decommissioning mitigation measures will be the same as construction mitigation measures with similar best practices measures.

14.8 Assessment of Likely Significant Effects

14.8.1 Taking into account the embedded mitigation measures as detailed in Section 14.7, the potential for the Scheme to generate likely significant effects was assessed using the methodology as detailed in Section 14.4 of this Chapter. In the sections below, the magnitude of impacts and resulting significance of effects

during the construction, operation and decommissioning phases of the scheme are discussed.

Construction Phase Noise

14.8.2 The following main noise-generating activities have been assessed for the ES, as other activities that could take place (e.g. works involving other static or moving plant items) will produce much lower levels of noise and would be insignificant in comparison to the activities assessed.:

- Site preparation, which will likely include the use of excavators; and
- Installation of solar PV panels, which will likely include the use of push press piling rigs and excavators.

14.8.3 Information regarding noise emissions from equipment used along the cable routing during the construction phase has been obtained from Annex C of BS 5228-1. This data has been obtained by field measurements for items of plant in actual use on construction and open sites in the UK. Levels quoted in this standard are based on an average (logarithmic) of measured sound levels, and where appropriate have been derived from more than one model of similarly sized plant. The noise data used in this assessment is presented below along with the assumptions used for this assessment including the percentage of the construction period that each equipment will be operating (% on time).

Table 14.21: Construction Noise Input Data

Equipment	Sound Power Level SWL [dB(A)]	No of Items	% On Time
Diesel Generator	93.1	1	100
Tracked Excavator	102.2	1	20
Dump Truck	102	1	50
Lorry	104.9	1	100
Tower Crane	96.7	1	100
Piling	104.4	1	10
Lump Hammer	96.5	1	25

Noise Modelling and Results

14.8.4 Three-dimensional noise modelling has been undertaken using the data in **Table 14.21**, three-dimensional noise modelling has been undertaken to predict noise levels at a large number of locations both horizontally and vertically. CadnaA (v2024) noise modelling software has been used. This model is based on the ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered.

14.8.5 The following parameters were used in the prediction model:

- A ground absorption factor of G=0.8 (soft ground); and
- Receiver heights of 1.5m (ground floor – living rooms) and 4.0m (first floor - bedrooms).

14.8.6 The noise from construction activities at the Sites has been calculated for the closest sensitive receptors, as defined above, and compared against the relevant criteria from BS5228. The relevant criteria are based on construction only occurring during the weekday day time (07:00-18:00) and Saturdays (08:00-13:00) as it is understood that this is when construction is likely to occur.

Table 14.22: Construction Noise Assessment Table

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
A001	A	64.4	70	28.4	Negligible
A002	A	64.4	70	24.4	Negligible
A003	A	64.4	70	27.8	Negligible
A004	A	49.9	65	29.7	Negligible
A005	A	49.9	65	29.8	Negligible
A006	A	49.9	65	31.8	Negligible
A007	A	49.9	65	30.7	Negligible
A008	A	49.9	65	32.6	Negligible
A009	A	58.6	65	29.6	Negligible
A010	A	49.7	65	33.3	Negligible
A011	A	49.7	65	33.1	Negligible
A012	A	64.4	70	30.1	Negligible
A015	A2	60.3	65	33.2	Negligible
A016	A2	60.3	65	36.8	Negligible
A017	A2	60.3	65	28.4	Negligible
B020	B	43.7	65	31.9	Negligible
B021	B	61.7	65	29.0	Negligible
B022	B	51.9	65	22.0	Negligible
B023	B	51.9	65	30.2	Negligible
B024	B	51.9	65	31.5	Negligible
B025	B	43.7	65	24.9	Negligible
B026	B	43.7	65	26.1	Negligible
B027	B	43.7	65	29.6	Negligible
BESS001	BESS	46.6	65	43.0	Negligible

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
BESS002	BESS	46.6	65	42.6	Negligible
BESS003	BESS	39.9	65	37.0	Negligible
BESS004	BESS	39.9	65	31.9	Negligible
BESS005	BESS	39.9	65	31.3	Negligible
BESS006	BESS	39.9	65	28.9	Negligible
C030	C	57.1	65	39.7	Negligible
C031	C	57.1	65	38.9	Negligible
C032	C	57.1	65	35.2	Negligible
D040	D	57.1	65	40.7	Negligible
D041	D	57.1	65	42.0	Negligible
D042	D	46.7	65	38.4	Negligible
D043	D	52.8	65	36.8	Negligible
D044	D	41.8	65	31.4	Negligible
D045	D	57.1	65	40.6	Negligible
E050	E	41.8	65	35.1	Negligible
E051	E	57.5	65	31.1	Negligible
E052	E	47.1	65	26.7	Negligible
E053	E	53.5	65	23.8	Negligible
E054	E	60.7	65	26.4	Negligible
E055	E	53.5	65	25.1	Negligible
E056	E	60.7	65	26.0	Negligible
E057	E	53.5	65	23.8	Negligible
E058	E	60.7	65	23.0	Negligible
E059	E	53.5	65	28.7	Negligible
E060	E	60.7	65	25.1	Negligible
E061	E	53.5	65	25.6	Negligible
E062	E	43.6	65	26.4	Negligible
E063	E	37.3	65	30.0	Negligible
E064	E	43.6	65	30.9	Negligible
F070	F	54.7	65	29.2	Negligible
F071	F	54.7	65	29.3	Negligible
F072	F	54.7	65	34.7	Negligible

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
F073	F	54.7	65	34.3	Negligible
F074	F	54.7	65	35.7	Negligible
F075	F	54.7	65	34.8	Negligible
F076	F	54.7	65	32.7	Negligible
F077	F	54.7	65	30.1	Negligible
F078	F	43.7	65	32.7	Negligible
F079	F	43.7	65	34.8	Negligible
F080	F	43.7	65	34.4	Negligible
F081	F	55.4	65	34.5	Negligible
F082	F	55.4	65	34.6	Negligible
F083	F	55.4	65	33.4	Negligible
F084	F	55.4	65	37.5	Negligible
G090	G	64.0	70	29.2	Negligible
G091	G	57.5	65	28.9	Negligible
G092	G	63.1	70	28.1	Negligible

Significance of Effects

14.8.7 The assessment results in **Table 14.22** shows that noise levels from the construction activities are below background levels at all receptors. This is therefore below the LOAEL at all sensitive receptors, as per the methodology outlined above. The construction noise is therefore predicted to be Negligible at all receptors. This is an indication of Moderate/Minor effects and **not significant**.

Construction and Decommissioning Traffic Noise

14.8.8 Eighteen hour (18 hr) Annual Average Weekday Traffic (AAWT) traffic flows have been used to model the change in road traffic level as a result of the Scheme.

14.8.9 Traffic flows have been taken from Chapter 13: Transport and Access **[EN010170/APP/GH6.2.13]**. The routes are presented in Figures 13.6 to 13.9 of Chapter 13: Transport and Access.

14.8.10 The traffic flows were provided for the '2028 Future Baseline' scenario i.e. the calculated likely traffic on those roads in the absence of the Scheme. This is referred to as the 'Do Minimum' scenario below.

14.8.11 Traffic flows were also provided for the '2028 Future Baseline + Green Hill Development' scenario i.e. the calculated likely traffic on those roads with the Scheme. This is referred to as the 'Do Something' Scenario below.

14.8.12 A quantitative assessment has been undertaken to establish the change in road traffic noise level between these scenarios (i.e. the change of traffic noise level due to increased vehicle movements as a result of the Scheme). The predicted noise level and change in average daytime level is shown in **Table 14.23**.

14.8.13 The assessment of construction traffic noise for each site is presented below.

Table 14.23: Traffic Noise Assessment Table

Receptor Ref	Associated Green Hill Site	Representative Noise Level L_{Aeq}, dB	Predicted Construction Traffic Noise		
			Do Minimum (L_{Aeq}, dB)	Do Something (L_{Aeq}, dB)	Change in Noise Level (dB)
A001	A	64.4	48.8	48.9	0.0
A002	A	64.4	56.9	56.9	0.0
A003	A	64.4	54.1	54.1	0.0
A004	A	57.1	54.1	54.1	0.0
A005	A	57.1	49.3	49.4	0.0
A006	A	57.1	63.5	63.7	0.2
A007	A	57.1	54.6	54.6	0.0
A008	A	57.1	67.4	67.4	0.0
A009	A	58.6	63.1	63.1	0.0
A010	A	49.7	55.6	55.7	0.1
A011	A	49.7	58.7	58.8	0.1
A012	A	64.4	58.4	58.4	0.0
A015	A2	60.3	79.2	79.2	0.0
A016	A2	60.3	65.5	65.5	0.0
A017	A2	60.3	51.6	51.6	0.0
B020	B	43.7	27.9	27.9	0.0
B021	B	61.7	34.8	34.8	0.0
B022	B	51.9	38.6	38.6	0.0
B023	B	51.9	36.3	36.3	0.0
B024	B	51.9	36.7	36.7	0.0
B025	B	43.7	23.4	23.4	0.0
B026	B	43.7	24.4	24.4	0.0
B027	B	43.7	26.6	26.6	0.0
C030	C	57.1	46.1	46.4	0.1
C031	C	47.6	47.4	47.7	0.2
C032	C	53.5	56.8	57.1	0.2

Receptor Ref	Associated Green Hill Site	Representative Noise Level L_{Aeq}, dB	Predicted Construction Traffic Noise		
			Do Minimum (L_{Aeq}, dB)	Do Something (L_{Aeq}, dB)	Change in Noise Level (dB)
D040	D	46.7	58.4	58.8	0.4
D041	D	53.5	54.8	55.2	0.2
D042	D	46.7	56.4	56.7	0.3
D043	D	52.8	55.4	55.7	0.2
D044	D	41.8	57.1	57.4	0.3
D045	D	52.8	54.5	54.7	0.2
E050	E	41.8	55.8	56.1	0.3
E051	E	57.5	48.1	48.4	0.0
E052	E	47.1	50.2	50.5	0.2
E053	E	53.5	46.9	46.9	0.0
E054	E	60.7	49.8	49.8	0.0
E055	E	53.5	69.1	69.1	0.0
E056	E	60.7	70.6	70.7	0.1
E057	E	53.5	55.6	55.6	0.0
E058	E	60.7	57.5	57.5	0.0
E059	E	53.5	69.1	69.1	0.0
E060	E	60.7	70.8	70.8	0.0
E061	E	53.5	56.9	56.9	0.0
E062	E	43.6	58.4	58.4	0.0
E063	E	37.3	55.5	55.8	0.3
E064	E	43.6	53.5	53.9	0.4
F070	F	54.7	54.5	54.5	0.0
F071	F	54.7	63.6	63.6	0.0
F072	F	54.7	43.1	43.1	0.0
F073	F	54.7	49.5	49.6	0.1
F074	F	54.7	65.2	65.2	0.0
F075	F	54.7	64.9	64.9	0.0
F076	F	54.7	54.2	54.2	0.0
F077	F	54.7	72.2	72.2	0.0
F078	F	43.7	47.1	47.1	0.0
F079	F	43.7	47.7	47.7	0.0

Receptor Ref	Associated Green Hill Site	Representative Noise Level L_{Aeq}, dB	Predicted Construction Traffic Noise		
			Do Minimum (L_{Aeq}, dB)	Do Something (L_{Aeq}, dB)	Change in Noise Level (dB)
F080	F	43.7	47.7	47.8	0.0
F081	F	55.4	47.2	47.2	0.0
F082	F	55.4	58.2	58.3	0.1
F083	F	55.4	59.3	59.3	0.0
F084	F	55.4	55.0	55.0	0.0
G090	G	64.0	28.0	28.0	0.0
G091	G	57.5	16.0	16.0	0.0
G092	G	63.1	20.5	20.5	0.0

Significance of Effects

14.8.14 **Table 14.23** shows that the maximum change in noise level from construction noise is predicted to be less than 1 dB for all sensitive receptors. This is equivalent to a Moderate/Minor magnitude of impact. Many sensitive receptors are also calculated to experience no change in traffic noise as a result of the construction traffic (i.e. ≤ 0 dB change), which is equivalent to a neutral magnitude of impact.

14.8.15 The Negligible or Neutral magnitude of impact, calculated for all sensitive receptors equates to a Moderate/Minor or Neutral adverse effect, which is **not significant**.

Noise from Construction Activities along the Cable Route Corridor

14.8.16 The construction activities for the Cable Route Corridor will include the following activities:

- Trenching and cable duct installation;
- Cable pulling and jointing;
- Horizontal Directional Drilling (HDD); and
- Installation of the cable route, which will likely include the use of excavators and dozers.

14.8.17 Due to the type of equipment used during the construction and enabling works, it is considered that trenching and cable duct installation activities are likely to cause the greatest impact in terms of noise and vibration along the Cable Route Corridor during construction. For this reason, noise and vibration impacts for the construction of the Cable Route Corridor have been assessed based on the activities associated with trenching and cable duct installation as a worst-case scenario.

14.8.18 Further key information on these activities is detailed as follows:

- The trenching works are linear and transient in nature, whereby trench excavation, duct installation and backfilling could occur simultaneously along a 100m section at a time; and
- Along roads, breaking of the road surface is required to dig the trenches, whereas over open ground, no breaking is required.

14.8.19 For the construction of the cables within the Cable Route Corridor and specifically the activities associated with trenching, the following items of vibration inducing equipment have been considered:

- A vibratory roller for re-surfacing following trenching works. It is assumed a small ride-on-roller would be used and this activity would only take place where the Cable Route Corridor requires the removal of the existing road surface.

14.8.20 The main noise sources from construction activities along the cable routing are separated into two categories depending on the surface material of the ground (i.e. excavation on open ground, or excavation on roads) as the equipment and activities will vary between these scenarios.

14.8.21 Information regarding noise emissions from equipment used along the cable routing during the construction phase has been obtained from Annex C of BS 5228-1. This data has been obtained by field measurements for items of plant in actual use on construction and open sites in the UK. Levels quoted in this standard are based on an average (logarithmic) of measured sound levels, and where appropriate have been derived from more than one model of similarly sized plant.The noise data used in this assessment is presented below along with the assumptions used for this assessment including the percentage of the construction period that each equipment will be operating (% on time).

Table 14.24: Cable Routing Corridor Construction Noise Input Data

Activity	Equipment	Sound Power Level SWL [dB(A)]	No of Items	% On Time
Excavation And Duct Installation Along Roads				
Breaking road surface	Hand-Held Circular Saw	115	1	5
	Mini Excavator with Hydraulic Breaker	111	1	10
	Road Breaker (Hand-Held Pneumatic)	110	1	10
Generator	Diesel Generator	84	1	100
Trenching	Mini Tracked Excavator	93	1	10
Backfilling	Dump Truck	107	1	20
Excavation On Open Ground				
Trenching	Mini Tracked Excavator	93	1	10

Activity	Equipment	Sound Power Level SWL [dB(A)]	No of Items	% On Time
	Dumper	84	1	40
Backfilling	Dump Truck	107	1	20

Noise Modelling and Results

14.8.22 Three-dimensional noise modelling has been undertaken based on the data in **Table 14.24**, three-dimensional noise modelling has been undertaken to predict noise levels at a large number of locations both horizontally and vertically. CadnaA (v2024) noise modelling software has been used. This model is based on the ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered.

14.8.23 The following parameters were used in the prediction model:

- All sources have been modelled at 1m;
- A ground absorption factor of G=0.8 (soft ground); and
- Receiver heights of 1.5m (ground floor – living rooms) and 4.0m (first floor - bedrooms).

14.8.24 The noise from construction activities along the cable route corridor has been calculated for the sensitive receptors closest to the corridor, as defined above, and compared against the relevant criteria from BS5228. The relevant criteria are based on construction only occurring during the weekday day time (07:00-18:00) and Saturdays (08:00-13:00) as it is understood that this is when construction is likely to occur.

Table 14.25: Construction Noise along Cable Route Corridor Assessment Table

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
A004	A	49.9	65	37.4	Negligible
A016	A2	63.0	70	30.0	Negligible
A017	A2	63.0	70	38.9	Negligible
B021	B	62.5	70	40.1	Negligible
BESS001	BESS	46.6	65	42.3	Negligible
BESS002	BESS	46.6	65	58.2	Low
BESS003	BESS	39.9	65	42.7	Low

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
C030	C	57.1	65	49.9	Negligible
C031	C	57.1	65	38.9	Negligible
C032	C	57.1	65	35.2	Negligible
CR01	Cable	63.0	70	60.9	Negligible
CR02	Cable	62.5	70	42.7	Negligible
CR03	Cable	62.5	70	43.3	Negligible
CR04	Cable	57.1	65	34.5	Negligible
CR05	Cable	62.4	65	50.3	Negligible
CR06	Cable	62.4	65	45.4	Negligible
CR07	Cable	62.4	65	47.1	Negligible
CR08	Cable	62.4	65	41.4	Negligible
CR09	Cable	48.3	65	45.1	Negligible
CR10	Cable	42.5	65	37.6	Negligible
CR11	Cable	63.5	70	27.3	Negligible
CR12	Cable	63.0	70	47.0	Negligible
D042	D	53.6	65	39.0	Negligible
D045	D	57.1	65	40.6	Negligible
E051	E	62.0	65	45.5	Negligible
F073	F	56.3	65	45.1	Negligible
F078	F	49.4	65	29.0	Negligible
F079	F	49.4	65	27.6	Negligible
F083	F	57.0	65	38.1	Negligible
G090	G	65.4	70	38.0	Negligible

Significance of Effects

14.8.25 The assessment results in **Table 14.25** shows that noise levels from the construction activities along the cable route are below background levels at all receptors except BESS002 and BESS003 where construction noise is above background levels but below the BS5228 threshold. This is therefore below the SOAEL at all the above receptors, and below the LOAEL at all but two of the receptors, as per the methodology outlined above. The construction noise is therefore predicted to be Negligible at all receptors except for BESS002 and BESS003 where it is predicted to be a Low magnitude of impact. This is an indication of Moderate/Minor and Moderate effects and **not significant**.

Construction Vibration

14.8.26 BS 5228-2 refers to the Transport Research Laboratory (TRL) (Ref 14.22) report 429 'Groundborne Vibration Caused by Mechanised Construction Works' (2000). Figure 50 of the TRL report indicates that ground vibration from miscellaneous vehicle operations on construction sites (including scrapers, rollers, dumpers, breakers, dozers and HGVs) are in the region of 1 mm/s PPV at approximately 10m, decreasing to the region of 0.1 mm/s PPV at approximately 50m.

14.8.27 Actual vibration levels from works are dependent on a number of factors including ground conditions, plant or vehicle size, the nature of the works (in particular piling methods), the speed of HGV movements and the quality of surface of haul or other temporary roads. Vibration from vehicles on the access roads will be minimised through regular maintenance of access route road surfaces and reduced HGV speeds on access routes, as will be detailed in the oCTMP and can be secured by condition, if required.

14.8.28 BS 5228-2 indicates that impact or vibratory piling activities generally only generate vibration impacts when they are located less than 20m from sensitive locations. The impact depends on the type of piling, ground conditions, and receptor distance. Vibration from smaller scale push piling techniques, which are proposed be used for the installation of solar module mounting structures, are generally limited to 1mm/s for distances up to 10m.

14.8.29 It is considered that any periods of construction vibration experienced at a sensitive receptor would be unlikely to exceed one month, with no permanent residual effect once works are completed. As such, any construction vibration effects are considered to be short-term in duration.

14.8.30 Based on the distances between sensitive receptors and locations where heavy ground works (excavation, push piling) may take place, it is considered that vibration from construction works experienced at sensitive receptors will be below the SOAEL for the majority of receptors, with some receptors closest (less than 10m) to the works being above the SOAEL but below 10 mm/s PPV for short periods of time, as per the criteria in **Table 14.7** and **Table 14.8** and as such is equivalent to a low magnitude of impact for most receptors and a medium magnitude of impact for those closest to the works for short periods of time. For receptors of high sensitivity this would be equivalent to a moderate effect for most receptors which is **not significant** and a moderate/major effect for the receptors within 10m from the works for a short period of time which is a likely **significant effect**.

14.8.31 BS5228-2 refers to levels above the SOAEL but below 10 mm/s as "*likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.*". It is therefore considered that the measures contained in the CEMP (including prior warning and communication of the short time period they are likely to experience these levels) are sufficient to reduce the overall magnitude of impact to below the SOAEL.

14.8.32 Therefore, once considering the embedded mitigation (CEMP and BPM) this would be equivalent to a moderate effect for all receptors which is **not significant**.

14.8.33 Vibration levels from activities (i.e. onsite works and construction HGV traffic) are anticipated to be below the SOAEL as per the criteria in **Table 14.7** and **Table 14.8** and as such is equivalent to a low magnitude of impact. This is equivalent to a moderate effect which is **not significant**.

Operational Phase

Noise from Proposed Solar and BESS Equipment

14.8.34 The key sources of noise from the operational phase of the Scheme are the inverters and transformers serving the solar panels, the substation, and the inverters serving the Battery Energy Storage units

Inverters and Transformers (Serving the Solar Panels)

14.8.35 It is understood that the inverters and transformers serving the solar panels will be housed in conversion units located around the Sites.

14.8.36 The manufacturer's data does not contain octave-band data for these units; therefore, a typical frequency spectrum has been applied. The octave-band source data used within the modelling is presented in **Table 14.26** and is derived from data for a similar unit manufactured by *SMA Solar Technology AG* (SMA).

Table 14.26: Conversion Unit Input Data

Unit	Sound Power Level SWL [dB(A)]	Octave Band Centre Frequency Hz							
		63	125	250	500	1000	2000	4000	8000
SMA Conversion Unit	90	53	64	72	77	78	76	85	81

Solar PV Panels

14.8.37 Green Hill A to Green Hill G will be serviced by tracker solar panels or fixed solar panels. The tracker unit model used for purposes of this assessment is the Soltec Tracker which has a Sound Pressure Level of 50.1 dB L_{Aeq} at 1m distance. Fixed solar panels do not have any moving parts and therefore have no noise emission associated with them.

Substation

The primary noise associated with the substations is the transformers. There are different types of substations required across the Scheme: 33kV, 400kV and 132kV. Transformers will be required at the 400kV and 132kV substations. The Applicant's electrical engineering consultants has advised that all substation transformer units will operate with a Sound Power Level of 88 dB and that the following number of transformers will be present on each site: Green Hill A: 2,

Green Hill B: 1, Green Hill C: 5, Green Hill E: 2, Green Hill F: 2, Green Hill G: 2, Green Hill BESS: 5.

14.8.38 No octave-band data is available for the substation equipment, and therefore, a typical spectrum has been applied and adjusted to a level of 88 dB.

Table 14.27: Transformer Input Data

Unit	Sound Power Level SWL [dB(A)]	Octave Band Centre Frequency Hz							
		63	125	250	500	1000	2000	4000	8000
Transformer	88	88	94	93	86	80	62	60	54

Inverters and Transformers (Serving the BESS)

14.8.39 The Scheme will accommodate a Battery Energy Storage System (BESS).

14.8.40 The main noise source from the BESS units are the inverters that service them. The octave-band source data used within the modelling is derived from manufacturer data and is presented in **Table 14.28**.

Table 14.28: BESS Storage Inverter Input Data

Unit	Sound Power Level SWL [dB]	Octave Band Centre Frequency Hz							
		63	125	250	500	1000	2000	4000	8000
SMA inverter with silencer (4600 kVA)	83.4	60.1	66.8	72.1	69.2	68.2	72.8	81.0	75.5

Rating Corrections

14.8.41 As per Step 3 of the BS 4142 methodology outlined in 14.4.19, corrections should be applied to the absolute noise level to account for any audible acoustic features (e.g. tonality, impulsivity, intermittency etc.) at the location of the noise sensitive receptors which have the potential to increase the level of effect at nearby properties.

14.8.42 The character of the sound from the Scheme will generally be low level and constant, with no rapid change in level or character of noise. Therefore, no correction for impulsivity is considered necessary.

14.8.43 It is considered that the plant will not have identifiable on/off conditions, with many items operating at gradually varying loads relative to the intensity of light incident upon the solar panels and the air temperature. Therefore, no correction for intermittency has been applied.

14.8.44 Similarly, based on manufacturer data for the key plant items, tonal elements are also not likely to be perceptible at the nearest noise sensitive receptors. As such, a no correction for tonal characteristics is considered necessary.

Noise Modelling and Results

14.8.45 Three-dimensional noise modelling has been undertaken based on the source data to predict noise levels at a large number of locations both horizontally and vertically. CadnaA (v2024) noise modelling software has been used. This model is based on the ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered.

14.8.46 The following parameters were used in the prediction model:

- A ground absorption factor of G=0.8 (soft ground); and
- Receiver heights of 1.5m (ground floor – living rooms) and 4.0m (first floor - bedrooms).

14.8.47 Green Hill A, Green Hill A.2, Green Hill B, Green Hill D, Green Hill E, Green Hill F and Green Hill G have been modelled as solar array sites. Green Hill BESS has been modelled as a battery energy storage center in line with the data above for both option A and option B layouts, the 'worst-case' (i.e. highest noise level) results presented for each sensitive receptor. Similarly, for Green Hill C, both the solar panel arrays and BESS option have been modelled with the 'worst-case' (i.e. highest noise level) results presented for each sensitive receptor.

14.8.48 Calculations have been based on the BESS Inverters and Substation Transformers operating simultaneously at full capacity, which represents worst-case conditions during the peak daytime and night-time periods. The conversion units and trackers will only operate at full capacity during the daytime hours; however, they have been included in the night-time assessment to represent a worst-case scenario to cover the early morning hours during the summer months.

14.8.49 It should be noted that the above assessment incorporates a number of worst-case assumptions, including all noise sources being fully operational throughout the night-time period. Many of the noise sources will be dependent on the level of sunlight, and therefore, load, and batteries are likely only to be used for electricity export during peak demand periods. As such, the night-time noise levels are likely to be substantially lower in practice.

Table 14.29: Operational Noise Assessment Table

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
A001	A	Daytime (07:00 – 23:00)	35	24	-11
		Night-time (23:00 – 07:00)	35	27	-8
A002	A	Daytime (07:00 – 23:00)	35	20	-15

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
		Night-time (23:00 – 07:00)	35	22	-13
A003	A	Daytime (07:00 – 23:00)	35	21	-14
		Night-time (23:00 – 07:00)	35	23	-12
A004	A	Daytime (07:00 – 23:00)	42	21	-21
		Night-time (23:00 – 07:00)	38	22	-16
A005	A	Daytime (07:00 – 23:00)	42	20	-22
		Night-time (23:00 – 07:00)	38	22	-16
A006	A	Daytime (07:00 – 23:00)	42	24	-18
		Night-time (23:00 – 07:00)	38	25	-13
A007	A	Daytime (07:00 – 23:00)	42	20	-22
		Night-time (23:00 – 07:00)	38	21	-17
A008	A	Daytime (07:00 – 23:00)	42	23	-19
		Night-time (23:00 – 07:00)	38	24	-14

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
A009	A	Daytime (07:00 – 23:00)	35	20	-15
		Night-time (23:00 – 07:00)	35	22	-13
A010	A	Daytime (07:00 – 23:00)	42	34	-8
		Night-time (23:00 – 07:00)	36	35	-1
A011	A	Daytime (07:00 – 23:00)	42	34	-8
		Night-time (23:00 – 07:00)	36	35	-1
A012	A	Daytime (07:00 – 23:00)	35	24	-11
		Night-time (23:00 – 07:00)	35	25	-10
A015	A.2	Daytime (07:00 – 23:00)	35	20	-15
		Night-time (23:00 – 07:00)	35	21	-14
A016	A.2	Daytime (07:00 – 23:00)	35	23	-12
		Night-time (23:00 – 07:00)	35	26	-9
A017	A.2	Daytime (07:00 – 23:00)	35	20	-15

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
		Night-time (23:00 – 07:00)	35	22	-13
B020	B	Daytime (07:00 – 23:00)	35	28	-7
		Night-time (23:00 – 07:00)	36	29	-7
B021	B	Daytime (07:00 – 23:00)	44	18	-26
		Night-time (23:00 – 07:00)	35	21	-14
B022	B	Daytime (07:00 – 23:00)	35	9	-26
		Night-time (23:00 – 07:00)	35	14	-21
B023	B	Daytime (07:00 – 23:00)	35	27	-8
		Night-time (23:00 – 07:00)	35	28	-7
B024	B	Daytime (07:00 – 23:00)	35	21	-14
		Night-time (23:00 – 07:00)	35	22	-13
B025	B	Daytime (07:00 – 23:00)	35	18	-17
		Night-time (23:00 – 07:00)	36	19	-17

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
B026	B	Daytime (07:00 – 23:00)	35	21	-14
		Night-time (23:00 – 07:00)	36	22	-14
B027	B	Daytime (07:00 – 23:00)	35	28	-7
		Night-time (23:00 – 07:00)	36	28	-8
C030	C	Daytime (07:00 – 23:00)	35	32	-3
		Night-time (23:00 – 07:00)	35	35	0
C031	C	Daytime (07:00 – 23:00)	35	31	-4
		Night-time (23:00 – 07:00)	35	34	-1
C032	C	Daytime (07:00 – 23:00)	42	20	-22
		Night-time (23:00 – 07:00)	36	22	-14
D040	D	Daytime (07:00 – 23:00)	35	27	-8
		Night-time (23:00 – 07:00)	35	29	-6
D041	D	Daytime (07:00 – 23:00)	35	28	-7

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
		Night-time (23:00 – 07:00)	35	30	-5
D042	D	Daytime (07:00 – 23:00)	36	23	-13
		Night-time (23:00 – 07:00)	35	27	-8
D043	D	Daytime (07:00 – 23:00)	36	22	-14
		Night-time (23:00 – 07:00)	35	25	-10
D044	D	Daytime (07:00 – 23:00)	35	21	-14
		Night-time (23:00 – 07:00)	35	22	-13
D045	D	Daytime (07:00 – 23:00)	35	28	-7
		Night-time (23:00 – 07:00)	35	31	-4
E050	E	Daytime (07:00 – 23:00)	35	26	-9
		Night-time (23:00 – 07:00)	37	28	-9
E051	E	Daytime (07:00 – 23:00)	35	30	-5
		Night-time (23:00 – 07:00)	37	31	-6

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
E052	E	Daytime (07:00 – 23:00)	35	28	-7
		Night-time (23:00 – 07:00)	37	30	-7
E053	E	Daytime (07:00 – 23:00)	41	15	-26
		Night-time (23:00 – 07:00)	37	17	-20
E054	E	Daytime (07:00 – 23:00)	41	20	-21
		Night-time (23:00 – 07:00)	37	20	-17
E055	E	Daytime (07:00 – 23:00)	41	13	-28
		Night-time (23:00 – 07:00)	37	18	-19
E056	E	Daytime (07:00 – 23:00)	41	20	-21
		Night-time (23:00 – 07:00)	37	21	-16
E057	E	Daytime (07:00 – 23:00)	41	15	-26
		Night-time (23:00 – 07:00)	37	18	-19
E058	E	Daytime (07:00 – 23:00)	39	23	-16

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
		Night-time (23:00 – 07:00)	35	25	-10
E059	E	Daytime (07:00 – 23:00)	39	27	-12
		Night-time (23:00 – 07:00)	35	30	-5
E060	E	Daytime (07:00 – 23:00)	35	20	-15
		Night-time (23:00 – 07:00)	35	21	-14
E061	E	Daytime (07:00 – 23:00)	35	19	-16
		Night-time (23:00 – 07:00)	35	22	-13
E062	E	Daytime (07:00 – 23:00)	35	25	-10
		Night-time (23:00 – 07:00)	35	26	-9
E063	E	Daytime (07:00 – 23:00)	35	24	-11
		Night-time (23:00 – 07:00)	35	25	-10
E064	E	Daytime (07:00 – 23:00)	35	26	-9
		Night-time (23:00 – 07:00)	35	27	-8

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
F070	F	Daytime (07:00 – 23:00)	38	18	-20
		Night-time (23:00 – 07:00)	35	18	-17
F071	F	Daytime (07:00 – 23:00)	38	18	-20
		Night-time (23:00 – 07:00)	35	20	-15
F072	F	Daytime (07:00 – 23:00)	38	29	-9
		Night-time (23:00 – 07:00)	35	30	-5
F073	F	Daytime (07:00 – 23:00)	38	30	-8
		Night-time (23:00 – 07:00)	35	32	-3
F074	F	Daytime (07:00 – 23:00)	38	25	-13
		Night-time (23:00 – 07:00)	35	27	-8
F075	F	Daytime (07:00 – 23:00)	38	24	-14
		Night-time (23:00 – 07:00)	35	26	-9
F076	F	Daytime (07:00 – 23:00)	38	18	-20

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
		Night-time (23:00 – 07:00)	35	22	-13
F077	F	Daytime (07:00 – 23:00)	38	22	-16
		Night-time (23:00 – 07:00)	35	25	-10
F078	F	Daytime (07:00 – 23:00)	35	22	-13
		Night-time (23:00 – 07:00)	35	23	-12
F079	F	Daytime (07:00 – 23:00)	35	29	-6
		Night-time (23:00 – 07:00)	35	29	-6
F080	F	Daytime (07:00 – 23:00)	35	25	-10
		Night-time (23:00 – 07:00)	35	28	-7
F081	F	Daytime (07:00 – 23:00)	36	26	-10
		Night-time (23:00 – 07:00)	35	28	-7
F082	F	Daytime (07:00 – 23:00)	36	24	-12
		Night-time (23:00 – 07:00)	35	26	-9

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
F083	F	Daytime (07:00 – 23:00)	36	19	-17
		Night-time (23:00 – 07:00)	35	20	-15
F084	F	Daytime (07:00 – 23:00)	36	26	-10
		Night-time (23:00 – 07:00)	35	26	-9
G090	G	Daytime (07:00 – 23:00)	35	27	-8
		Night-time (23:00 – 07:00)	35	29	-6
G091	G	Daytime (07:00 – 23:00)	42	22	-20
		Night-time (23:00 – 07:00)	35	24	-11
G092	G	Daytime (07:00 – 23:00)	42	23	-19
		Night-time (23:00 – 07:00)	35	23	-12
BESS001	BESS	Daytime (07:00 – 23:00)	39	33	-6
		Night-time (23:00 – 07:00)	35	34	-1
BESS002	BESS	Daytime (07:00 – 23:00)	39	31	-8

Receptor Ref	Associated Green Hill Site	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Operational Noise (L_{Aeq}, dB)	Difference for BS4142 assessment (dB)
		Night-time (23:00 – 07:00)	35	32	-3
BESS003	BESS	Daytime (07:00 – 23:00)	36	31	-5
		Night-time (23:00 – 07:00)	35	32	-3
BESS004	BESS	Daytime (07:00 – 23:00)	36	24	-12
		Night-time (23:00 – 07:00)	35	25	-10
BESS005	BESS	Daytime (07:00 – 23:00)	36	21	-15
		Night-time (23:00 – 07:00)	35	23	-12
BESS006	BESS	Daytime (07:00 – 23:00)	42	20	-22
		Night-time (23:00 – 07:00)	38	21	-17

* The Representative Noise Level L_{A90}, dB given in this column is the measured background noise level in the relevant period, representative of the sensitive receptor location, except where the background noise level is below 35 dB L_{A90}, and thus 35 dB has been used as the relevant criteria from which to compare the impact, in line with the methodology and criteria set out in 14.4.18 to 14.4.32.

Significance of Effects

14.8.50 The assessment results shown in **Table 14.29** show that noise levels from the Scheme are predicted to be no higher than the existing background noise levels at the closest sensitive receptors during the day and night-time, which is below NOAEL and thus equivalent to a negligible magnitude of impact. This is an indication of a Moderate/minor effect and **not significant.**

14.8.51 In addition, as the measured existing background noise levels are below 30 dB in some locations, which would fall within the very low category for background

sound levels as defined in Sections 14.4.21 to 14.4.24, it is therefore considered appropriate and best practice for absolute noise levels to be considered for the assessment of magnitude of impact at these locations. The relevant criteria are summarised in **Table 14.10** and are based on the internal noise levels within habitable rooms of the sensitive receptors (e.g. bedroom / living room).

14.8.52 All the predicted operational noise levels in **Table 14.29** are below 35 dB $L_{Aeq,T}$. To calculate the internal noise levels at all receptors, a typical 'worst-case' scenario of partially open windows has been assessed. A typical reduction across a façade with a partially open window is 10 – 15 dB, depending on many factors (BS8233 refers to 15dB reduction). Therefore, to ensure a worst-case' assessment, the minimum 10dB reduction has been applied as the sound reduction across a partition with a partially open window. Based on the data above, the resulting internal noise level will all be below the relevant internal noise level criteria as summarised in **Table 14.10**. Therefore, this would result in a Negligible magnitude of impact and supports the conclusion of **not significant** effects.

Replacement of Batteries and Panels

Noise from Operational Activities relating to the Replacement of Batteries and Solar Panels

14.8.53 As the noise from operational activities relating to replacement of batteries and panels is a periodic and temporary noise source (large scale replacement of solar panels is once over the lifetime of the operation period and BESS units replacement is max every 10 years), the noise has been assessed against the construction thresholds in BS5228, as detailed in Sections 14.4.10 to 14.4.12.1.

14.8.54 The activities include: shutting down and isolating the components, disconnecting panels from electrical systems, removing mounting hardware, dismantling old panels, installing new mounting structures or modifying existing ones, placement, securement and connection of new solar panels, installation of batteries, racking, connections and grounding, electrical, functional and performance testing, grid synchronisation and power output validation, system monitoring setup and software updates, removal of waste and old components.

14.8.55 The above activities that have the potential to generate significant noise levels have been included in a 3D noise model to calculate the potential noise levels from these activities at the nearby noise sensitive receptors to the Sites.

14.8.56 Information regarding noise emissions from equipment likely to be used for these activities has been obtained from Annex C of BS 5228-1. This data has been obtained by field measurements for items of plant in actual use on construction and open sites in the UK. Levels quoted in this standard are based on an average (logarithmic) of measured sound levels, and where appropriate have been derived from more than one model of similarly sized plant. The noise data used in this assessment is presented below assuming that all equipment will be operating for 100% of the assessment period. The activities not mentioned in **Table 14.30** will be insignificant in comparison (i.e. negligible increase in noise levels) and are thus not assessed.

Table 14.30: Replacement of Batteries and Panels Noise Input Data

Activity	Equipment	Sound Pressure Level SPL @10m, dB $L_{Aeq,T}$
Removal of hardware and equipment	Core drill	85
Dismantling, handling and moving panels and equipment	Tracked mobile crane	67
Installing or modifying mounting structures	Lump hammer	69
Placement and securement of new solar panels	Handheld welder	73
Installation of batteries, racking, connections and grounding	Handheld welder	73
Removal of waste and old components	Tractor (towing equipment)	80

Noise Modelling and Results

14.8.57 Three-dimensional noise modelling has been undertaken based on the source data to predict noise levels at a large number of locations both horizontally and vertically. CadnaA (v2024) noise modelling software has been used. This model is based on the ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered.

14.8.58 The following parameters were used in the prediction model:

- Sources have typically been modelled at 1m, with larger equipment (i.e. mobile crane and tractor) at 1.5m high;
- A ground absorption factor of G=0.8 (soft ground); and
- Receiver heights of 1.5m (ground floor – living rooms) and 4.0m (first floor - bedrooms).

14.8.59 The noise levels from the replacement activities have been calculated for the receptors closest to each site and compared against the relevant criteria from BS5228. The relevant criteria have been based on these activities only occurring during the weekday daytime (07:00-18:00) or Saturday daytime (08:00-13:00) as this is understood to be the likely periods of construction.

Table 14.31: Replacement of Batteries and Panels Assessment Table

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
A001	A	64.4	70	45.4	Negligible
A002	A	64.4	70	38.7	Negligible
A003	A	64.4	70	41.3	Negligible
A004	A	49.9	65	36.9	Negligible
A005	A	49.9	65	39.2	Negligible
A006	A	49.9	65	40.5	Negligible
A007	A	49.9	65	38.6	Negligible
A008	A	49.9	65	39.4	Negligible
A009	A	58.6	65	39.8	Negligible
A010	A	49.7	65	58.1	Low
A011	A	49.7	65	59.5	Low
A012	A	64.4	70	40	Negligible
A015	A2	60.3	65	52.6	Negligible
A016	A2	60.3	65	43.2	Negligible
A017	A2	60.3	65	38.1	Negligible
B020	B	43.7	65	46.8	Low
B021	B	61.7	65	37	Negligible
B022	B	51.9	65	29.7	Negligible
B023	B	51.9	65	41.2	Negligible
B024	B	51.9	65	39.4	Negligible
B025	B	43.7	65	35.4	Negligible
B026	B	43.7	65	38.4	Negligible
B027	B	43.7	65	47.3	Low
BESS001	BESS	46.6	65	45.2	Negligible
BESS002	BESS	46.6	65	43.2	Negligible
BESS003	BESS	39.9	65	46.5	Low
BESS004	BESS	39.9	65	40.0	Low
BESS005	BESS	39.9	65	39.1	Negligible
BESS006	BESS	39.9	65	34.4	Negligible
C030	C	57.1	65	50.4	Negligible
C031	C	57.1	65	57.2	Low

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
C032	C	57.1	65	37.4	Negligible
D040	D	57.1	65	56.5	Negligible
D041	D	57.1	65	58.1	Low
D042	D	46.7	65	60.1	Low
D043	D	52.8	65	55.3	Low
D044	D	41.8	65	38.7	Negligible
D045	D	57.1	65	50.8	Negligible
E050	E	41.8	65	40.1	Negligible
E051	E	57.5	65	53.9	Negligible
E052	E	47.1	65	57.6	Low
E053	E	53.5	65	33.8	Negligible
E054	E	60.7	65	36.3	Negligible
E055	E	53.5	65	34.5	Negligible
E056	E	60.7	65	35.3	Negligible
E057	E	53.5	65	34.8	Negligible
E058	E	60.7	65	46.8	Negligible
E059	E	53.5	65	59.2	Low
E060	E	60.7	65	40	Negligible
E061	E	53.5	65	42.4	Negligible
E062	E	43.6	65	50.6	Low
E063	E	37.3	65	39.4	Low
E064	E	43.6	65	47.5	Low
F070	F	54.7	65	39.8	Negligible
F071	F	54.7	65	41.5	Negligible
F072	F	54.7	65	58.4	Low
F073	F	54.7	65	57.4	Low
F074	F	54.7	65	60.1	Low
F075	F	54.7	65	57.1	Low
F076	F	54.7	65	40.3	Negligible
F077	F	54.7	65	45.8	Negligible
F078	F	43.7	65	42.1	Negligible
F079	F	43.7	65	56.2	Low

Receptor Ref	Associated Green Hill Site	Ambient Noise Level $L_{Aeq,T}$, dB	BS5228 Threshold Level, dB	Predicted Construction Noise L_{Aeq}, dB	Magnitude of Impact
F080	F	43.7	65	54.8	Low
F081	F	55.4	65	42	Negligible
F082	F	55.4	65	44.9	Negligible
F083	F	55.4	65	44.2	Negligible
F084	F	55.4	65	43.6	Negligible
G090	G	64.0	70	39.5	Negligible
G091	G	57.5	65	58	Low
G092	G	63.1	70	35.1	Negligible

Significance of Effects

14.8.60 The assessment result shown in **Table 14.31** shows that noise levels from the replacement of batteries and panels are either below background levels or above background levels but below the BS5228 threshold. This is therefore below the SOAEL or below the LOAEL, respectively, as per the methodology outlined above. The construction noise is therefore predicted to be either Negligible or a Low magnitude of impact. This is an indication of Moderate/Minor and Moderate effects and **not significant**.

Decommissioning Phase

14.8.61 Decommissioning will result in very similar noise sources to construction with similar or lower effects.

Significance of Effects

14.8.62 Typical decommissioning noise levels across the overall duration of the decommissioning programme will likely be limited to a low magnitude impact. For receptors of high sensitivity this equates to a moderate adverse effect which is **not significant**.

14.9 Additional Mitigation Measures

14.9.1 No additional mitigation measures for the Scheme are presented.

14.10 Residual Effects

14.10.1 This section summarises the residual effects of the Scheme on noise and vibration and receptors following the adoption of embedded and additional mitigation.

14.10.2 The construction noise levels are predicted to be within the relevant noise threshold level for all receptors along the proposed Scheme, except for the calculated increase in traffic noise at two sensitive receptors. Therefore, the likely

significant effects found for construction noise are all not significant except for two sensitive receptors, where the effects were found to be significant..

14.10.3 Construction activity on the Sites and along the Cable Route Corridor would likely be experienced by limited receptors at any given time as work progresses across the Scheme. Therefore, the magnitude of change is negligible which results in a moderate/minor residual effect which is **not significant.**

14.10.4 Assessments have been undertaken in accordance with the guidance contained within BS 4142 and have predicted that operational noise levels at the nearest receptors to the Scheme would exceed the existing background noise levels in many cases, and as such have been assessed as having moderate to moderate/major significance effects. However, due to very low existing background noise levels at the receptors, and as stated within BS 4142, alternative guidance has been used to assess noise impacts, which considers absolute noise levels created by the Scheme. As such, embedded mitigation is being used to ensure noise levels during the operational phase do not result in significant impacts in accordance with WHO/BS 8233 and IEMA guidance. Therefore, considering context, the magnitude of change is negligible which results in a moderate/minor residual effect which is **not significant.**

14.10.5 It is anticipated that through the use of the embedded mitigation measures outlined above (e.g. selection of quieter plant, positioning of noise-emitting equipment away from sensitive receptors, and the use of enclosures, louvres and/or acoustic barriers around inverters and BESS cooling fans), operational noise from associated solar farm plant will result in no significant residual adverse effects.

14.11 Cumulative Effects

14.11.1 A list of cumulative projects can be found in Appendix 25.1 **[EN010170/APP/GH6.3.25.1]** of the ES. A summary of cumulative effects will be listed within Chapter 25: Cumulative Effects and Effects Interaction **[EN010170/APP/GH6.2.25]** of this ES.

14.11.2 It is considered that cumulative noise effects during the construction and operational phases may occur when developments are within 500m of a common receptor. At greater distances, any noise emissions would be attenuated such that there would normally be no combined effect.

14.11.3 Use of the CEMP will consider cumulative effects of transport in accordance with the oCEMP. There are not considered to be any likely significant cumulative effects in conjunction with other developments.

14.11.4 The ODS will consider cumulative effects during decommissioning. It is not known at this stage which developments would be constructed or decommissioned in conjunction with the Scheme.

Cumulative Construction Effects

14.11.5 It is considered that due to the short-term nature of construction works and the large distances between the committed developments and the Green Hill Order Limits, the cumulative effects of construction noise and vibration are unlikely to

result in any effects of higher significance than those already assessed in this chapter.

14.11.6 Any simultaneous construction works are predicted be at a large enough distance away from each other to be sufficiently attenuated at the location of a common receptor, and in any cases where the construction noise levels are equal at the receptor location (i.e. a doubling of sound pressure levels) this would be equivalent to a +3dB increase of total noise at the receptor and would not change the concluded likelihood of significant effects as per the assessment detailed in this report.

Cumulative Effects of Operational Phases

14.11.7 Following a review of the committed developments, the majority of these are at sufficient distance to be adequately attenuated at the location of any common receptors (i.e. over 500m). In any case, these developments would be subject to their own noise assessments and suitable mitigation measures to achieve appropriate noise levels at the relevant receptors.

14.11.8 From a review of the calculated operational noise levels from the Green Hill scheme, as presented in this chapter, it can be seen that the vast majority (~90%) of the calculated noise levels are at least 5dB below background noise levels at the receptor location. As a result of this, the combined noise levels with committed developments would not exceed the background noise levels unless the committed developments were not sufficiently attenuated. It therefore follows that Green Hill is sufficiently quiet in the operational phase to not cause any significant cumulative effects at these locations.

14.11.9 Therefore, we have assessed in more detail the combined effects of any committed developments within 500m of the Green Hill sensitive receptors, where the Green Hill operational noise levels are calculated to be higher than 5dB below background noise levels. The only committed development that falls into this category is Grendon Lakes battery energy storage system (BESS) within North Northamptonshire (Wellingborough Area) with planning ref: NW/23/00360/FUL.

14.11.10 Noise levels from the Grendon Lakes BESS site are presented in the RPS Environmental Statement Appendix 9.3 Noise Assessment Report (dated 3rd March 2022) and have been used to determine the cumulative noise levels at the common receptors).

14.11.11 A detailed assessment of the cumulative effects from the operational phases of these developments is presented below:

Table 14.32: Cumulative Operational Effects from Grendon Lakes BESS and Green Hill

Receptor Ref (/ RPS ref)	Time Period	Representative Noise Level* L_{A90}, dB	Predicted Green Hill Operational Noise (L_{Aeq}, dB)	Predicted Grendon Lakes Operational Noise (L_{Aeq}, dB)	Cumulative Operational Noise Level	Difference for BS4142 assessment (dB)
BESS001 / Pastures Farm	Daytime 07:00 – 23:00	39	33	30	35	-4
	Night-time 23:00 – 07:00	35	34	30	35	0
BESS003 / Hall Farm	Daytime 07:00 – 23:00	36	31	27	33	-4
	Night-time 23:00 – 07:00	35	32	27	33	-2
BESS005 / Grendon Hall	Daytime 07:00 – 23:00	36	21	27	28	-8
	Night-time 23:00 – 07:00	35	23	27	29	-7
BESS006 / Grendon Caravans	Daytime 07:00 – 23:00	42	20	33	33	-9
	Night-time 23:00 – 07:00	38	21	33	33	-5

* The Representative Noise Level L_{A90}, dB given in this column is the measured background noise level in the relevant period, representative of the sensitive receptor location, except where the background noise level is below 35 dB L_{A90}, and thus 35 dB has been used as the relevant criteria from which to compare the impact, in line with the methodology and criteria set out in 14.4.18 to 14.4.32.

It can therefore be seen from Table 14.32, that the cumulative noise levels are equal to or below background noise levels, and therefore no significant effects will occur as a result of the cumulative noise levels from Green Hill and Grendon Lakes BESS.

It is therefore concluded that the cumulative effects from all committed developments in conjunction with Green Hill does not result in any new or worsened significant effects.

14.12 Summary

14.12.1 **Table 14.33** sets out a summary of the noise and vibration environmental effects.

Table 14.33: Summary of Residual Effects for Noise and Vibration

Description of effect	Magnitude of Impact	Sensitivity of Receptor	Embedded Mitigation	Significance of Effect (with embedded mitigation)	Likely Significant Effects	Additional Mitigation Measures	Residual Effect (with additional mitigation)
Construction Phase							
Construction and decommissioning phase traffic noise	Negligible to Neutral	High	CEMP and BPM	Moderate/Minor or Neutral	Not Significant	N/A	Moderate/Minor or Neutra (not significant)
Construction noise at receptors along the Cable Route Corridor	Negligible to Low	High	CEMP and BPM	Moderate/Minor	Not Significant	N/A	Moderate/Minor (not significant)
Construction vibration	Negligible to Medium	High	CEMP and BPM	Minor to Moderate	Not Significant	N/A	Minor to Moderate (not significant)
Operational Phase							
Noise from Solar Panels and BESS Equipment on nearest sensitive receptors	Negligible	High	Selection of Plant and acoustic barrier	Moderate/ Minor	Not Significant	N/A	Moderate/ Minor (not significant)
Noise from Replacement of Equipment on nearest sensitive receptors	Negligible to Low	High	CEMP and BPM	Moderate/ Minor to Moderate	Not Significant	N/A	Moderate/ Minor to Moderate (not significant)

References

Ref 14.1 Green Hill Solar Farm (2024) Scoping Report. Available at: EN010170-000012-GHSF - Scoping Report.pdf

Ref 14.2 The Control of Pollution Act (1974). Available at: Control of Pollution Act 1974

Ref 14.3 The Environmental Protection Act (1990). Available at: Environmental Protection Act 1990

Ref 14.4 National Policy Statement (NPS) for Energy EN-1 (2024). Available at: Overarching National Policy Statement for energy (EN-1) - GOV.UK

Ref 14.5 National Policy Statement (NPS) for Energy EN-3 (2024). Available at: National Policy Statement for renewable energy infrastructure (EN-3) - GOV.UK

Ref 14.6 National Policy Statement (NPS) for Energy EN-5 (2024). Available at: National Policy Statement for electricity networks infrastructure (EN-5) - GOV.UK

Ref 14.7 National Planning Policy Framework (NPPF) (2024). Available at: National Planning Policy Framework - Guidance - GOV.UK

Ref 14.8 Planning Policy Guidance (PPG) - Noise (2019). Available at: Planning practice guidance: Noise - GOV.UK

Ref 14.9 The Noise Policy Statement for England (2010). Available at: Noise policy statement for England - GOV.UK

Ref 14.10 North Northamptonshire Local Plan 2011 - 2031 (2016). Available at: North Northamptonshire Local Plan | North Northamptonshire Council

Ref 14.11 West Northamptonshire Joint Core Strategy Local Plan (2014). Available at: West Northamptonshire Joint Core Strategy Local Plan (Part 1) | West Northamptonshire Council

Ref 14.12 Milton Keynes City Plan 2016 – 2031 (2019). Available at: Plan:MK 2016-2031

Ref 14.13 Bedford Borough Council Local Plan 2030 (2020). Available at: Local Plan 2030 | Bedford Borough Council

Ref 14.14 British Standards (BS) 4142:2014+A1:2019 Methods for rating and assessing Industrial and commercial sound (BS 4142) (June 2019). Available at: BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound

Ref 14.15 BS 8233:2014 Guidance on sound Insulation and noise reduction for buildings (BS 8233:2014). Available at: BS 8233:2014 - Guidance on sound insulation and noise reduction for buildings

Ref 14.16 BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 (Noise). Available at: BS 5228-1:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites. Noise

Ref 14.17 BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 2 (Vibration). Available at: BS 5228-1:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites. Vibration

Ref 14.18 Calculation of Road Traffic Noise (CRTN). Available at: Design Manual for Roads and Bridges (DMRB) Volume 11

Ref 14.19 Design Manual for Roads and Bridges (DMRB) LA 111 (May 2020). Available at: Design Manual for Roads and Bridges (DMRB) LA 111

Ref 14.20 World Health Organization (WHO) – Guidelines for Community Noise (1999). Available at: Guidelines for community noise

Ref 14.21 BRE (various) - BRE Controlling particles, vapour and noise pollution from construction sites, Parts 1 to 5, (November 2003). Available at: Controlling particles, vapour and noise pollution from construction sites - set of five Pollution Control Guides(AP 160) DOWNLOAD

Ref 14.22 HILLER D. M. and CRABB G. I. Groundborne vibration caused by mechanised construction works. TRL Report 429. Wokingham: TRL, 2000. Available at: Groundborne vibration caused by mechanised construction works