Chapter E
Noise

East Claydon Greener Grid Park Environmental Statement

Chapter E Noise

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E1.0 Introduction

E1.1 This Chapter of the Environmental Statement ('ES') has been prepared by TNEI Services Ltd (TNEI) on behalf of Statkraft UK Ltd ('the applicant'). It assesses the Proposed Development described in Chapter C in relation to Noise.

E1.2 The Proposed Development will introduce new noise sources into the area in the form of construction plant and activities during the construction phase, and fixed plant during the operational phase, such as the battery units cooling systems, battery inverter/Medium Voltage (MV) transformer units, High Voltage (HV) transformers and Synchronous Compensators.

E1.3 Noise will be emitted during the construction, operation and decommission of the Proposed Development. This Chapter provides a summary of the noise effects anticipated for each phase and, where appropriate, details of the proposed scope and methodology for the assessment work.

E1.4 The baseline situation is considered before the likely environmental effects of the Proposed Development are identified. Mitigation measures to reduce potential noise effects are identified as appropriate, before the residual effects are assessed.

E1.5 This Chapter is supported by the following technical appendices provided at Volume 2 to this ES:

- Appendix E1: Consultation and baseline noise survey details
- Appendix E2: Illustration of scenarios modelled for noise

E1.6 This Chapter is also supported by the following technical figures provided at Volume 2 to this ES:

- Figure E1: Noise Monitoring and Assessment Locations

About the Author

E1.7 This Chapter was prepared by Moise Coulon of TNEI, a specialist energy consultancy with an Acoustics team experienced in undertaking industrial noise assessments for electrical infrastructure and energy generating/storage developments inclusive of Battery Energy Storage Systems (BESS) and Synchronous Compensators. Moise has over 17 years' experience in undertaking noise assessments and preparing Environmental Impact Assessments, is a full Member of the Institute of Acoustics (IOA) and holds the IOA Diploma in Acoustics and Noise Control.

E2.0 Policy Context

Overview of applicable Policy and Guidelines

E2.1 This assessment is carried out in accordance primarily with the principles contained within the following policy and guidelines:

- UK Government's National Planning Policy Framework (original publication March 2012 and last updated December 2024[1]) (NPPF);
- UK Government's Noise Policy Statement for England from 2010[2] (NPSE);
- UK Government's Planning Practice Guidance on Noise[3] (PPG Noise);
- Vale of Aylesbury Local Plan (2013 – 2033, September 2021 [4] (VALP);
- British Standard 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments' [5] (BS 5228); and,
- British Standard 4142: 2014+A1: 2019, Methods for rating and assessing industrial and commercial sound'[6] (BS 4142).

National Policy

E2.2 NPPF is the current planning policy guidance within England and, alongside NPSE and PPG Noise, includes noise-related overarching aims to mitigate and reduce noise from new developments.

E2.3 PPG Noise provides guidance for implementation of the NPPF, providing slightly more specific and detailed guidance on the assessment of noise. PPG Noise presents a *'noise exposure hierarchy'* detailed within a table (Paragraph 005). The hierarchy table considers instances when *'Noise can be heard and causes small changes in behaviour, attitude or other physiological response…'* as equivalent to the Lowest Observed Adverse Effect Level (LOAEL) and the action required is to *"mitigate and reduce to a minimum"*. In instances when *'The noise causes a material change in behaviour, attitude or other physiological response…'* this would be equivalent to the Significant Observed Adverse Effect Level (SOAEL) and the action required would be to *"avoid"*.

Local Policy

E2.4 Buckinghamshire Council is the local Council and has adopted the local development plan contained within the document "*Vale of Aylesbury Local Plan (VALP) 2013 – 2033, September 2021*" for the area within which the site is located. The VALP policy NE5 states the following:

"Noise pollution

Significant noise-generating developments will be required to minimise the impact of noise on the occupiers of proposed buildings, neighbouring properties and the surrounding environment. Applicants may be required to submit a noise impact study or to assess the effect of an existing noise source upon the Proposed Development, prior to the determination of a planning application.

Developments likely to generate more significant levels of noise will be permitted only where appropriate noise attenuation measures are incorporated which would reduce the impact on the surrounding land uses, existing or proposed and sensitive human and animal receptors, to acceptable levels in accordance with Government guidance.

Where necessary, planning conditions will be imposed and / or planning obligations sought in order to specify and secure acceptable noise limits, hours or operation and attenuation measures. Planning permission for noise-sensitive development, such as housing, schools and hospitals, will not be granted if its users would be affected adversely by noise from existing uses (or programmed development) that generate significant levels of noise."

E2.5 Accordingly, the assessment of potential noise impact from the Proposed Development has been carried out with due consideration of the requirements of both national and local policies.

Other Relevant Guidance

BS 5228 – Technical guideline for construction noise

E2.6 The BS 5228 standard provides useful guidance on practical noise control. Part 1 provides recommendations for basic methods of noise control including sections on community relations, training, occupational noise effects, neighbourhood nuisance and project supervision. The annexes provide information on noise sources, noise calculation procedures, mitigation measures and their effectiveness.

E2.7 Part 1 also contains sound power level data for a variety of construction plant. This data was obtained from field measurements of actual plant operating on construction and open sites in the United Kingdom and is therefore appropriate to use as source level data for construction noise predictions.

BS 4142 – Technical guideline for industrial noise

E2.8 BS 4142 is applicable for the assessment of industrial noise for existing / operating developments and proposed developments (operational phase). As part of the BS 4142 assessment process for a proposed new development, an initial estimate is made by comparing representative background sound level with the predicted noise levels at nearby receptors (i.e. residential properties). The full process of BS 4142 requires that the assessment considers the context in which the sound occurs before concluding on potential noise impacts. As such there is no definitive pass/fail element to the standard.

E2.9 The initial estimate criteria given by BS 4142 are as follows:

- A difference of around +10 dB or more is likely to be an indication of a *'significant adverse impact, depending on the context'*.
- A difference of around +5 dB is likely to be an indication of an *'adverse impact, depending on the context.'*
- The lower the rating level is relative to the representative background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this

is an indication of the specific sound source having a *'low impact, depending on the context'*.

E2.10 To assess the context, BS 4142 states that all pertinent factors should be taken into consideration, including, but not limited to:

- The absolute level of sound;
- The character and level of the residual sound compared to the character and level of the specific sound;
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions; and,
- Any other criteria that could be relevant.

E2.11 BS 4142 suggests that in instances where the existing sound environment is considered either particularly low or particularly high then absolute levels may be more relevant than the initial estimate. The standard state:

"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.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse"

E2.12 It is important to consider that in some situations the initial estimate is not the most relevant and that the full assessment process can lead to a different outcome than suggested in the initial estimate. For example, when representative background sound levels are low or very low, the levels from the development may be found to exceed the background levels by a large margin in excess of 5dB hence an 'adverse impact, depending on the context' could be found as part of the initial estimate. But if the development's sound is relatively low or residual levels are high then when considering the context the conclusion of a BS 4142 could conclude a low impact. And at the other extreme, in high background environment any increase due to the development, even if marginal, may not be desirable and therefore whilst a 'low impact, depending on the context' is found in the initial estimate, the full assessment could conclude an adverse impact with recommendations for noise mitigation measures.

E2.13 In 2020, the Association of Noise Consultants (ANC) produced a technical note on BS 4142[7] to provide further guidance on the use of the full BS 4142 process. With regards to consideration of the context, the technical note states:

'There is no theoretical limit to how the context can or should influence the impact assessment, but any alteration of the conclusions of an assessment due to the context should be sufficiently explained and justified for the specific circumstances in question.'

E3.0 Assessment Methodology & Significance Criteria

Assessment Methodology

Study Area

E3.1 The nearest Noise Sensitive Receptors (NSRs) that may be subject to the effects of noise from the various phases of the Proposed Development have been identified.

E3.2 The identified NSRs are shown in Figure E1 in context of the Proposed Developed Area where fixed operational plant are proposed (i.e. land to the north of East Claydon National Grid Substation). All NSRs are scattered residential properties within approximately 1km of the Site.

E3.3 As part of the assessment process, out of all the identified NSRs, a sample of those closest to both construction activities and the proposed operational fixed plant in any direction have been selected as the Noise Assessment Locations (NALs) used for this assessment. The Figure E1 shows the selected NALs and they are detailed in Table E3.1 below:

Table E3.1 – Noise Assessment Locations (nearest noise sensitive receptors)

NAL Id-Name	Eastings	Northings	Bearing	Approximate distance (m) to nearest track or foundation where construction may occur	Approximate distance to nearest operational fixed plant
NAL1 - Tuckey Farm	475390	226773	Southeast	480	480
NAL2 - Tuckey Barn	475401	226604	Southeast	540	540
NAL3 - Berry Leys Farm	475619	226382	Southeast	840	840
NAL4 - Station House	474989	226060	South	125 (to Site entrance temporary construction access track west of the house on East Claydon Rd)	620
NAL5 - Monkomb Farm	474223	226414	Southwest	275 (to Bund)	330
NAL6 - Furzen Farm	474209	227561	Northwest	800	800
NAL7 - Verny House	473801	227310	North	780	780

Construction Noise Methodology

E3.4 During construction (and decommissioning) of the Proposed Development, noise will be generated mostly by construction plant on Site, however there would also be construction related traffic noise generated off-site on local roads.

E3.5 The construction phases will be temporary and for the Proposed Development it is considered that noise emissions attributable to the on-site plant is the main topic for consideration. Off-site road traffic noise associated with construction deliveries and construction staff driving to the Site will be temporary and the temporary access track junction with East Claydon Road is approximately 125m from the nearest receptor. Therefore off-site construction traffic is unlikely to give rise to a significant noise impact at nearby receptors found along the road network and has been scoped out. This is consistent with the scope outlined in the Scoping Report (Appendix B1 of this ES).

E3.6 The methodology and good practice control measures are taken from BS 5228 guidelines. A qualitative construction noise assessment has been undertaken to identify distances between receptors and potential main construction activities, describe the likely construction hours, likely duration of construction and to suggest mitigation measures to reduce the potential noise effects from on-site construction activities.

E3.7 Annex E of BS 5228 provides an indicative ABC method to set potential construction threshold values. Depending on the existing baseline levels, a receptor would fall into Category A, B or C and three possible thresholds could apply per category, depending on the construction time period. Category A contains the most stringent criteria and category B and C have higher thresholds for receptors where the baseline noise environment is higher. As an example, the Category A thresholds are:

- 65 dB $L_{Aeq,t}$ for Daytime (07:00 – 19:00 weekdays and 07:00 to 13:00 Saturdays)
- 55 dB $L_{Aeq,t}$ Evenings and Weekends (19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00 – 23:00 Sundays)
- 45 dB $L_{Aeq,t}$ Night-Time (23:00 – 07:00 weekdays, Saturdays and Sundays)

E3.8 The following steps have been undertaken as part of the BS 5228 assessment:

- Identify receptors and describe anticipated construction days/hours, full duration (in months) and type of activities.
- Establish baseline noise levels from measurements as part of a noise survey, and accordingly define the Category A, B or C for each receptor and define which criteria may be applicable depending on construction days/hours.
- Appraise if the appropriate thresholds are likely to be exceeded and suggest suitable mitigation measures

Operational Noise Methodology

E3.9 Operational noise would be emitted from fixed plant, mostly from the cooling system of battery units, and from other electrical infrastructure such as Battery specific Power Conversion Systems (PCS) consisting of Inverters and Medium Voltage Transformers. There would also be HV Transformers and Synchronous Compensator Buildings with associated cooling plant located outside the building.

E3.10 Operational noise has been assessed in accordance with the BS 4142 guidelines which provides a full process to assess potential noise impacts from proposed industrial sources at the nearest identified NSRs. The methodology employed for this assessment is summarised below:

- Establish existing baseline noise levels for the NSRs, from measurements made as part of a noise survey;
- Predict noise levels from the Proposed Development based on the proposed layout (See Appendix C1 of the ES) and candidate plant noise source data; and,
- Assesses the potential noise impact at the receptors. As part of the full assessment, both the BS 4142 initial estimate (i.e. comparison of background with the Proposed Development noise levels) and the BS 4142 context are considered to conclude on the potential noise impact and the requirement for noise mitigation.

E3.11 The baseline conditions are described in a below section of this ES chapter. Predictions were undertake using the noise propagation modelling software, CadnaA, and was informed by various candidate plant sound power levels assumptions and use of the outdoor sound propagation standard ISO 9613-2[8] in which parameters such as atmospheric absorption, topography and ground attenuation are considered. The inputs within the CadnaA 3D model were as follows:

- Height data- Terrain 50 m outside the site boundary and detailed survey topography data within the site boundary;
- Geographical location of proposed sources assumed based on a block layout provided by the applicant;
- Sound Power Levels and operational times of the proposed sources;
- Temperature is assumed to be 10°C and relative humidity as 70%;
- A ground attenuation factor of 1 (soft ground) has been used, with specific areas of developed ground (including the Proposed Development area) modelled with a ground attenuation factor of 0 (hard ground); and,
- Receiver heights are set to 4 m.

Significance Criteria

E3.12 The potential noise effects associated with the Proposed Development have been assessed with consideration of the above methodologies to determine the significance of the noise impacts at the receptors.

E3.13 The duration of temporary effects is assumed to comprise:

- Short-term (a period of up to 3 year);
- Medium-term (a period of between 3 year and up to 15 years); and
- Long-term (a period of more than 15 years).

E3.14 The significance will be determined by the temporality of the noise, the magnitude and the sensitivity of the receptor. The magnitude and sensitivity are described in Table E3.2 and Table E3.3 below:

Table E3.2 - Magnitude of Noise Effects

Magnitude	Description
High	Causes an important change in behaviour and / or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.
Medium	Noise can be heard and may cause small changes in behaviour and / or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. Potential for non-awakening sleep disturbance. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.
Low	Noise can be heard but does not cause any change in behaviour or attitude, e.g. increasing volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.
Very Low	Noise can't be heard, no discernible change in baseline noise levels.

Table E3.3 Sensitivity of Noise Receptors

Sensitivity	Description
High	The receptor/resource has little ability to absorb change without fundamentally altering its present character, or is of international or national importance.
Medium	The receptor/resource has moderate capacity to absorb change without significantly altering its present character, or is of high importance. This will be the case for most residential receptors.
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance.
Very Low	The receptor/resource is tolerant of change without detriment to its character, or does not make a significant contribution to local

E3.15 A significance Rating Matrix was used in this assessment to define the interaction of magnitude and sensitivity, as shown in Table E3.4 below. A Minor Adverse significance or below is considered for this assessment to be not significant in EIA terms. Effects considered to be significant in EIA terms are shown in bold in the table below.

Table E3.4 Effect Significance Matrix

Magnitude	Sensitivity			
	High	Medium	Low	Very Low
High	**Major Adverse**	**Major-Moderate Adverse**	**Moderate-Minor Adverse**	Minor Adverse
Medium	**Major-Moderate Adverse**	**Moderate -Minor Adverse**	Minor Adverse	Negligible
Low	**Moderate -Minor Adverse**	Minor Adverse	Negligible	Negligible

Very Low	Minor Adverse	Negligible	Negligible	Negligible

Consultation

E3.16 In the pre-application advice received (ref: 24/01836/COMM), comments on noise indicated that a noise assessment inclusive of a survey and predictions are expected by Buckinghamshire Council (BC) to support the planning application, and that cumulative noise impact with nearby other developments will need to be considered. TNEI subsequently prepared the noise section of the EIA Scoping Request (ref 24/02556/SO) (see Appendix B1 for the EIA Scoping Report) and the Scoping Opinion dated 14th November 2024 (provided at Appendix B2) includes a Noise and Vibration section stating:

"The LPA welcome the applicant's proposal to scope noise impacts into the EIA for the construction, operation and decommissioning phases of the development. The LPA is especially concerned about the cumulative noise impacts of the development alongside other battery storage facility proposals in the vicinity of the site.

There are concerns that ground-borne vibration from the construction, operation and decommissioning would result from the proposal. The LPA cannot agree to scoping these matters out and the ES should include the likely significant effects associated with these matters."

E3.17 To address these points, TNEI sent a noise consultation letter in December 2024, however, BC planning officers responded, stating that *"The local planning authority is short of resource and inundated with applications. Unless any information is submitted as part of a formal planning performance agreement (which is currently not in place here) or a planning application, officers are unable to engage with consultants on applications that are to be submitted."* The email correspondences and the TNEI consultation letter are included in Appendix E1.

E3.18 As no official response was received from BC, the assumptions for this noise assessment have been based on the scope outlined in the Scoping Report and refined with key parameters discussed in the December 2024 consultation letter. The approach taken for key parameters is :

- operational noise cumulative impact with Tuckey Solar Farm has been considered (in the Chapter N Cumulative Impacts);
- the background sound levels from the TNEI noise survey undertaken in April and May 2024, detailed in the consultation letter, has been used for the noise assessment;
- the operational noise assessment has been undertaken following the full process of BS 4142 to ensure the Proposed Development includes sufficient noise mitigation to avoid an adverse impact, with consideration of the context; and,
- a qualitative construction assessment has been undertaken, in addition to the operational noise assessment. Ground borne vibration during construction is not specifically covered as it is assumed that any mitigation for construction noise (i.e. use of good practice) will also be applicable to ground borne vibration and as such reduce any potential temporary effect.

Assumptions and Limitations

E3.19 A comprehensive noise survey of 13 days was undertaken by TNEI to establish existing noise levels at three locations in the area and baseline already known from Tuckey Farm Solar Farm noise report (ref 19/A0983/DIS) at two other locations was also used. Both surveys show very similar existing noise levels at all receptors, thus indicating a relatively robust baseline. More detail is provided in the below baseline section.

E3.20 Within the CadnaA software, complex models can be used to simulate the propagation of noise and assumptions of plant sources, locations and operating times are important factors. The noise propagation models are intended to give a good approximation of the Proposed Development noise levels and contribution of each individual source. However, it is expected that actual levels are unlikely to be matched exactly with modelled values and the following limitations in noise modelling should be considered:

- The predicted barrier attenuation provided by local topography, bund, walls, buildings and other structures in the intervening ground has been accounted as accurately as possible for this Proposed Development noise model based on detailed existing site topography and proposed topography combined with terrain 50 m topography outside the site. Most relevant buildings have been accounted for however there may be distance less relevant buildings not accounted for;
- The models assume all sound sources are operating continuously and simultaneously. In reality, not all plant will be operating at the same time.
- All assessment locations are modelled as downwind of all sound sources and propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night. These conditions are favourable to noise propagation.

E3.21 As a result of these limitations, the models will tend to over-predict, and actual noise levels are likely to be lower than those presented in this chapter for the majority of the time.

E4.0 Baseline Conditions

Current Conditions

E4.1 The Proposed Development is located within a rural location with no major roads, industries or cities immediately found in the vicinity.

E4.2 TNEI undertook a baseline noise survey at three Noise Monitoring Locations (NMLs) during April and May 2024 and a noise survey was already available from another two NMLs as part of a 2021 survey undertaken by RPS in August and September 2021 for the Tuckey Solar Farm has been used to inform the assessment.

E4.3 The baseline noise survey from TNEI lasted 13 days between 26th April 2024 and 8th May 2024. The survey from RPS lasted 8 days between 27th August 2021 and 3rd September 2021 and was detailed in the Tuckey Solar Farm noise report for discharge of planning conditions (planning reference 19/A0983/DIS).

E4.4 The NMLs and on-site observations are detailed in Table E4.1 below and shown on a map in Figure E1.

Table E4.1 Noise Monitoring Locations

NML		Coordinates		Description / Observations at commission and decommission of equipment
ID	**Name / Location**	**Eastings**	**Northings**	
NML1 (TNEI / April-May 2024)	In the field immediately north of Station House. TNEI survey April-May 2024 for 13 days.	474972	226090	25/04/2024 MR on install day: Road noise from East Claydon Rd. Farm work in distance. Birdsong. Humming from overhead lines, very faint. 08/05/2024 TS on decommission day: Birdsong, occasional road noise to south. Some machinery operating at property to south.
NML2 (TNEI / April-May 2024)	In the field Southeast of Monkomb Farm. TNEI survey April-	474392	226228	22/04/2024 MR on install day: Resident to northwest trimming a

NML		Coordinates		Description / Observations at commission and decommission of equipment
ID	Name / Location	Eastings	Northings	
	May 2024 for 13 days.			hedge. Road noise audible to south. Birdsong in trees and foliage. Mild breeze. Overcast, oktas 8/8. Farm work in field to the south. 08/05/2024 TS on decommission day: Birdsong dominant, distant road noise is audible to the north.
NML3 (TNEI / April-May 2024)	In the field to the north end of the indicative development area. To represent Verney House and others to the north. TNEI survey April-May 2024 for 13 days.	474392	226903	22/04/2024 MR on install day: Overcast, 8/8 oktas. Mild breeze. Farm works can be heard in adjacent field, distant. Land has just been worked. Birdsong in trees and shrubbery. Distant road noise is audible. 08/05/2024 TS on decommission day: Birdsong, distant road noise is audible to north.
NML4 (RPS / August-Sept 2021)	In the field near Tuckey Farm and Tuckey Barn. RPS survey August-September 2021.	475344	226541	As per RPS notes: At the time of setting up and collecting the survey the following noise sources were noted as affecting the acoustic environment: distant road traffic

NML		Coordinates		Description / Observations at commission and decommission of equipment
ID	Name / Location	Eastings	Northings	
				movements, distant machinery noise and natural sound (wind in trees, bird calls, insects etc.).
NML5 (RPS / August-Sept 2021)	In the field north of Berry Leys Farm. RPS survey August-September 2021.	475570	226408	As per RPS notes: At the time of setting up and collecting the survey the following noise sources were noted as affecting the acoustic environment: Local road traffic movements on East Clayton Road, distant road traffic movements, distant machinery noise and natural sound (wind in trees, bird calls, insects etc.).

Source:

E4.5 The noise monitoring equipment from TNEI consisted of Rion NL-52 Sound Level Meter (SLM) fitted with appropriate environmental wind shield. All noise monitoring equipment (calibrator, SLM and microphones) used for the study are categorised as Class 1. The equipment was calibrated onsite at the beginning and end of the measurement period with no significant deviations noted. The microphone was mounted approximately 1.2 m above the ground and away from nearby reflective surfaces i.e., building façades, fences etc.

E4.6 Meteorological data was also collected, with a Kestrel portable weather station and a tipping bucket rain gauge installed near the noise monitoring equipment. In regard to weather conditions, BS 4142 states:

'Record the weather conditions that could affect measurements. Monitor wind speed at the measurement location, using an anemometer, and record the wind speed together with the wind direction. Exercise caution when making measurements in poor weather conditions such as wind speeds greater than 5 m/s.'

E4.7 As part of the post-survey data analysis, all noise data recorded during periods of high wind above 5 m/s or periods of precipitation have been removed from the datasets. A series of

charts, including time series graphs statistical and distribution analysis charts, is included at the end of the December 2024 consultation letter (found in Appendix E1) which detail the measured meteorological data, measured background sound levels and data points excluded.

E4.8 BS 4142 suggest that representative background levels are selected for an assessment, notably section 8.2 states:

'In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.'

E4.9 Table E4.2 presents the representative background sound level and residual sound levels selected for daytime and night-time after reviewing all of the data detailed within the series of charts.

Table E4.2 Representative Background and Residual Sound Levels

NML	Item	Daytime	Night-time
NML1	Range of Background Sound Levels (dB $L_{A90,t}$)	24-58	21-44
	Representative Background Sound Levels (dB $L_{A90,t}$)	34	28
	Range of Residual Sound Levels (dB $L_{Aeq,t}$)	27-66	22-58
	Representative Residual Sound Levels (dB $L_{Aeq,t}$)	51	39
NML2	Range of Background Sound Levels (dB $L_{A90,t}$)	25-47	22-44
	Representative Background Sound Levels (dB $L_{A90,t}$)	36	28
	Range of Residual Sound Levels (dB $L_{Aeq,t}$)	28-69	25-58
	Representative Residual Sound Levels (dB $L_{Aeq,t}$)	45	35
NML3	Range of Background Sound Levels (dB $L_{A90,t}$)	22-50	19-41
	Representative Background Sound Levels (dB $L_{A90,t}$)	31	26
	Range of Residual Sound Levels (dB $L_{Aeq,t}$)	27-56	20-56
	Representative Residual Sound Levels (dB $L_{Aeq,t}$)	41	32
NML4	Range of Background Sound Levels (dB $L_{A90,t}$)	25-42	19-36
	Representative Background Sound Levels (dB $L_{A90,t}$)	35	26
	Range of Residual Sound Levels (dB $L_{Aeq,t}$)	33-79	24-57
	Representative Residual Sound Levels (dB $L_{Aeq,t}$)	44	33
NML5	Range of Background Sound Levels (dB $L_{A90,t}$)	23-51	19-37
	Representative Background Sound Levels (dB $L_{A90,t}$)	34	24

NML	Item	Daytime	Night-time
	Range of Residual Sound Levels (dB $L_{Aeq,t}$)	41-78	22-61
	Representative Residual Sound Levels (dB $L_{Aeq,t}$)	58	40

Assumed Baseline

E4.10 The baseline noise levels have therefore been established through measurements at a total of five locations in the area.

E4.11 During the measurements the existing East Claydon National Grid Substation was operational and noise from that substation is in theory included as part of the baseline noise levels in Table E4.2 above. This is most relevant for NAL4-Station House (474989,226060) located immediately adjacent to that substation and where noise from the substation would form part of the existing environment. To represent that location data was measured at NML1 in the field immediately opposite the property Station House hence not immediately adjacent to the substation. No specific noise from the substation was noted at NML1, and only humming from overhead lines were noted as very faint. As such the baseline level used for NAL4-Station House include low or no noise for the existing substation and this is judged a worst-case assumption. In reality baseline levels at NAL4-Station House could be higher than assumed in this report.

E4.12 Furthermore, the existing substation will be replaced by the 'replacement substation' which will be located to the west of the existing substation and will be in operation at the same time as the Proposed Development. As set out in Chapter B, it is assumed the existing substation will be decommissioned when the replacement one is complete and in operation. It is anticipated that the replacement substation would have similar operational noise levels to the existing substation and it is judged that this will not affect significantly the baseline levels assumed at the receptors (NALs) in this assessment. Even at NAL4-Station House, due to the baseline levels assumed being worst-case, the effect of assuming the replacement substation is operational when the Proposed Development is operational would not materially impact the results of this assessment. Overall the baseline levels at all receptors are assumed relevant for a situation with the current substation but also for the assumed baseline with the future replacement substation.

Future Baseline

E4.13 There are no known current or predicted future processes (other than the Proposed Development) that are near enough to change the baseline conditions significantly at the nearest NSRs to the Proposed Development. As detailed in the assumed baseline, the replacement substation is already assumed so the future baseline would likely remain broadly similar to the current baseline at this location.

E5.0 Potential Effects

E5.1 The potential noise assessment results presented within this section are inclusive of Embedded Mitigation only (also called primary/tertiary). The effect of Additional Mitigation measures are presented later in the chapter and assessed in the Residual Effects section.

Embedded Mitigation

Construction

E5.2 For the construction phase, embedded mitigation includes the use of core working hours which could be conditioned to reduce impact during more sensitive times of the day, and the use of good practice measures which are to be detailed in a Construction Environmental Management Plan (CEMP) and employed to minimise noise impacts. These are considered embedded as they are detailed in Chapter C – in the 'construction methodology' section, and the Construction Traffic Management Plan at Appendix G3 of this ES.

E5.3 The core on-site construction hours are suggested to be restricted to Daytime only, between 07:00 – 18:00 Monday to Friday and 07:00 – 14:00 on Saturdays. No construction works will be undertaken outside these hours or on Sundays or Bank Holidays. Any construction works outside of these hours will be limited to emergency works.

E5.4 Furthermore, it should be noted that deliveries will likely be limited between 08:00 – 17:00 Monday to Friday and between 08:00 – 13:00 on Saturdays with peak periods on the surrounding highway network being avoided where possible.

E5.5 Good site practices would be implemented during construction to minimise the likely effects to a minimum. Section 8 of BS 5228 recommends a number of simple control measures that would be employed onsite, as summarised below:

- Ensure that construction staff is aware of the proximity to nearby residential properties;
- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- Ensure that any extraordinary site work continuing throughout 24 hours of a day (for example, crane operations lifting components onto the tower) would be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid significant traffic flows;
- Ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Select inherently quiet plant where appropriate and ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Instruct that machines would be shut down between work periods or throttled down to a minimum;

- Regularly maintain all equipment used on site, including maintenance related to noise emissions;
- Vehicles would be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation;
- Ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided; and,
- The contact details for an appointed community liaison officer will be provided to residents and the community liaison officer will keep residents informed of construction progress, program, and key milestones. In the event noise complaints are received, the community liaison officer will discuss the complaint with the resident to try and resolve the issue. Following an initial subjective appraisal based for example on a visit at the complainant property, remedial measures will be used, or the case will be escalated promptly for detailed noise monitoring and investigation. Records will be kept of all complaints received, as well as all follow-up actions taken to resolve them.

Operation

E5.6 For operational noise, the assessment process has followed an iterative approach as the design of the project has evolved; early noise feasibility studies were undertaken by TNEI based on a large area of land potentially under the Applicant's control, located around the National Grid Substation. TNEI made early recommendations with regards to a preferred location at the northern end of the available land, approximately equidistant between NAL1-Tucker Farm and NAL5-Monkoomb Farm. The layout design evolution which led to the layout presented in the ES follows this principle and as such the geographical location of the layout within available land is considered as embedded noise mitigation.

E5.7 Furthermore to the geographical location of the layout, embedded mitigation for operational noise was added at a later stage in the evolution of the layout design, and which notably includes:

- An acoustic fence 4 m high covering the Southeast corner of the compound and targeted to reduce noise at NAL1-Tuckey Farm.
- A bund 5m high covering the Southwest corner of the compound and targeted to reduce noise at NAL5-Monkomb Farm.
- Detailed topographical data for proposed height where the Southwest corner inside the compound is below current ground levels, thus screening even more behind the bund the proposed battery and PCS units closest to NAL5.

Decommissioning

E5.8 It is assumed that a Decommissioning Environmental/Ecological Management Plan (DEMP) will be prepared and agreed with the LPA prior to the decommissioning works commencing, and that this will follow the structure of the Framework CEMP set out within Chapter C of the ES. This would cover the measures set out above.

Major Hazards and Accidents

E5.9 Major hazards and accidents are not judged relevant to this chapter and were not considered.

Phasing

E5.10 Phasing is judged relevant for construction noise and was considered below in the assessment of potential effects for construction noise.

During Construction

E5.11 Construction noise is transient in nature and will vary in both its duration and location, as items of plant move around to construct different elements of the Proposed Development. Noisiest construction activities will mostly be caused by the temporary use of heavy plant equipment such as excavators, generators, and concrete mixers.

E5.12 The receptors identified near to potential on-site construction activities are shown as NALs 1-7 in Figure E1 and also detailed in Table E3.1 . The nearest to any construction is NAL4-Station House located at approximately 125 m from the site entrance temporary construction access track west of the house on East Claydon Rd. Other NALs are located at a distance of at least 275 m from construction activities at the western edge of the main compound where the bund is proposed.

E5.13 The construction period is anticipated to last 24 months from start to completion. Phase 1 would be the site preparation (build tracks and foundation) for Months 1-5, Phase 2 the main compound construction period with various activities for Months 6-18 and Phase 3 will be site clearance for Months 19-24.

E5.14 The core construction hours are detailed in the Embedded Mitigation section and as a summary are proposed to be limited to 07:00 – 18:00 Monday to Friday and 07:00 to 14:00 on Saturdays. Deliveries are also suggested to be limited to 08:00 – 17:00 Monday to Friday and between 08:00 – 13:00 on Saturdays with peak periods on the surrounding highway network being avoided where possible.

E5.15 During the earthworks at the start of the construction for the temporary construction access tracks leading from the road to the main compound, there is a potential for noise levels to be near to the most stringent Daytime BS 5228 threshold value of 65 dB $L_{Aeq,t}$ at NAL4-Station House on the few days when work is focused in this area. However, this will be very short term and little or it is still expected that at 125m the 65 dB LAeq,t would be met subject to the implementation of the proposed embedded mitigation measures.

E5.16 The magnitude of change is low and the sensitivity of the receptors is medium, as such a short-term Minor Adverse effect is predicted for construction noise. This represents a not significant impact and no additional mitigation is anticipated to be required.

During Operation

Layout assumptions

E5.17 The submitted layout STA008-PL-04B_rev06 and STA008PL-3_rev09 Proposed Block Layout Plan (Operational) at Appendix C1 of the ES has been assumed.

Plant assumptions

E5.18 The operational aim of the Proposed Development is to support the grid. The Proposed Development is for a Battery Energy Storage System (BESS) with a capacity up to 500 MW with a 4h charge/discharge duration. This is combined with 4 Synchronous Compensator also found in the centre of the BESS layout.

E5.19 All predictive noise modelling has been undertaken using data for candidate plant that would be appropriate for a development of this size and class and two scenarios of technology/manufacturers have been considered to illustrate a possible range of results. The main noise sources expected are detailed below:

- **Battery Units:** The Proposed Development will comprise a large number of battery units stacked next to each other in 4 quadrants of 125MW capacity. The battery units will be liquid-cooled and in TNEI's experience with various systems and technology, the main noise source from each battery unit will be from the cooling system and no specific noise character is expected. When the battery cells are charging or discharging, the cooling unit noise is often dependent on ambient temperature and power load. When the batteries are on idle (neither charging nor discharging), there would still be a need to continuously keep the temperature at relatively low temperatures and in this situation the noise would mostly be dependent on ambient temperature. Most battery unit products are designed to operate in high ambient temperatures, typically of 40 °C and above, however, for a site in England this situation will occur rarely (if ever) and the typical cooling requirements are often less than the maximum capabilities of the cooling system design. Not many products have detailed sound power levels associated with ambient temperature and load and very often sound power data is provided for laboratory simulated maximum operating conditions only.
- **PCS (Inverter/Transformer) units:** The battery units will be connected to Power Conversion Systems (PCS) units composed of Inverters and Medium Voltage (MV) Transformers. In most instances, a single PCS can service a small group or row of smaller capacity battery units. The main noise source from these PCS units will be cooling noise and, to a lesser degree, transformer noise. Similar to the battery units, the noise from these units will usually vary depending on the ambient temperatures and the power load. The transformer noise is from small MV transformers units that form part of the PCS and in TNEI's experience a low-level tone may be emitted (typically in the 100 Hz frequency band). However, as the relative output from these MV transformers is low, they tend to be masked by the cooling noise from the cooling of both PCS and surrounding battery units and, as such, the tone tends not to be audible at distances more than 100 m.
- **HV Grid Transformers:** There will be two large High-Voltage (HV) transformers located in a central location in the main compound and also two smaller HV

transformers in a small area to the south of the main compound. This represents a small amount of HV Transformers in total in comparison to the whole system which will include several more Battery Units & PCS Units and is therefore a small contributor overall to the Proposed Development noise levels.

- **Synchronous Compensators :** Two industrial shed-style buildings will host Synchronous Compensators inside. Noise from the inside of the building emanating outside through the building fabric has been considered, as well as associated cooling plant located just outside each of the buildings. The break-out noise from the Synchronous Compensator buildings and associated outside cooling plant is a small contributor overall to the Proposed Development noise levels.
- **Other less significant noise sources :** Other noise sources such as auxiliary transformers, mini-substation or emergency diesel generators will be included as part of the Proposed Development but are not expected to contribute significantly or would only be used in emergency situations only, and as such have not been included within the noise predictions. In TNEI's experience of noise assessments for BESS and Synchronous Compensators developments, it is judged appropriate to consider only the Battery Units, PCS, HV Transformers and Synchronous Compensators for the operational phase noise predictions.

E5.20 Several different models are currently available for all of the above items of plant associated with the Proposed Development, and new products are introduced to the market regularly. Therefore there will be a wide range of products available when it comes to procurement. At this stage, the exact equipment specifications to be chosen are not known as such two main scenarios have been considered based on 2 different manufacturers/technology. The scenarios are reflective of the types of plant typical of a development of this size and nature and is based on plant for which TNEI had managed to acquire sufficiently detailed noise source data at the time of writing. The plant assumptions are detailed in the Table E5.1:

Table E5.1 - Summary of Noise sources assumptions without additionnnal mitigation

Scenario Id	Item Modelled	Sound Power Lw (dBA)	Detail of sound source and how it was modelled
S1 Unmitigated	Battery Unit: Fluence Cube	74.3	Several units making up to 500 MW/4h spread across the full compound and each unit dimension is ~ 2.4m (L) x 2 m (W) x 4.5 m (H) dimensions and cooling fans located inside with an extract louvre on front panel. Modelled as building with 1 emitting façade which is a vertical area source on the front panel
	PCS: SMA XUP without Silencer, Charging 100%	90.6	Several units spread across the full compound at the end of rows of battery units. Each unit dimensions is ~ 9 m (L) x 2 m (W) x 3 m (H). Modelled as a building with 5 noise emitting facades (4 x side and 1x roof). Without Silencer, Charging 100%.
	HV Transformer: ABB	88	An Oil Natural Air Forced (ONAF – a method of cooling) HV Grid Transformer that was measured at 68 dB at 2m and has been assumed with the spectrum of an ABB branded transformer. Modelled as a building with 5 noise emitting facades (4 x side and 1x roof).

Scenario Id	Item Modelled	Sound Power Lw (dBA)	Detail of sound source and how it was modelled
	Sync. Comp. Building	86.5 (Internal Sound Pressure Level)	Buildings hosting the Synchronous Compensators, located centrally within the main compound. Internal reverberant sound pressure level (Lp) of 86.5dB from calculations based on building dimension and 2 x Sync. Comp inside. Walls and roofs assumed with Kingspan Acoustic Performance Guide UK lowest attenuation specifications (i.e. AWP/60 + no lining with Rw = 25 dB for walls and ceiling).
	Sync. Comp. External Cooling: 16 Fan Chiller	91.6	Externally located cooling area located near the Sync. Comp. Building Assumed as an area source 2 m above ground.
	Acoustic fences, bunds and detailed site topography	N/A	Acoustic fence 4 m high covering the Southeast corner of the compound and targeted to reduce noise at NAL1-Tuckey Farm. Bund 5m high covering the Southwest corner of the compound and targeted to reduce noise at NAL5-Monkomb Farm. Detailed topographical data proposed assumed that the Southwest corner inside the compound is below current ground levels, thus screening even more behind the bund the proposed battery and PCS units closest to NAL5.
S2 Unmitigated	Battery Unit: Sungrow Titan V2.0 unmitigated 25 °C and 80% Power	96.6	Several units making up to 500 MW / 4h spread across the full compound and each unit dimension is ~ 6 m (L) x 2.5 m (W) x 4.5 m(H) (essentially the size of a 20ft container) and cooling fans located inside with an extract on the roof where most of the noise is emitted. Modelled as a cube with 5 emitting facades with each façade having a specific sound power between 73 dB and 79 dB and the roof a sound power of 96.6 dB. Data used is meant to represent ambient temperature 25 °C and 80% power.
	PCS: Sungrow MVS5140-LS	85.9	Several units spread across the full compound at the end of rows of battery units. Each unit dimensions is ~ 6 m (L) x 2.8 m (W) x 2.4 m (H). Modelled as a building with 5 noise emitting facades (4 x side and 1x roof), the rear is the loudest at 85.9 dB and other facades are between 72 and 80dB each.
	HV Transformer: ABB	Same as S1 Unmitigated.	
	Sync. Comp. Building		
	Sync. Comp. External Cooling 16 Fan Chiller		

Scenario Id	Item Modelled	Sound Power Lw (dBA)	Detail of sound source and how it was modelled
	Acoustic fences, bund and detailed site topography		

Predicted Specific and Rating Levels of BS 4142

E5.21 The sound levels predicted using the CadnaA modelling software are considered to be the Specific Sound Levels. In accordance with BS 4142, the Specific Sound Level must be converted into a Rating Level. The Rating Level allows for character corrections to be added to account for characteristics of the sound that may be perceived as more annoying or intrusive. In particular, the Rating Level considers corrections for tonality, impulsivity and intermittency of the sound, as well other sound characteristics that are neither tonal, impulsive, or intermittent, but are *"otherwise readily distinctive against the residual acoustic environment."*

E5.22 For the assessment, the following has been considered regarding character corrections:

- **Tonality:** Electrical plant such as power transformers are often inherently tonal at source, typically in the 100 Hz frequency band. BS 4142 corrections, however, are only applied if the noise characteristics are present **at the receptor location, not at the source location.** TNEI have used professional judgement and considerable experience of BESS developments of similar nature and scale to subjectively determine that a character correction of 0 dB is appropriate for application within the assessment at all receptors, given the distance from source to receiver is at least 330m. Within the noise model, as per the description of each item of plant included earlier in this Chapter, the cooling noise from the battery and PCS units is anticipated to be the dominant noise source and will likely mask any noise emissions from the low-level MV transformer units and the comparatively few number (four) of HV transformers.
- **Impulsivity:** Impulsivity is not considered to be a relevant sound characteristic of a BESS development when operational. Once operational, the noise is likely to be predictable and consistent.
- **Intermittency:** As with impulsivity, intermittency is not considered to be a relevant sound characteristic in this case. Once operational, the Proposed Development will be operational for extended durations. This is not considered to be a demonstration of intermittency.
- **Other Sound Characteristics:** No other characteristics that would be 'readily distinctive against the residual acoustic environment' are anticipated.

E5.23 With due regard to the above, no character corrections are required, therefore the Rating Level is equal to the Specific Sound Level. The predicted Rating Levels for the Scenarios without mitigation are included in Table E5.2 and Table E5.3 below. Graphics of the noise models and associated noise predictions out of CadnaA are included in Appendix E2.

Initial Estimate of BS 4142

E5.24 The initial estimate of BS 4142 is a numerical comparison of the Rating Levels against the Representative Background Sound Levels. The results of the initial estimate for the scenarios without mitigation is included in Table E5.2 (Daytime) and Table E5.3 (Night-time) below:

Table E5.2 – Daytime BS 4142 Initial Estimate **without** additionnnal mitigation

NAL	Residual Sound (dB L_{Aeq})	Representative Background Sound (dB, L_{A90})	Rating Level		Initial Estimate, numerical comparison between Rating and Background		Initial Estimate, potential impact (low/adverse/significant adverse, depending on the context)	
			S1 Unmitigated	S2 Unmitigated	S1 Unmitigated	S2 Unmitigated	S1 Unmitigated	S2 Unmitigated
NAL1-Tuckey Farm	44	35	33	42	-2	7	Low	Adverse
NAL2-Tuckey Barn	44	35	31	40	-4	5	Low	Low
NAL3-Berry Leys Farm	58	34	30	37	-4	3	Low	Low
NAL4-Station House	51	34	32	39	-2	5	Low	Low
NAL5 - Monkomb Farm	45	36	36	44	0	8	Low	Adverse
NAL6 - Furzen Farm	41	31	33	39	2	8	Low	Adverse
NAL7 - Verny House	41	31	30	37	-1	6	Low	Adverse

Table E5.3 – Night-time BS 4142 Initial Estimate **without** additionnnal mitigation

NAL	Residual Sound (dB L_{Aeq})	Representative Background Sound (dB, L_{A90})	Rating Level		Initial Estimate, numerical comparison between Rating and Background		Initial Estimate, potential impact (low/adverse/significant adverse, depending on the context)	
			S1 Unmitigated	S2 Unmitigated	S1 Unmitigated	S2 Unmitigated	S1 Unmitigated	S2 Unmitigated
NAL1-Tuckey Farm	33	26	33	42	7	16	Adverse	Significant Adverse
NAL2-Tuckey Barn	33	26	31	40	5	14	Low	Significant Adverse
NAL3-Berry Leys Farm	40	24	30	37	6	13	Adverse	Significant Adverse
NAL4-Station House	39	28	32	39	4	11	Low	Significant Adverse
NAL5 - Monkomb Farm	35	28	36	44	8	16	Adverse	Significant Adverse
NAL6 - Furzen Farm	32	26	33	39	7	13	Adverse	Significant Adverse
NAL7 - Verny House	32	26	30	37	4	11	Low	Significant Adverse

E5.25 The initial estimate shows that, without consideration of the context:

- Scenario 1 Unmitigated: In daytime, there could be a low impact at all NALs. In night-time, there could be an adverse impact at NALs 1,3,5 and 6.
- Scenario 2 Unmitigated: In daytime, there could be an adverse impact at NAL1 and NAL5-7. In night-time, there could be a significant adverse impact at all NALs.

E5.26 As the initial estimate results are depending on the context, the context must be assessed before making a conclusion and this is detailed in the below paragraphs.

Context Assessment, conclusion of BS 4142 process and EIA Significance

E5.27 BS 4142 and the ANC Technical Note provides relatively detailed guidance on how to assess the context with some specific topics suggested. The context assessment for each topic is detailed in Table E5.4 below for the scenarios without additional mitigation.

Table E5.4 BS 4142 context assessment **without** additional mitigation

Context Topic	BS 4142 or ANC Technical Note Relevant Quotations	Assessment
Absolute Level of Sound	BS 4142: *'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.'* ANC: *'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 LA90, and low rating levels as being less than about 35 dB LAr,Tr. The WG 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.'*	The background levels are judged to be low in daytime and very low in night-time at all NALs. Absolute levels of the Proposed Development are therefore as, or more, relevant than the margin by which the rating level exceeds the background, especially at night. The Rating Levels of S1 Unmitigated are up to 36 dB at one location (and less than 33 dB at others) which is not high. The Rating Levels of S2 Unmitigated are higher than S1 Unmitigated and may be classed as relatively high. Consideration of the Absolute level of sound suggest that the impact may be less than the initial estimate.
Character and Level of Residual Sound	*BS 4142: 'The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and / or commercial nature is likely to be perceived and how people react to it.'*	The average residual sound levels are 45dB LAeq at NAL5 (the most sensitive) in daytime and Rating Levels do not exceed 36 dB for S1 Unmitigated so that is well below the residual levels indicating the Proposed Development when unmitigated would be well below residual noise levels in daytime. For the night-time, the Rating Levels are only +1dB above the residual levels of 35 dB for S1 Unmitigated . The sound character from the Proposed Development is anticipated to be relatively steady state and relatively low level without character at receptor locations so will not be overly disruptive or annoying in terms of its character. Consideration of the Character and Level of Residual Sound does not indicate any change required to the initial estimate.

Context Topic	BS 4142 or ANC Technical Note Relevant Quotations	Assessment
Sensitivity of Receptor	BS 4142: *'The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as: i) facade insulation treatment; ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and iii) acoustic screening.'*	It could be relevant to consider indoor levels thresholds at night in more detail. Consideration of the Sensitivity of receptor suggest that the impact may be equal or less than the initial estimate.
Other Pertinent Contextual Factors	ANC: *'Three contextual elements are set out in Clause 11, but it is important to note that the list is not exhaustive and all pertinent factors should be considered'.*	The assessment considers candidate plant and the typical sound level output for this type of plant. As part of the procurement process, plant will be specified in order to minimise noise output. The noise model assumes all plant was operating concurrently; however not all cooling units will necessarily be required to operate at the same time and as such, overall noise levels are likely to be lower than predicted; and, For much of the time cooling equipment may be operating at lower capacities and overall sound output will be reduced. Consideration of other pertinent factor suggest that the impact may be less than the initial estimate.

E5.28 In the context assessment presented in Table E5.4, three out of the four topics considered suggest that the impact may be less than the initial estimate, especially at night due to very low background and Rating Levels not being particularly high. As such, it is judged that the full BS 4142 assessment demonstrates that when the context is considered:

- Scenario 1 Unmitigated: In daytime, there could be a low impact at all NALs. In night-time, there could be a low impact at all NALs with as an exception a possibility of an adverse impact to remain at night at NALs 1 and 5.
- Scenario 2 Unmitigated: In daytime, there could be a low impact at all NALs. In night-time, there could be an adverse impact at most NALs, especially at NAL1 and 5.

E5.29 Overall, when considering both unmitigated scenarios (i.e. only embedded mitigation) it is concluded that in accordance with BS 4142 following full consideration of the context, there is a potential for an adverse impact at night at NAL1 and 5 and additional noise mitigation would be required.

E5.30 The above BS 4142 conclusion needs to be reviewed considering Table E3.4 (Matrix of significance of effects) as part of the EIA process. The magnitude of change is medium, and the sensitivity of the receptors is medium, as such a **Moderate -Minor Adverse effect** is

predicted for operational noise. This represents a **Significant** impact, and some additional mitigation measures will be required.

During Decommissioning

E5.31 Decommissioning noise impacts is expected to be similar or less to construction noise, therefore refer to the construction noise assessment of effects above.

E6.0 Mitigation and Monitoring

This section discusses the additional noise mitigation measures that may be required over and above the embedded (also called primary/tertiary) noise mitigation measures.

During Construction

E6.1 It was found that without additional mitigation, there would be no significant construction noise effects so only the embedded mitigation would be required and no additional noise mitigation measures are required.

During Operation

E6.2 Beyond the embedded mitigation (i.e. geographical location of the layout within available land and iterative site design process), additional noise mitigation measures are required for the operational phase to reduce the overall impact. This will be composed of careful selection of plant to be installed.

E6.3 Noise modelling has been undertaken to consider the 2 scenarios with change of plant assumptions as detailed in Table E6.1.

Table E6.1 - Summary of Noise sources assumptions with additional mitigation

Scenario Id	Item Modelled	Sound Power Lw (dBA)	Detail of sound source and how it was modelled
S1 Mitigated	Battery Unit: Fluence Cube	Same as S1 Unmitigated.	
	PCS: SMA XUP with Silencer, Charging 67%	79.7	This SMA PCS unit has a noise attenuation option and noise data is available for various % of operation inclusive of charge mode and grid-feed mode. The sound power here is reduced compared to the sound power of scenario S1 Unmitigated.
	HV Transformer: ABB	Same as S1 Unmitigated.	
	Sync. Comp. Building		
	Sync. Comp. External Cooling: 16 Fan Chiller		
	Acoustic fences, bunds and detailed site topography		
S2 Mitigated	Battery Unit: Sungrow Titan V2.0 mitigated with attenuator box on top, 25 °C & 80% Power	72	This Sungrow Titan V2.0 battery unit has an option for a noise attenuation box fitted on the roof. The noise coming from the roof is significantly reduced to 72 dB sound power and all other sides are reduced slightly too.
	PCS: Sungrow MVS5140-LS	Same as S2 Unmitigated.	

Scenario Id	Item Modelled	Sound Power Lw (dBA)	Detail of sound source and how it was modelled
	HV Transformer: ABB		
	Sync. Comp. Building		
	Sync. Comp. External Cooling: 16 Fan Chiller		
	Acoustic fences, bunds and detailed site topography		

During Decommissioning

E6.4 No further mitigation measures are required, as per the construction phase assessment.

E7.0 Residual Effects

E7.1 The potential noise assessment results with additional mitigation are presented in this section.

During Construction

E7.2 No additional mitigation measures beyond embedded mitigation are suggested for construction noise. There would be no significant residual effects from construction noise.

During Operation

Initial Estimate of BS 4142

E7.3 The results of the initial estimate for the scenarios with additional mitigation is included in Table E7.1(Daytime) and Table E7.2(Night-time) below. Graphics of these detailed mitigation scenarios are also included in Appendix E2.

Table E7.1 – Daytime BS 4142 Initial Estimate **with** additional mitigation

NAL	Residual Sound (dB L_{Aeq})	Representative Background Sound (dB, L_{A90})	Rating Level		Initial Estimate, numerical comparison between Rating and Background		Initial Estimate, potential impact (low/adverse/significant adverse, depending on the context)	
			S1 Mitigated	S2 Mitigated	S1 Mitigated	S2 Mitigated	S1 Mitigated	S2 Mitigated
NAL1-Tuckey Farm	44	35	32	24	-3	-11	Low	Low
NAL2-Tuckey Barn	44	35	30	22	-5	-13	Low	Low
NAL3-Berry Leys Farm	58	34	29	20	-5	-14	Low	Low
NAL4-Station House	51	34	31	22	-3	-12	Low	Low
NAL5 - Monkomb Farm	45	36	34	26	-2	-10	Low	Low
NAL6 - Furzen Farm	41	31	33	24	2	-7	Low	Low
NAL7 - Verny House	41	31	29	22	-2	-9	Low	Low

Table E7.2 – Night-time BS 4142 Initial Estimate **with** additionnnal mitigation

NAL	Residual Sound (dB LAeq)	Representative Background Sound (dB, L_{A90})	Rating Level		Initial Estimate, numerical comparison between Rating and Background		Initial Estimate, potential impact (low/adverse/significant adverse, depending on the context)	
			S1 Mitigated	S2 Mitigated	S1 Mitigated	S2 Mitigated	S1 Mitigated	S2 Mitigated
NAL1-Tuckey Farm	33	26	32	24	6	-2	Adverse	Low
NAL2-Tuckey Barn	33	26	30	22	4	-4	Low	Low
NAL3-Berry Leys Farm	40	24	29	20	5	-4	Low	Low
NAL4-Station House	39	28	31	22	3	-6	Low	Low
NAL5 - Monkomb Farm	35	28	34	26	6	-2	Adverse	Low
NAL6 - Furzen Farm	32	26	33	24	7	-2	Adverse	Low
NAL7 - Verny House	32	26	29	22	3	-4	Low	Low

E7.4 The initial estimate shows that, depending on the context:

- Scenario 1 Mitigated: In daytime, there could be a low impact at all NALs. In night-time, there could be an adverse impact at NALs 1, 5 and 6.
- Scenario 2 Mitigated: In daytime, there could be low impact at all NALs. In night-time, there could be a low impact at all NALs.

E7.5 Again, as the initial estimate results are depending on the context, the context must be assessed before making a conclusion and this is detailed in the below paragraphs.

Context Assessment, conclusion of BS 4142 process and EIA Significance

E7.6 The context assessment for each relevant contextual topic is detailed in Table E7.3 in relation to the scenarios with additional mitigation.

Table E7.3 BS 4142 context assessment **with** additional mitigation

Context Topic	BS 4142 or ANC Technical Note relevant quotations	Assessment
Absolute Level of Sound	Identical to Table E5.4 of context assessment without mitigation.	The background levels are judged to be low in daytime and very low in night-time at all NALs. Absolute levels of the Proposed Development are therefore as, or more, relevant than the margin by which the rating level exceeds the background, especially at night. The Rating Levels of S1 Mitigated are up to 33-34 dB at NAL5-6 (and less than 30 dB at others) which is not high. The Rating Levels of S2 Unmitigated are even lower and would be classed as low. **Consideration of the Absolute level of sound suggest that the impact may be less than the initial estimate.**
Character and Level of Residual Sound		The average residual sound levels are at least 44 dB LAeq at all NALs in daytime and Rating Levels do not exceed 34 dB at any of the NALs for any of the two mitigated scenarios, in fact at the most sensitive location NAL5-Monkomb Farm the rating levels are 19 dB below the residual levels (for S2 Mitigated) indicating the Proposed Development when mitigated would be well below residual noise levels in daytime and should not be noticeable. For the night-time, the Rating Levels are at least 9 dB below the residual levels at NAL5 (for S2 Mitigated) indicating a very low likelihood of the noise being noticeable at night (at an outdoor location). The sound character from the proposed development is not expected to be out of context with the existing environment at the NALs. **Consideration of the Character and level of residual sound suggest that the impact may be less than the initial estimate.**
Sensitivity of Receptor		It could be relevant to consider indoor levels thresholds at night in more detail. **Consideration of the Sensitivity of receptor suggest that the impact may be equal or less than the initial estimate.**
Other Pertinent Contextual Factors		The assessment considered candidate plant and the typical sound level output for this type of plant. As part of the procurement process, plant will be specified in order to minimise noise output. The noise model assumes all plant was operating concurrently; however not all cooling units will necessarily be required to operate at the same time and as such, overall noise levels are likely to be lower than predicted; and, For much of the time cooling equipment may be operating at lower capacities and overall sound output will be reduced. **Consideration of other pertinent factor suggest that the impact may be less than the initial estimate.**

E7.7 In the context assessment presented in Table E7.3, four out of the four topics considered suggest that the impact may be less than the initial estimate, especially at night due to very low background and Rating Levels being considered relatively low following mitigation

measures. As such, it is judged that the full BS 4142 assessment with consideration of additional mitigation demonstrates that when the context is considered:

- Scenario 1 Mitigated: In daytime, there could be a low impact at all NALs. In night-time, there could be a low impact at all NALs.
- Scenario 2 Mitigated: In daytime, there could be a low impact at all NALs. In night-time, there could be low impact at all NALs.

E7.8 Overall, when considering both mitigated scenarios it is concluded that in accordance with BS 4142 following full consideration of the context, there is a potential for a low impact both day and night with the use of appropriate additional noise mitigations. Noise mitigation will be required, and it has been demonstrated via modelling of various scenarios that plant selection will be important, as well as ensuring that the embedded mitigation is implemented.

E7.9 As part of the EIA process, the above BS 4142 conclusion for the mitigated scenarios needs to be reviewed in light of Table E3.4(Matrix of significance of effects). The magnitude of change is low and the sensitivity of the receptors is medium, as such a Minor Adverse effect is predicted for operational noise with additional noise mitigations in place. This represents a not significant residual impact.

During Decommissioning

E7.10 Similar to construction, no additional mitigation measures beyond embedded mitigation are suggested for decommissioning noise. There would be no significant residual effects from construction noise.

E8.0 Summary & Conclusions

E8.1 This chapter has assessed the impact of noise at nearby receptors which were identified as residential receptors in proximity from the construction and operational phases of the Proposed Development.

E8.2 A qualitative construction noise has been undertaken and found that during the build or the construction access tracks, there may be earthwork involved within 125m of one receptor at Station House. Subject to the use of embedded mitigation which will include core construction hours in daytime, good practice and implementing a CEMP (in accordance with the CEMP at Chapter C) and implementing the CTMP (Appendix G2), the BS 5228 threshold established with due regards to the baseline noise levels is not anticipated to be exceeded for these short term construction activities. No significant impact due to construction (or decommissioning) is predicted.

E8.3 The noise from the operational phase has been assessed following the BS 4142 assessment process which includes a review of the baseline (inclusive of background levels and residual levels) and noise predictions of the Proposed Development based on a noise model and candidate plant assumptions. Two scenarios of plant and technology have been considered to provide a range of representative results.

E8.4 When considering both unmitigated scenarios (i.e. with embedded mitigation only) it is concluded that in accordance with BS4142, following full consideration of the context, there is a potential for an adverse impact at night at Tuckey Farm and Tuckey Barn and Monkomb Farm and as such additional noise mitigation would be required. This represents a significant impact without additional noise mitigation.

E8.5 Detailed noise mitigation scenarios have been considered and modelled and it is concluded that in accordance with BS 4142 following full consideration of the context, there is a potential for a low impact both day and night at Tuckey Farm and Tuckey Barn and Monkomb Farm (and all other receptors) with the use of appropriate noise mitigations. Noise mitigation will be required, and it has been demonstrated via modelling of various scenarios that plant selection will be important, as well as ensuring that embedded noise mitigation is implemented. The assessment assumes as embedded mitigation a 4m acoustic fence in the Southeast corner and a 5 m bund in the Southwest corner. And as additional noise mitigation which would also need to be implemented, the assessment has considered a selection of candidate plant to illustrate possible levels of attenuation achievable, but ultimately the final choice of plant would have to be carefully selected with regards to noise. The overall assessment concludes a not significant residual impact for the operational phase subject to implementation of noise mitigation measures.

E8.6 Table E8.1 below summarises the predicted noise effects of the Proposed Development on nearby Noise Sensitive Receptors (i.e. residential properties).

Table E8.1 Summary of Effects

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
During Construction (and decommissioning)				
Residential Receptors	On-site construction activities	Minor Adverse and Not Significant	No additional mitigation, only embedded mitigation applicable (core hours, use of good practice during construction and a CEMP / CTMP / DEMP)	Minor Adverse and Not Significant
During Operation				
Residential Receptors	Operational noise from fixed plant such as Battery Units, Inverters, Transformers and Sync. Comp.	**Moderate -Minor Adverse and Significant** (Embedded mitigation assumes bunds/fences and geographical location of main compound within land available)	Additional mitigation is required and will need to include selection of appropriate battery units and transformers/inverters plant	Minor Adverse and Not Significant

E9.0 Abbreviations & Definitions

E9.1 The below Table E9.1 summarises all main abbreviations and definitions used in the Noise assessment:

Table E9.1 Main abbreviations and definitions for noise

Term in Full	Abbreviation	Definition
Association of Noise Consultants	ANC	The ANC is a trade association for acoustic, noise & vibration consultancy practices in the UK.
British Standard	BS	British Standard from the British Standards Institution (BSI), the UK's national standards body. BSI sets technical specifications for a wide range of products and services.
Environmental Health Officer	EHO	Environmental Health Officer within a Council/Local Authority, usually dealing with noise matters (amongst other environmental topics .
Institute of Acoustics	IOA	The UK's Professional body for those working in Acoustics.
Noise Sensitive Receptor	NSR	Noise Sensitive Receptor, a receptor which may be identified as potentially sensitive to noise from proposed or existing developments. These are usually residential properties but can also be hotels, schools, hospitals and in some case ecological receptors.
Noise Assessment Location	NAL	Noise Assessment Location, a specific point where a NSR has been identified and which has been selected for a detailed noise assessment.
Noise Monitoring Location	NML	Noise Monitoring Location, a specific location where a noise monitoring equipment was located during a survey.
Decibel	dB	The ratio between the quietest audible sound and the loudest tolerable sound is a million to one in terms of the change in sound pressure. A logarithmic scale is used in noise level measurements because of this wide range. The scale used is the decibel (dB) scale which extends from 0 to 140 decibels (dB) corresponding to the intensity of the sound level.
Environmental Impact Assessment	EIA	Environmental Impact Assessment (EIA) is a means of drawing together by the developer, in a systematic way, a description of the development and information relating to of the likely significant environmental effects arising from a development.
Ground Effects	N/A	The modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver. Described using the term ‘G’, and ranges between 0 (hard), 0.5 (mixed) and 1 (soft).
Sound Power Level	Lw	Is the sound power level. It is a measure of the total noise energy radiated by a source of noise, and is used to calculate noise levels at a distant location. The LWA is

		the A-weighted sound power level, usually expressed in dB LAeq.
Noise index Leq	Leq	Is the equivalent continuous sound level, and is the sound level in dB of a steady sound with the same energy as a fluctuating sound over the same period. It is possible to consider this level as the ambient noise encompassing all noise at a given time. The $L_{Aeq,T}$ is the A-weighted equivalent continuous sound level over a given time period (T).
Noise index L90	L90	Index represents the noise level in dB exceeded for 90 percent of the measurement period and is used to indicate quieter times during the measurement period. It is often used to measure the background noise level. The $L_{A90,15\ min}$ is the A-weighted background noise level over a fifteen minute measurement sample
Noise emission	N/A	The noise energy emitted by a source, also referred to as the Sound Power Levels.
Noise immission	N/A	The sound pressure level received at a given location (e.g. the nearest dwelling).
Ambient Sound (in BS 4142)	N/A	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far. Described using the metric, LAeq (t).
Specific Sound Level (in BS 4142)	N/A	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr. Described using the metric LAeq (t). Also referred to in this report as the Immission Level.
Residual Sound Level (in BS 4142)	N/A	Equivalent continuous A-weighted sound pressure level of the residual sound without the specific sound source(s) present at the assessment location over a given time interval, T. Described using the metric LAeq (t).
Background Sound Level (in BS 4142)	N/A	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels. Described using the metric LA90 (t).
Rating Level (in BS 4142)	N/A	The Specific Sound Level adjusted for the characteristics of the sound. The Rating Level is calculated by adding a penalty or penalties (if required) to the Specific Sound Level when the sound source contains audible characteristics such as tonal, impulsive or intermittent components. Described using the metric, LAeq (t).
Daytime Hours (in BS 4142)	N/A	07:00 to 23:00 every day
Night time Hours (in BS 4142)	N/A	23.00 to 07.00 every day.

E10.0 References

1 National Planning Policy Framework (NPPF). Available online: https://www.gov.uk/government/publications/national-planning-policy-framework--2

2 Noise Policy Statement for England, Department for the Environment and Rural Affairs, published 2010 (NPSE). Available online: https://www.gov.uk/government/publications/noise-policy-statement-for-england

3 Planning Practice Guidance on Noise (PPG Noise), last updated 22nd July 2019. Available online: https://www.gov.uk/guidance/noise--2

4 Vale of Aylesbury Local Plan 2013 – 2033, September 2021 (VALP). Available online: https://buckinghamshire-gov-uk.s3.amazonaws.com/documents/Aylesbury_local_plan_L46JWaT.pdf

5 BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments ' (BS 5228). Available for purchase on www.bsigroup.com

6 British Standard 4142: 2014+A1: 2019, Methods for rating and assessing industrial and commercial sound' (BS 4142). Available for purchase on www.bsigroup.com

7 Association of Noise Consultants (ANC) Technical note on BS 4142. Available online : https://www.association-of-noise-consultants.co.uk/bs-4142-guidance

8 International Standards Organization ISO 9613-2:2024, Acoustics. Attenuation of Sound During Propagation Outdoors. Part 2: General Method of Calculation (ISO 9612-2) . Available for purchase on www.iso.org