Noise Impact Assessment

JT Energy Storage
Land to the east of Dalzell Street near Woodend

JT ENERGY STORAGE LTD (WINDEL ENERGY)

R25.12242/2/IK
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REPORT DETAILS

Client	JT Energy Storage Ltd (Windel Energy)
Report Title	Noise Impact Assessment – JT Energy Storage
Site Address	Land to the east of Dalzell Street near Woodend
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QUALITY ASSURANCE

Issue No.	Issue Date	Author	Technical Review
1	01/05/25		
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1.0 INTRODUCTION

1.1 This noise impact assessment report been prepared by Vibrock Limited on behalf of JT Energy Storage Limited (Windel Energy) ('the Applicant') in support of a planning application to Cumberland Council ('the Council') with regards to a proposed Battery Energy Storage with associated underground grid connection to the point of connection at the National Grid Woodend electricity distribution site ('the Proposed Development') at Land to the east of Dalzell Street near Woodend, Cumbria, CA24 3LF (NGR 300842, 513769) ('the Site').

1.2 An assessment of the potential noise impacts of the Proposed Development during the construction and operational phases has been completed at the identified noise-sensitive premises in the vicinity of the Site. The assessment has referenced local and national planning policy and the guidance presented within BS 4142 '*Methods for rating and assessing industrial and commercial sound*'.

1.3 A glossary of acoustic terminology is presented in Appendix A.

2.0 SITE DESCRIPTION AND DEVELOPMENT PROPOSAL

2.1 Site Description

2.1.1 The Site comprises land to the east of Dalzell Street between the villages of Bigrigg, Cleator and Moor Row (NGR: E: 300842, N: 513769). The larger settlements of Egremont, Cleator Moor and Whitehaven are all located within a 5km radius of the Site. The Lake District National Park boundary lies approximately 2.7km to the north-east. The Site is wholly located within the administrative boundary of Cumberland Council.

2.1.2 The Site boundary including the underground cable route to the point of connection at Woodend substation measures 1.18ha. The proposed cable route will follow Dalzell Street southwards to the point of connection at Woodend substation.

2.1.3 The Site area, excluding the cable route, wherein the Proposed Development will be located will be approximately 0.58ha. The Site area for the triangular field to the northern portion of the Site to be used for BNG purposes is 0.32ha.

2.1.4 The Site comprises pastureland, which has most recently been used for the grazing of livestock. The Site is split across two fields, separated by an access track. The Site boundaries are demarcated by hedgerow and scattered trees.

2.1.5 Access to the Site is via the existing track taken from Dalzell Street, a local road. Dalzell Street connects with the A5086 and the A595, approximately 1-1.25km to the south of the Site.

2.1.6 The Site is adjoined to the eastern boundary by National Cycle Route 72, a long-distance route, which connects Ravenglass, Cumbria with South Shields, Tyne & Wear. To the north and south of the Site is agricultural land. To the western boundary is Dalzell Street.

2.1.7 The indicative redline boundary and the proposed Site are illustrated in Figure 1 of this report.

2.2 Development Proposal

2.2.1 The Proposed Development comprises the construction and installation of a 30 MW Battery Energy Storage System (BESS), associated infrastructure, access and landscaping and underground cable corridors.

2.2.2 The Proposed Development will consist of 16 containerised battery storage units and 8 Power Conversion Systems (PCS) comprised of an inverter, medium voltage transformers, switchgear and control units.

2.2.3 The proposed Site Layout Plan is shown in Figure 2 of this report.

3.0 NOISE POLICY AND GUIDANCE

3.1 National Planning Policy and Guidance

Noise Policy Statement for England (NPSE)

3.1.1 The NPSE sets out the Government's policy on noise and includes the long term vision of promoting good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

3.1.2 This long term vision is supported by the following aims:

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

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

3.1.3 There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

- NOEL (No Observed Effect Level) – this is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise;
- LOAEL (Lowest Observed Adverse Effect Level) – this is the level above which adverse effects on health and quality of life can be detected.

3.1.4 Extending these concepts further, NPSE leads to the concept of a significant observed adverse effect level:

- SOAEL (Significant Observed Adverse Effect Level) – this is the level above which significant adverse effects on health and quality of life occur.

3.1.5 NPSE acknowledges that it is not possible to have a single objective noise-based measure that defines NOEL, LOAEL and SOAEL that is applicable to all sources of noise in all situations. It is therefore suggested that more specific advice from other applicable noise standards and guidance could be employed to determine suitable noise level criteria within the overall principles of the NPSE.

National Planning Policy Framework (NPPF)

3.1.6 The NPPF was first published on 27 March 2012 and last updated in December 2024. This sets out the government's planning policies for England and how these are expected to be applied.

3.1.7 Where issues of noise impact are concerned the NPPF provides brief guidance in Chapter 15 '*Conserving and enhancing the natural environment*' as follows:

Paragraph 187:

"Planning policies and decisions should contribute to and enhance the natural and local environment by……

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."

Paragraph 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; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

Paragraph 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."

Planning Practice Guidance (PPG)

PPG - Noise

3.1.8 PPG is written in support of the NPPF and provides an increased level of specific planning guidance.

3.1.9 PPG-Noise states that noise needs to be considered when new development may create additional noise or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced). Where justified, noise can override other planning concerns, although it is important to look at noise in the context of the wider characteristics of a development proposal, its likely users and its surroundings, as these can have an important effect on whether noise is likely to pose a concern.

3.1.10 Plan-making and decision taking need to take account of the acoustic environment and in doing so consider:

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

3.1.11 In line with the Explanatory note of the NPSE this would include identifying whether the overall effect of the noise exposure would be above or below the significant observed adverse effect level (SOAEL) and the lowest observed adverse effect level (LOAEL) for the given situation.

3.1.12 When noise is not perceived to be present, there is by definition no effect. As the noise exposure increases, it will cross the 'No Observed Effect Level'. However, the noise has no adverse effect so long as the exposure does not cause any change in behaviour, attitude or other physiological responses of those affected by it.

3.1.13 As the exposure increases further, it crosses the LOAEL boundary above which the noise starts to cause small changes in behaviour and attitude and consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise).

3.1.14 Increasing noise exposure will at some point cause the SOAEL boundary to be crossed. Above this level the noise causes a material change in behaviour. If the exposure is predicted to be above this level the planning process should be used to avoid, but not necessarily prevent, this effect occurring, for example through use of appropriate mitigation such as by altering the design and layout.

3.1.15 The table below summarises the noise exposure hierarchy from PPG-Noise.

Table 1: Noise Exposure Hierarchy

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

PPG - Renewable and Low Carbon Energy

"*Battery Energy Storage Systems:*

Electricity storage can enable us to use energy more flexibly and de-carbonise our energy system cost-effectively – for example, by helping to balance the system at lower cost, maximising the usable output from intermittent low carbon generation (e.g. solar and wind), and deferring or avoiding the need for costly network upgrades and new generation capacity."

3.2 Local Planning Policy

Cumberland Council

3.2.1 Until the adoption of a local plan covering the whole of the unitary authority, the Proposed Development should be determined in accordance with the Copeland Local Plan 2021-2039 (LP) which was adopted in December 2024. The LP presents the strategy for physical development in the area and is used to guide land-use planning and informing decisions across the former Copeland administrative area.

3.2.2 There are a number of policies pertinent to noise for development design and planning and the relevant policies are summarised below.

Policy DS4: Design and Development Standards

The Council will expect all new development to meet high-quality design standards which contribute positively to the health and wellbeing of residents. This means that developments must:

n) Mitigate noise pollution through good layout, design and appropriate screening;

Policy CC1: Large Scale Energy Developments (excluding nuclear and wind energy developments)

The Council will support proposals for large scale renewable and carbon neutral energy schemes and other large scale energy developments, including (but not limited to) solar farms, geothermal, low-carbon and decarbonisation, hydrogen to energy plants, and battery stores. Careful consideration should be given to siting, scale and design of the development and associated infrastructure to avoid individual and/or cumulative impacts on the following:

- *The amenity of sensitive neighbouring uses (including by virtue of noise, dust, odour, air quality, traffic, glare or visual impact).*

3.3 Standards and Guidance

BS 4142:2014 + A1:2019 Methods for rating and assessing industrial and commercial sound

3.3.1 This British Standard was first published in October 2014, with minor revision in 2019, and supersedes BS 4142:1997, which is withdrawn.

3.3.2 This edition describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described, use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes.

3.3.3 The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. When making assessments and arriving at decisions it is essential to place the sound in context.

3.3.4 This standard is intended to be used for the purposes of:

1) investigating complaints;
2) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and
3) assessing sound at proposed new dwellings or premises used for residential purposes.

3.3.5 This standard is not intended to be applied for the following purposes:

- The determination of noise amounting to a nuisance;
- The derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels;
- The assessment of low frequency noise;
- The assessment of sound from the passage of vehicles on public roads and railway systems;
- The assessment of sound from recreational activities, including all forms of motorsport; music and other entertainment; shooting grounds; construction and demolition; domestic animals; people; and public address systems for speech;
- The assessment of sound from other sources falling within the scopes of other standards or guidance.

3.3.6 The sound level from a source when determined as a discrete entity, distinct and free of other influences contributing to the ambient sound is referred to as the 'specific sound level'. The specific sound level is evaluated, at an identified assessment location, over the appropriate reference time interval which is as follows:

- 1 hour during the daytime (07:00 – 23:00); and
- 15 minutes during the night-time (23:00 – 07:00).

3.3.7 The specific noise may be subject to an acoustic feature correction if the noise level at the assessment location is subjectively considered to exhibit certain acoustic features that could increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level.

3.3.8 This standard requires the assessor to consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention. Such features are considered by applying the following corrections to the specific sound level to obtain the rating level as follows:

Subjective Prominence	Tonality	Impulsivity	Other Characteristics
Just Perceptible	+2 dB	+3 dB	-
Clearly Perceptible	+4 dB	+6 dB	-
Highly Perceptible	+6 dB	+9 dB	-
Readily Distinctive Against Residual Environment	-	-	+3 dB
Intermittency	-	-	+3 dB

3.3.9 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be considered. If one feature is dominant, then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion. The rating level is equal to the specific sound level if there are no such features present or expected to be present.

3.3.10 In addition to the above, this edition of the standard also presents a number of objective methods for the characterisation of sound to be used when the subjective method is not sufficient.

3.3.11 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level and considers the following.

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 or more is likely to be an indication of an adverse impact, depending on the context.

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

3.3.12 Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) The absolute level of sound.
2) The character and level of the residual sound compared to the character and level of the specific sound.
3) 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.

3.3.13 Response to sound can be subjective and is affected by many factors both acoustic and non-acoustic. The significance of its impact, for example, can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood. This edition of the standard recognises the importance of the context in which a sound occurs.

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

3.3.14 British Standard 8233:2014 provides guidance for sound insulation and noise reduction in buildings. Tables in the document advise on acoustic criteria and limits which are appropriate for various types of space that have different functions. The guidance applies to external noise as it affects the internal acoustic environment from steady sources without a specific character.

3.3.15 For dwellings, the main considerations are; for bedrooms, the acoustic effect on sleep and for other rooms the acoustic effect on resting, listening and communicating. Table 4 in the BS gives desirable ambient noise levels that should not be exceeded. For dwellings the daytime, 07:00 – 23:00 hours, values are between 35 – 40 dB $L_{Aeq,16h}$ depending on the specific use of the room. The guideline value for bedrooms at night-time, 23:00 – 07:00 hours, is 30 dB $L_{Aeq,8h}$.

3.3.16 BS 8233 states that for external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier

environments. There is also a recognition that the above guideline values may not be achievable in all circumstances and that a balance between noise and other factors will require to be made.

3.3.17 For regular individual noise events with the potential to cause sleep disturbance it is stated that a guideline value may be set in terms of SEL or L_{AFmax}. No further guidance is provided with respect to an appropriate criterion which may be adopted for the assessment of such events. The assessment of night-time events has therefore drawn upon the guidance detailed within the WHO: Guidelines for Community Noise document as summarised below.

World Health Organisation (WHO): Guidelines for Community Noise (1999)

3.3.18 This is a wide-ranging document describing the effects of community noise, and although the WHO *Environmental Noise Guidelines for the European Region* (2018) presents new guideline noise levels, the indoor guideline values in the GCN are still relevant. This document provides useful information about the effects of noise that may occur at certain levels of exposure and an appropriate criterion for the assessment of individual events.

3.3.19 Indoor guideline values are provided for bedrooms with the aim of protecting against sleep disturbance, a guideline value of 30 dB $L_{Aeq,8h}$ for continuous noise and 45 dB L_{AFmax} for single sound events is recommended. To enable casual conversation during the daytime an internal guideline noise level of 35 dB $L_{Aeq,16h}$ is also recommended.

3.3.20 With respect to night-time L_{AFmax} noise levels, the WHO states:

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

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise

3.3.21 BS 5228-1 provides guidance on the prediction, measurement, assessment and control of noise generated from construction sites.

3.3.22 Annex E.3.2 refers to an assessment approach known as the 'ABC method'. This method is adopted to identify whether the level of construction noise impacting neighbouring residents is significant based on the existing pre-construction ambient noise level.

3.3.23 Primarily, the ABC Method requires the ambient noise level for the appropriate period (daytime, evening/weekends or night-time) to be measured and rounded to the nearest 5 dB. From this the relevant Category (A, B or C) can then be determined as shown in the table below.

Table E.1 Example threshold of potential significant effect at dwellings

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

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

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

3.3.24 To perform an assessment the category threshold value 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.

3.3.25 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.

3.3.26 It is noted that LOAEL and SOAEL in the NPSE are defined in terms of observed health effects based on the magnitude of the noise levels, i.e. absolute levels. In BS 5228, construction noise impacts are defined in terms of existing ambient noise level and change in noise levels. To date, there has been no official guidance published on how to reconcile these two methodologies.

4.0 BASELINE NOISE SURVEY

4.1 Survey Methodology

4.1.1 Sound levels were measured over a period from 21 March – 26 March 2025 at three locations selected to represent the closest noise-sensitive receptors to the Site.

4.1.2 A location plan illustrating the representative baseline noise monitoring locations is provided in Figure 3.

4.1.3 Measurements were undertaken with reference to the guidance presented within BS 7445 and BS 4142.

4.2 Instrumentation

4.2.1 The following instrumentation was used for the noise measurements:

Manufacturer	Description	Type	Serial Number	Date of Last Calibration
Cirrus	Class 1 Integrating Sound Level Meter	Optimus 1710 Optimus 1710 Optimus 1710	G300592 G078475 G305976	27/06/2024 13/05/2024 11/09/2024
Cirrus	Class 1 Acoustic Calibrator	CR:515	78061	13/05/2024

4.2.2 During the survey the microphones were protected with suitable outdoor windshields and mounted on tripods.

4.2.3 At all monitoring locations the equipment microphone was installed in 'free field' conditions (no vertical reflective surfaces within 3.5 metres of the microphone) and at a height of between 1.2 – 1.5 metres above ground level.

4.2.4 The following set-up parameters were used:

- Time Weighting: Fast
- Frequency Weighting: A
- Averaging-Integrating Period: 15 min
- Data Logging: Repeat (Contiguous)
- Resolution: 1 second

4.2.5 The measurement systems had been calibrated to traceable standards within the previous 24 months, and the hand-held calibrator within the previous 12 months.

4.2.6 The sound level meters were calibrated with the electronic calibrator prior to commencement and on completion of the survey. No significant drift in calibration was observed. Calibration certificates are available upon request.

4.3 Meteorological Conditions

4.3.1 Weather observations were made when in attendance on site during equipment installation and again on equipment collection. During site attendance on Friday 21 March 2025, conditions were dry and cloudy (8 Oktas). Windspeeds were in the range 4-5 ms^{-1} and with average air temperatures ranging from 15°C to 18°C. Relative humidity was 51%.

4.3.2 Weather conditions for the unattended measurement period have been obtained from publicly available meteorological data held on Wunderground.com for weather station ID:ICLEAT3. This weather station is located at Blind Lane, just south of Cleator Moor Bowling Club, approximately 1.2 kilometres north of the redline boundary of the Site.

4.3.3 Weather underground classifies each station with a 'gold standard' based upon the quality of the data submitted across a consecutive 5-day period. Although the station is not an aviation routine weather report (METAR) generating station, the data for the survey period passed Wunderground's quality control process and is therefore as reliable as data that would have been obtained from a consumer level weather station deployed in the vicinity of the Site.

4.3.4 Conditions during 21 March were generally unsettled with occasional rainfall and average windspeeds approaching and exceeding 5 ms^{-1}. Periods of rainfall were noted during the morning and afternoon of 23 March with the remaining period characterised by drier conditions and windspeeds generally below 4 ms^{-1}. Noise measurement data corresponding to the periods of rainfall and high winds were removed from the data analysis.

4.3.5 A graphical summary of windspeeds and precipitation rate during the extended survey are presented in Figure 4.

4.4 Survey Locations

4.4.1 The survey locations used to establish the typical background sound levels at the nearest NSRs were chosen to represent areas residents are likely to use for outdoor relaxation. On this basis, locations representative of the external amenity space of the nearest residential properties were selected.

4.4.2 The measurement locations were deemed to be sufficiently removed from the local road network and not adversely affected by noise from other commercial and industrial developments in the area.

4.4.3 The survey locations and a description at each site are listed in the table below and illustrated in Figure 3:

Location ID	Name	Grid Reference		Description
		X	Y	
ML1	Havenley, Dalzell Street	300713	514167	On grass in garden of property. Representative of High Lodge. The receptor was visible from this location.
ML2	Thorney Howe, Hollins Park	300553	514035	On grass, at south-east corner of garden.
ML3	East of Railway Embankment	300954	513758	On grass to the east of old railway embankment and east of lodge/stable sheds. Surrogate background location representative of The Old Vicarage / Church House.

4.4.4 It was not possible to undertake noise measurements directly at the properties High Lodge and The Old Vicarage/Church House as the residents were not at home at the time of the survey. Two surrogate locations were chosen (ML1 & ML3) to be representative of these receptors.

4.5 Description of the Ambient Noise

4.5.1 A description of the subjective ambient noise conditions at the survey locations are as follows:

- ML1: During the periods of attendance, contributions were noted from livestock in nearby fields, birdsong and leaf rustle. Other sounds included very occasional vehicle pass-bys on Dalzell Street.
- ML2: During the periods of attendance, contributions were noted from birdsong and leaf rustle. Other sounds included a constant and distant road traffic noise from the south-west, occasional livestock in nearby fields and occasional domestic sounds.
- ML3: During the periods of attendance, contributions were noted from constant and distant road traffic noise from the south-east, birdsong and leaf rustle.

4.6 Baseline Survey Results

4.6.1 The measurement data collected during the survey is summarised in the following table for the time periods relevant to this assessment.

Monitoring Location	Time Period		Ambient Sound Level Average $L_{Aeq,T}$ dB	Background Sound Level $L_{A90,T}$ dB	
				Average	Mode
ML1 Havenly	Daytime (Construction)	07:00 – 1900	46.9	n/a	n/a
	Daytime (Operation)	07:00 – 23:00	46.2	37.1	37.3

Monitoring Location	Time Period		Ambient Sound Level Average $L_{Aeq,T}$ dB	Background Sound Level $L_{A90,T}$ dB	
				Average	Mode
	Night-time (Operation)	23:00 – 07:00	39.0	29.3	23.2
ML2 Thorney Howe	Daytime (Construction)	07:00 – 1900	50.9	n/a	n/a
	Daytime (Operation)	07:00 – 23:00	49.9	36.4	37.7
	Night-time (Operation)	23:00 – 07:00	41.1	27.4	25.7
ML3 East of Railway Embankment	Daytime (Construction)	07:00 – 1900	43.6	n/a	n/a
	Daytime (Operation)	07:00 – 23:00	43.3	38.4	39.6
	Night-time (Operation)	23:00 – 07:00	38.7	31.2	28.2

4.6.2 In accordance with the guidance presented within BS4142, when determining appropriate Rating Level target criteria, the collected background measurement data has been analysed to derive typical daytime and night-time background $L_{A90,T}$ levels applicable at adopted assessment locations.

4.6.3 After reviewing the noise data collected during the baseline survey, the background sound levels during the night-time are considered to be very low i.e., below 30 dB $L_{A90,T}$. BS 4142:2014 advises that caution should be exercised in situations where the background sound levels are less than 10 dB above the noise floor of the measurement equipment.

4.6.4 The Cirrus Optimus 1710 with a Class 1 MK:224 pre-polarized microphone and MV:200 pre-amplifier has a noise floor of less than 18 dB(A). Taking the advice presented in BS 4142 and where the derived modal background sound level at any receptor is less than 28 dB(A), the target criterion be set at the level of the equipment noise floor plus 10 dB(A).

4.6.5 It should be noted that an external absolute noise limit of 28 dB $L_{Aeq,T}$ is 2 dB(A) lower than the indoor ambient noise target for good sleeping conditions as described in BS 8233:2014. In situations where residents are likely to be indoors sleeping with windows partially open during the night, this criterion noise level is appropriate.

4.6.6 The background sound levels to be adopted in the assessment of fixed plant noise during the operational phase rounded to the nearest integer are presented in the following table.

Receptor ID	Nearest Noise-Sensitive Premises	Representative Background Sound Level $L_{A90,T}$ (free-field) dB	
		Daytime 0700 - 2300	Night-time 2300 - 0700
NSR1	High Lodge	37	28
NSR2	Thorney Howe / Willow Howe / Meadow Howe	38	28
NSR3	The Old Vicarage / Church House	40	28

5.0 POTENTIAL NOISE EMISSIONS

5.1 Introduction

5.1.1 The level of noise in the local environs that arises from a site will depend on a number of factors. The more significant of which are:

- The sound level output of the plant or equipment used on site.
- The periods of operation of the plant on site.
- The distance between the source noise and the receiving position.
- The presence of screening due to barriers.
- The reflection of sound.
- Soft ground attenuation.

5.1.2 Noise levels during the construction phase and throughout the operational lifetime of the Site have been calculated at the identified assessment locations based on the following methodologies and assumptions.

5.2 Construction Phase

5.2.1 Construction of the development would typically take six months. At this stage it is proposed that construction activities on site would take place between the hours of 07:00 – 19:00 on weekdays, and 08:00 – 13:00 on Saturdays. No construction related activity would take place on Sundays or bank holidays. Any works outside of these hours would be limited to emergency works, unless otherwise agreed in writing with the Council.

5.2.2 The construction of the Proposed Development would be conducted in accordance with a Construction and Environmental Management Plan (CEMP) to manage activities and ensure there are no significant environmental effects.

Calculation Methodology

5.2.3 An estimate of the likely significant effects of noise from the construction activities has been made for a sample of local receptors in the vicinity of the Site. The predictions are based on the methodology contained within BS 5228-1:2009+A1 2014 '*Code of practice for noise and vibration control on construction and open sites. Part 1: Noise*'. The resultant noise levels are in terms of the Equivalent Continuous Sound Level, $L_{Aeq,T}$ over the core working day. The predictions are worst case in that it is assumed that any secondary measures have not been implemented.

Noise source Details

5.2.4 At this stage, full details of construction activities, methods and timescales are not available. The assessment of potential impacts therefore relies on outline construction information available at this stage. To adequately determine the potential magnitude of impact and associated mitigation measures, it is appropriate to undertake a quantitative assessment based on a number of informed worst-case assumptions.

5.2.5 Based on our experience of similar projects, the construction programme is likely to consist of the following principal operations:

- Site preparation and earthworks.
- Installation of substation and associated compound.
- Construction of bases for battery containers and associated infrastructure.
- Excavation of cable trench.
- Installation of battery containers.
- Installation of inverter/transformer cabins.
- Connection of electrical power.
- Testing and commissioning.
- Provision of landscaping including perimeter fencing.

5.2.6 Assumed construction stages and associated operations and plant to be employed have been determined with consideration given to the plant information provided in Appendix B. The table also contains various assumptions regarding activity 'on-time' and the likely number of on-site vehicle movements. The sound level data used to represent each construction noise source under assessment has been taken from Annex C of BS 5228 which presents current sound level data on specific items of site equipment and site activities.

5.2.7 All predictions have been calculated with the combinations of plant working at the closest point to each assessment location. They are therefore worst-case scenarios which may be of relatively short duration. However, they indicate the highest noise level to which a particular property or group of properties may be exposed during the working of the Site. The worst-case situation may occur intermittently over the lifetime of the construction phase, but longer term noise levels perceived outside of the Site boundary would normally be significantly less.

Construction Noise sensitive Receptors

5.2.8 The chosen receptors include the dwellings in the immediate vicinity of the proposed temporary works. These include the receptors in the vicinity of the electricity distribution site at Woodend, receptors along the cable route and the receptors in the vicinity of the BESS site. The construction NSRs are illustrated on Figure 5.

Calculation Results

5.2.9 The following table summarises the results of the noise level predictions at the identified assessment locations.

Construction Noise Sensitive Receptor ID	Assessment Location	Predicted Worst-case Construction Phase Noise Level $L_{Aeq,T}$ dB
CNSR 1	Croft End House, Woodend	77
CNSR 2	Station House, Woodend	74
CNSR 3	Railway Siding Woodend	68
CSNR 4	Woodend Farm	63
CNSR 5	High Lodge	51
CNSR 6	Thorney Howe / Willow Howe / Meadow Howe	48
CNSR 7	The Old Vicarage / Church House	53

5.3 Operational Phase

Calculation Methodology

5.3.1 In order to assist in the calculation of predicted noise levels from the energy storage facility, CadnaA noise modelling software has been used. The noise prediction software has been configured to undertake the noise calculations in accordance with ISO 9613 'Acoustics - Attenuation of sound during propagation outdoors'. Noise model configuration details are outlined in Appendix C.

5.3.2 Within the model, BESS units have been modelled as noise-generating buildings using vertical and horizontal area sources. Point sources have been used to represent transformers and inverters (Medium Voltage Power Station).

5.3.3 The predictions made by the modelling software are for 'free-field' sound levels to allow for an appropriate comparison with the free-field background sound levels measured during the survey.

5.3.4 The convention applied within BS 4142, and throughout this report, is that all measured or calculated values in the industrial noise assessment are rounded to the nearest integer.

Noise source Details

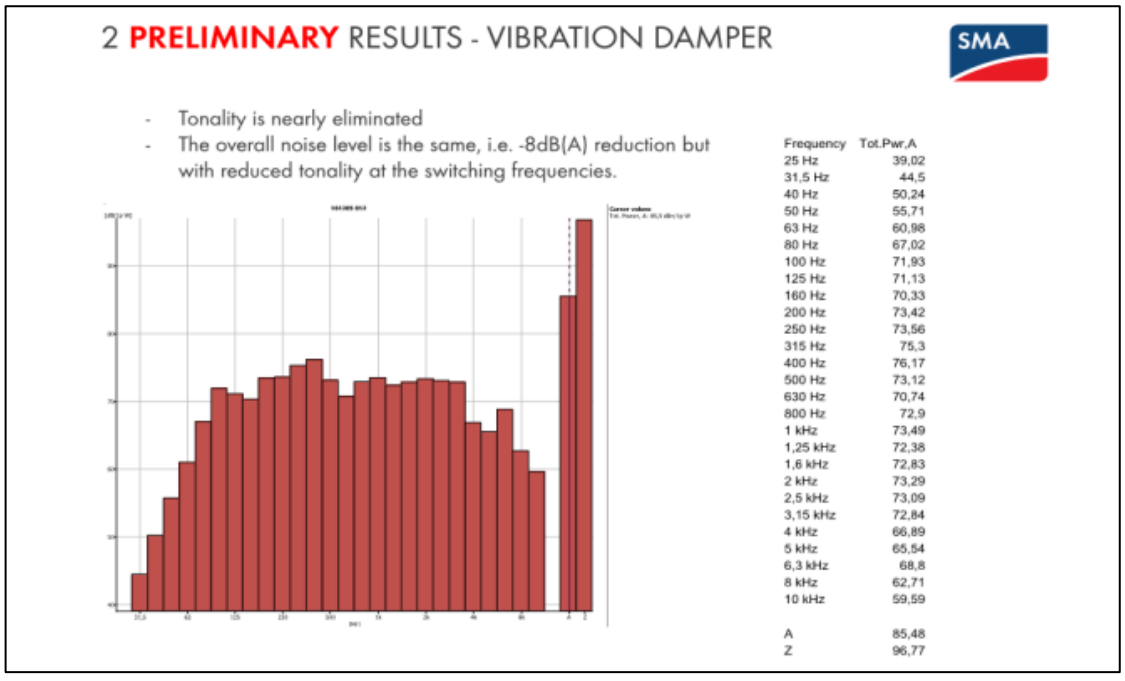
5.3.5 The sound levels used within this assessment are based on detailed noise test data provided by the manufacturer of the equipment and available online.

5.3.6 The BESS Compound comprises two main equipment areas, which include the battery unit deployment area and the on-site High Voltage step-up substation within the north-east of the compound. Noise levels from the sub-station are considered to be insignificant when compared to the operational sound power of the proposed battery storage and MV power station.

5.3.7 The Site will accommodate 8 PCS units and 16 containerised energy storage units using high cycle capacity lithium iron phosphate (LFP) battery cells. A single transformer will be located externally at ground level.

5.3.8 The information provided indicates that the PCS units will be from the SMA MV Power Station range fitted with appropriate dampeners to reduce overall noise emissions.

5.3.9 The following figure illustrates the A-weighted one third octave band centre frequency data for the SMA MV Power Station. Analysis of the one third octave band information indicates an absence of tonal content in the noise emissions.



5.3.10 The proposed energy storage units are the SolBank 3.0 energy storage system type S-5016-2H-NA|S-5016-4H-NA. These have an A-weighted sound pressure level of less than 75 dB(A) at 1 metre with software controlled noise reduction.

5.3.11 The main noise producing components associated with the SolBank 3.0 units are the chiller units used to power the liquid cooling system for the whole container.

5.3.12 The sound power (Lw) spectrum data for the fixed plant adopted in the noise model predictions is presented in Appendix C, Table C-1.

5.3.13 It is assumed that all plant is operating, simultaneously and continuously over the appropriate reference period to ensure that a worst-case scenario is assessed. Due to the ambient air temperatures is the UK, there is typically no requirement for the fan systems associated with the proposed plant to operate at 100% of their maximum rated speed. When fans operate at lower speeds there is a corresponding reduction in the emitted sound level.

5.3.14 Based on the worst-case assumption that ambient temperatures at the proposed Site would not exceed 35°C, noise test data for fan units operating at the 100% relative to their maximum rated speeds have been obtained for similar units installed at the Coalburn 2, South Lanarkshire site.

Calculation Results

5.3.15 The following table summarises the results of the noise level predictions at the identified assessment locations. As the units may operate continuously across the 1-hour daytime and 15-minute night-time reference periods the results are the same for both day and night regardless.

5.3.16 The daytime results are reported for an external receptor at 1.5 metres above ground level. For the night-time noise level predictions, the receiver is taken at 1st floor, i.e. 4.0 metres above ground level.

Receptor ID	Assessment Location	Calculated Specific Sound Level L_{sr} (free-field) dB	
		Daytime	Night-time
NSR1	High Lodge	31	33
NSR2	Thorney Howe / Willow Howe / Meadow Howe	27	29
NSR3	The Old Vicarage / Church House	34	35

6.0 ASSESSMENT

6.1 Construction Noise

6.1.1 Based on the results of the noise survey, and with reference to the 'ABC method' detailed in Annex E.3.2 of BS 5228, the table below specifies a threshold level at noise-sensitive premises above which there could be significant effect during the construction phase of the development.

6.1.2 Noise sensitive receptors in the vicinity of the electricity distribution site at Woodend have been assigned the lowest threshold category based upon the likely ambient noise levels at these locations. Although baseline noise measurements have not been completed near these receptors, it is conservative to assume the lowest category based on daytime ambient noise levels being similar to those in the north of the scheme, i.e. being below 62.5 dB $L_{Aeq,T}$.

Receptor ID	Assessment Location	Daytime Ambient Noise Level dB(A)	Rounded to nearest 5 dB	Category	Threshold Level dB(A)
CNSR 1	Croft End House, Woodend	<62.5 *	60	A	**65**
CNSR 2	Station House, Woodend	<62.5 *	60	A	**65**
CNSR 3	Railway Siding Woodend	<62.5 *	60	A	**65**
CSNR 4	Woodend Farm	<62.5 *	60	A	**65**
CNSR 5	High Lodge	47	45	A	**65**
CNSR 6	Thorney Howe / Willow Howe / Meadow Howe	51	50	A	**65**
CNSR 7	The Old Vicarage / Church House	44	45	A	**65**
* Based on the daytime ambient noise levels at the receptors in the north, it is assumed that those receptors at Woodend will also have a daytime ambient noise level below 62.5 dB(A) i.e. falling within the lowest Threshold Category A as per BS 5228-1.					

6.1.3 To avoid potential significant effects it is therefore recommended that the construction site noise level should not exceed the relevant threshold level. The threshold values relate to the average site noise level ($L_{Aeq,T}$) over the duration of the working day.

6.1.4 The following table presents an assessment of construction noise to determine if there could be a potential significant effect at both existing and proposed dwellings in the vicinity of the Site. Where construction noise levels do not exceed the threshold, the potential impacts are not considered to be significant.

Receptor ID	Calculated Worst Case Construction Noise Level $L_{Aeq,T}$ dB	Threshold Value	Threshold Criterion Exceeded
CNSR 1	77	65	**Yes**
CNSR 2	74	65	**Yes**
CNSR 3	68	65	**Yes**
CSNR 4	63	65	**No**
CNSR 5	51	65	**No**
CNSR 6	48	65	**No**
CNSR 7	53	65	**No**

6.1.5 This assessment demonstrates that during worst case construction activities and when they are undertaken in the vicinity of the receptors at Woodend the predicted worst case construction noise levels are likely to exceed the recommended threshold values. These include the receptors Croft End House, Station House and Railway Siding. In the case of Croft End House the excess of the threshold value is predicted to be 12 dB. For Station House and Railway Siding, the excesses are 9 dB and 3 dB respectively. These noise levels are the worst-case scenario and have not taken account of the proposed mitigation measures to be applied during construction, as detailed in Section 6 below.

6.1.6 The worst case construction phase in terms of noise generation is predicted to occur during cable trench formation. This is expected to pass close to the receptors at Woodend. For the remaining construction phases, the construction noise levels are not predicted to exceed the threshold values.

6.1.7 All other assessment locations are expected to meet the threshold criterion for the entirety of the construction phase.

6.1.8 It is recommended that the use of the above threshold values as strict compliance limits should be avoided. It is suggested that any identified exceedance of the above threshold values should not ultimately prevent works progressing or result in undue restrictions being placed upon the development but instead present the site operator and local authority with an opportunity to review the noise controls in place and ensure that all possible measures to avoid unnecessary noise are being taken in accordance with best practicable means.

6.2 Operational Noise

6.2.1 This assessment has been undertaken with reference to the guidance provided within BS 4142.

6.2.2 This standard requires the following levels to be established:

- The Background Sound Level
- The Specific Sound Level
- The Rating Level

Background Sound Level

6.2.3 BS 4142 requires the quantification of typical background sound levels at locations representing the noise-sensitive receptors. The results of the noise monitoring survey are presented in Section 3 of this report.

Specific Sound Level

6.2.4 The specific sound level has been determined by calculation following the guidance within Section 7 of BS 4142. The method of calculation is explained in Section 4 of this report.

Rating Level

6.2.5 In determining the Rating Level it is recognised that certain acoustic features can increase the significance of noise impact.

6.2.6 Noise emissions associated with operations at the Site are not considered to contain any significant tonal, impulsive or intermittent features and it is therefore not considered necessary to apply an acoustic feature correction to the specific sound levels.

6.2.7 The predominant noise sources associated with the plant are cooling fans which have broadband characteristics and, whilst the plant does cycle between operation and standby modes, any potential intermittency is unlikely to occur within the respective reference time intervals.

6.2.8 BS 4142 states that if there are no acoustic features present or expected to be present, the rating level is equal to the specific sound level.

Initial Estimate of Impact

6.2.9 The following table presents an 'initial estimate' of the likely impact of the Proposed Development during the daytime in accordance with BS 4142.

Assessment Location	Background Sound Level ($L_{A90,T}$ dB)	Specific Sound Level (L_s dB)	Acoustic Feature Correction (dB)	Rating Level ($L_{Ar,Tr}$ dB)	Initial Estimate Excess of rating over background sound level (dB)
NSR1: High Lodge	37	31	0	31	**-6**
NSR2: Willow Howe	38	27	0	27	**-11**
NSR3: Church House	40	34	0	34	**-6**

6.2.10 The following table presents an 'initial estimate' of the likely impact of the Proposed Development during the night-time in accordance with BS 4142.

Assessment Location	Background Sound Level ($L_{A90,T}$ dB)	Specific Sound Level (L_s dB)	Acoustic Feature Correction (dB)	Rating Level ($L_{Ar,Tr}$ dB)	Initial Estimate Excess of rating over background sound level (dB)
NSR1: High Lodge	28	33	0	33	**+5**
NSR2: Thorney Howe	28	29	0	29	**+1**
NSR3: Church House	28	35	0	35	**+7**

6.2.11 Typically, the greater the difference between the rating level and the background sound level, the greater the magnitude of the impact. BS 4142 states that where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. A difference of around +10 dB or more is likely to be an indication of a 'significant adverse' impact, depending on the context.

6.2.12 During the daytime the operation of the proposed development is likely to result in a low impact at the nearest noise sensitive receptors. During the night-time the predicted impact is likely to result in a low likelihood of adverse impact at the group of receptors at Thorney Howe. The operation of the fixed plant, without the proposed mitigation as set out in Section 5, is likely to result in an adverse impact at High Lodge and Church House/The Old Vicarage depending upon the context.

Context

6.2.13 BS 4142:2014 advises the initial estimated impact should be considered within the context of the Site and the surrounding acoustic environment. Factors including the absolute level of the sound, its characteristics and the sensitivity of the receptor can contribute to the modification of the initial impact where appropriate.

6.2.14 The character of the noise from the operational fixed plant has been discussed and is unlikely to possess characteristics such as tonality, impulsivity and intermittency.

6.2.15 When compared to the existing baseline noise levels at each receptor during the night-time the predicted specific noise level at the nearest receptor (NSR3) is more than 5 dB(A) lower. The introduction of the new noise source is likely to raise the baseline ambient noise by 1 dB. A change in noise level of 1 dB(A) is only just perceptible under laboratory conditions with 3 dB(A) being lowest change that is perceptible under environmental conditions. In summary the operational noise is unlikely to draw the attention of the nearest receptors when in outdoor areas of their property and the likely change in the ambient noise level at the nearest receptors would be considered negligible.

6.2.16 When considering noise generated by the fixed plant during the night-time, residents are likely to be indoors resting or sleeping with windows open. The BS 4142 assessment would indicate that the noise impact within a dwelling would be the same regardless of the façade construction of the nearest proposed noise sensitive receptors.

6.2.17 Assuming that a partially open window affords approximately 13 dB(A) reduction from a free field external noise level, the worst case absolute noise level of 35 dB $L_{Aeq,T}$ outside the bedroom window of Church House would result in an internal noise level of 22 dB(A). This is approximately 8 dB(A) below the indoor night-time noise criterion of 30 dB $L_{Aeq,T}$ for bedrooms as recommended in BS 8233:2014.

6.2.18 Considering the above points revision of the initial estimate of impact using context as described in BS 4142 is not proposed.

6.2.19 In accordance with the methodology in BS 4142:2014 + A1:2019, uncertainty and its potential effects on the acquisition of data and subsequent calculations is presented in Appendix D.

6.2.20 Consideration to specific mitigation for the construction and operational phases detailed above is discussed in Section 6.

7.0 MITIGATION

7.1 Construction Noise Mitigation

7.1.1 Generic safeguards exist to minimise the effects of construction noise, these include:

- The various EC Directives and UK Statutory Instruments that limit noise emissions of a variety of construction plant; and
- The powers that exist for local authorities under Sections 60 and 61 of the Control of Pollution Act 1974 to control noise from construction sites.

7.1.2 The adoption of Best Practicable Means (BPM), as defined in Section 72 of the Control of Pollution Act 1974, is usually the most effective means of controlling noise from construction sites. Such measures will be included within a Construction Environmental Management Plan (CEMP), to be secured by way of planning condition, and may include the following:

- Maintaining good public relations with local residents that may be affected by noise and vibration from construction works. Effective communication should be established, keeping local residents informed of the type and timing of works involved. Effective methods of keeping local residents informed include leaflet drops, posters, public meetings, and exhibitions.
- Provision of contact details for a site representative so that noise and vibration complaints arising from construction works are dealt with pro-actively and that subsequent resolutions are communicated to the complainant.
- All site staff would receive appropriate periodic environmental training throughout the construction period.
- Night-time working would be avoided where possible.
- Careful planning of construction activities and selection of plant to reduce noise emissions.
- The use of temporary acoustic barriers where appropriate.
- Locating static noisy plant in use as far away from sensitive receptors as is feasible for the particular activity.
- Using suitable equipment and ensuring such equipment is properly maintained and operated by trained staff.
- Using silenced equipment where possible, in particular silenced power generators if night-time power generation is required for site security or lighting.
- Vehicles and plant to be properly maintained and operated according to manufacturers' recommendations, in such a manner as to avoid causing excessive noise.
- Engine compartments should be closed when equipment is in use and the resonance of body panels and cover plates reduced through the addition of suitable dampening materials.
- Where practicable, rubber linings would be used on chutes and dumper trucks, etc.
- Ensuring plant machinery is turned off when not in use.

- Speed limits on access roads or tracks for HGVs.
- Care to be taken regarding the needs for reversing alarms, where possible, install non-tonal alarms.
- The gradient of any temporary haul road or track connecting work areas to the road network to be kept to a minimum.
- Deliveries would be programmed to arrive during daytime hours only.
- Drop heights would be minimised when loading/unloading vehicles.
- Ensuring that vehicles do not park or queue for long periods outside sensitive receptors with engines running unnecessarily.
- Generators required for 24-hour operation should be silenced and/or screened as appropriate.
- Problems concerning noise from construction works can often be avoided by taking a considerate and neighbourly approach to relations with local residents.

7.1.3 In addition to the above measures, it is proposed that the Development be registered to the Considerate Constructors Scheme (CCS) to further ensure that any potential negative effects are minimised.

7.1.4 Through the provisions of the Section 60 and 61 of the Control of Pollution Act 1974, the local authority has means of controlling construction noise where they consider that an unacceptable noise nuisance is being generated or could be generated by the works.

Residual Impacts

7.1.5 It is difficult to quantify the overall sound reduction that could be achieved through the implementation of multiple recommended mitigation measures identified above. However, an approximation to the likely attenuation can be realised through some basic acoustic principles that would apply following implementation of the recommended measures such as:

- Distance attenuation - up to 6 dB reduction per doubling of distance.
- Up to 5 dB attenuation for partial screening.
- Up to 10 dB attenuation for complete screening.
- Through the use of quiet plant.

7.1.6 It is expected that the recommended mitigation could reduce source noise levels at some locations for some periods of activity by 5 to 10 dB.

7.1.7 Where construction activities are undertaken close to the existing noise sensitive receptors (i.e. worst case operations), or where particularly noisy operations are undertaken (e.g. road breaking and excavations), it is anticipated that the impact magnitude at receptors at Woodend (CNSR1 to CNSR3) will range from small to medium.

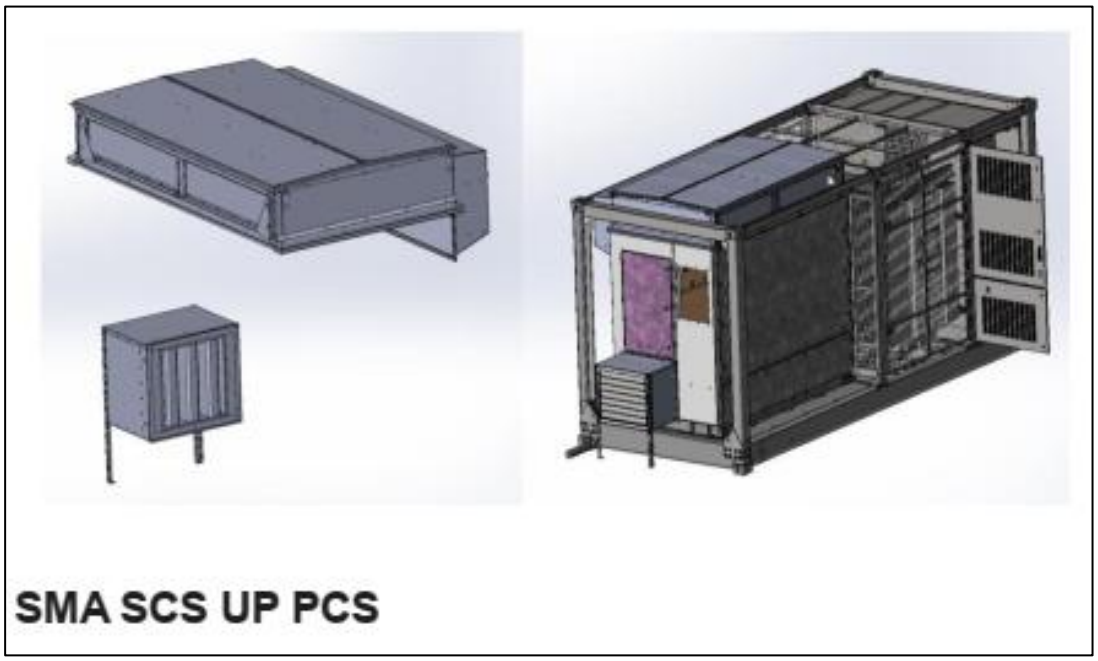
7.1.8 Where construction works take place adjacent to existing dwellings, large impacts may remain even after the implementation of recommended mitigation measures. However, impacts will be temporary and are likely to be of short duration.

7.2 Operational Noise Mitigation

7.2.1 The worst case assessment has identified that the operational use of the fixed plant during night-time periods may lead to noise levels resulting in adverse impacts at the nearest NSRs. Mitigation will be required to reduce the rating level.

7.2.2 The SolBank 3.0 units can utilise software to reduce operational noise by up to 5 dB(A). The software incorporates noise reduction modes which includes noise reduction for the active chiller speed at ambient temperatures equal to and below 35.0°C. In addition there are silent modes for the active fan speed.

7.2.3 If required, there are optional accessories for the battery inverter component of the PCS unit that can reduce the overall noise by a further 6 dB(A). The following figure illustrates the silencer kit (Left diagram) and installed to the inverter component side.



7.2.4 Assuming the software control is implemented for the proposed SolBank 3.0 units the previously prepared 3D acoustic model has been updated to incorporate a 5 dB(A) attenuation for the SolBank 3.0 units. The following table presents the BS 4142 assessment for the 'with mitigation' night-time scenario using software control.

Assessment Location	Background Sound Level ($L_{A90,T}$ dB)	Specific Sound Level (L_s dB)	Acoustic Feature Correction (dB)	Rating Level ($L_{Ar,Tr}$ dB)	Initial Estimate Excess of rating over background sound level (dB)
NSR1: High Lodge	28	30	0	30	**+2**
NSR2: Thorney Howe	28	27	0	27	**-1**
NSR3: Church House	28	33	0	33	**+5**

7.2.5 With the implementation of software control of the chillers and fans, a worst case predicted assessment level of adverse impact is estimated at Church House (NSR3). At the remaining receptors the predicted impacts range from low impact to low likelihood of adverse impact.

7.2.6 BS 4142 advises that adverse impacts include, but are not limited to, annoyance and sleep disturbance. The Standard goes on to state that:

"*Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact*."

7.2.7 The following 'with mitigation' scenario incorporates the software control presented above together with the addition of the silencer kits to the PCS units.

Assessment Location	Background Sound Level ($L_{A90,T}$ dB)	Specific Sound Level (L_s dB)	Acoustic Feature Correction (dB)	Rating Level ($L_{Ar,Tr}$ dB)	Initial Estimate Excess of rating over background sound level (dB)
NSR1: High Lodge	28	28	0	28	**0**
NSR2: Thorney Howe	28	24	0	24	**-4**
NSR3: Church House	28	30	0	30	**+2**

7.2.8 With the implementation of both software and physical attenuation methods, a worst case predicted assessment level of low likelihood of adverse impact is estimated at Church House (NSR3).

7.2.9 When considering the absolute noise level from the operational fixed plant during the night-time, and the reductions afforded by a partially open window, the likely indoor fixed

plant noise level at Church House will be approximately 17 dB(A). This is 12 dB lower than the indoor night-time noise criterion of 30 dB $L_{Aeq,T}$ for bedrooms as recommended in BS 8233:2014. At this level, noise from the operational fixed plant will be inaudible within the dwellings, and there is unlikely to be a change in behaviour, attitude or other physiological response from the residents in the vicinity of the development. As a result, there is no requirement for additional mitigation beyond that described above to offset the residual impacts.

7.2.10 At the remaining receptors the predicted impacts are likely to result in a low impact.

7.3 Significance in terms of Effect Levels (NOAEL, LOAEL and SOAEL)

7.3.1 Based on the above assessment and with reference to the noise exposure hierarchy outlined in PPG-Noise which supports the NPPF and NPSE, it is suggested that noise during the operational phase is likely to be occasionally present at the nearest NSRs but not intrusive and therefore considered to be at or below the 'Lowest Observed Adverse Effect Level (LOAEL) boundary. At this level noise will have little effect as the exposure is unlikely to cause any change in behaviour, attitude or other physiological responses of those affected by it.

7.3.2 As a result, the Proposed Development is considered to be consistent with the aims of the NPSE and NPPF which seek to mitigate and minimise 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.

8.0 CONCLUSIONS

8.1 This assessment has been prepared for submission to Cumberland Council (CC) and has considered the potential impact of the Proposed Development during the construction and operational phases on the existing noise sensitive receptors.

8.2 A detailed baseline noise survey has been undertaken to characterise the residual and background sound levels at the nearest noise sensitive receptors to the Site. The results of the on-site surveys have been analysed to determine typical daytime background sound levels at the noise sensitive receptors.

8.3 Predictions of operational fixed plant noise and noise during the construction phase have been undertaken at the closest existing noise sensitive receptors to the Proposed Development.

8.4 Potential noise levels likely to be generated during the construction of the Proposed Development have been evaluated and assessed in accordance with the guidance presented within BS 5228-1. This assessment has shown that noise levels are likely to exceed the threshold level above which there could be significant effects during the construction phase of the Proposed Development.

8.5 An assessment of potential operational noise impact associated with the Proposed Development has been made following the guidance presented within BS 4142. Following an initial estimate of noise impact, along with consideration of the context and any potential effects of uncertainty, the Proposed Development is considered likely to result in not greater than 'adverse' impact at the nearby receptors.

8.6 To address the significant effects during the construction phase, generic mitigation controls have been presented together with the likely noise reductions realised at the receptors. It is anticipated that the impact magnitude at receptors at Woodend (CNSR1 to CNSR3) will range from small to medium, although impact of significant adverse may occur when works are undertaken at their closest point to these receptors. Impacts will be temporary and are likely to be of short duration.

8.7 Noise impacts of the Proposed Development have been considered at an early stage in the design of the scheme with adjustment made to the proposed site layout and the orientation of battery container units to minimise potential impacts on nearby residential dwellings.

8.8 Software control and physical attenuation methods of the SolBank 3.0 units and PCS units respectively have been explored to obtain sufficient overall noise reduction at the receptors. With a combination of methods implemented, the cumulative operational noise is not predicted to exceed a worst-case outcome of low likelihood of adverse impact at all assessed NSRs.

8.9 On this basis the Proposed Development is considered to be consistent with the aims of the NPSE and NPPF which seek to mitigate and minimise 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.

9.0 REFERENCES

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FIGURE 1

Redline Boundary Plan

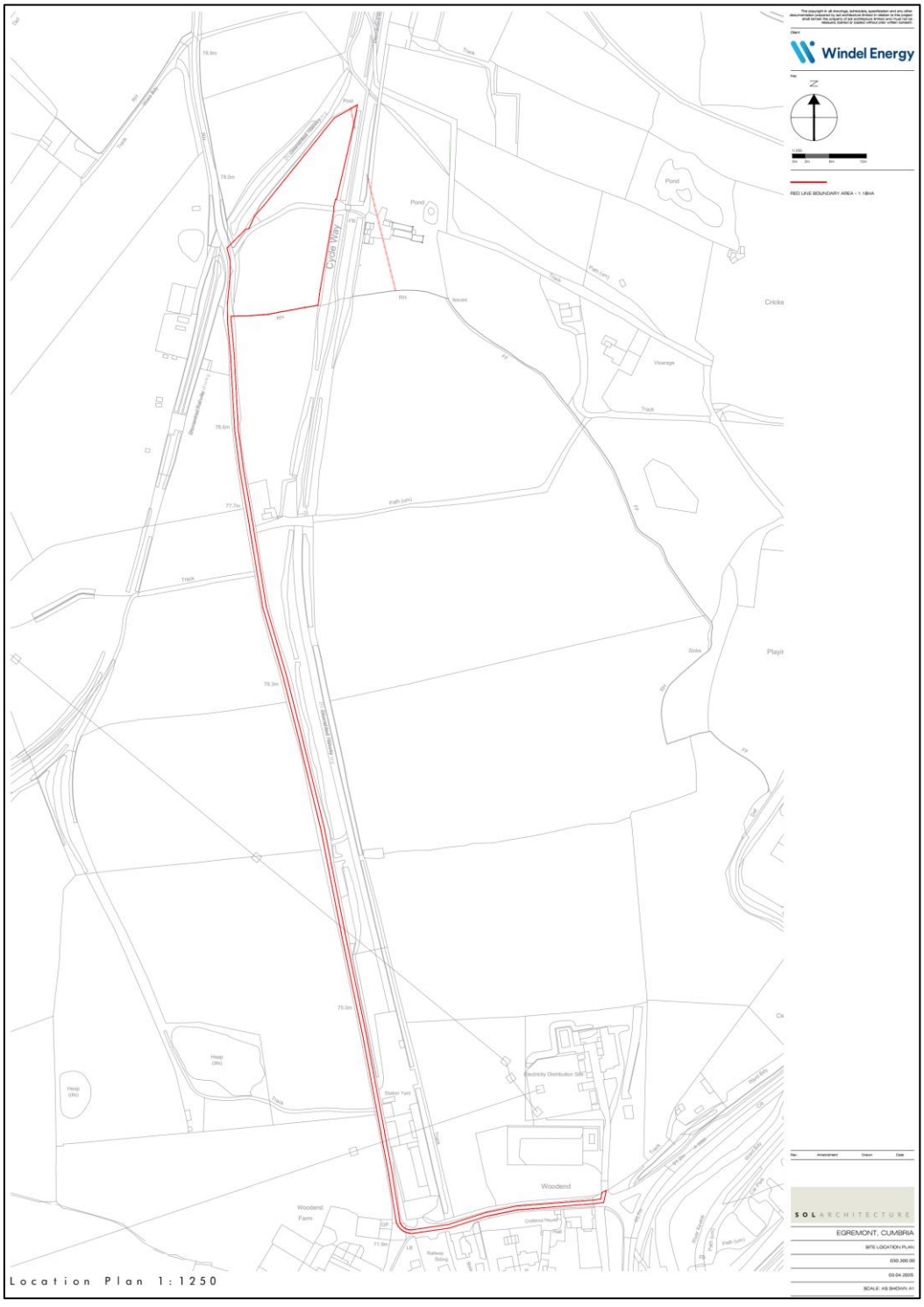


FIGURE 2

Proposed Site Layout Plan

FIGURE 3

Baseline Noise Measurement Locations

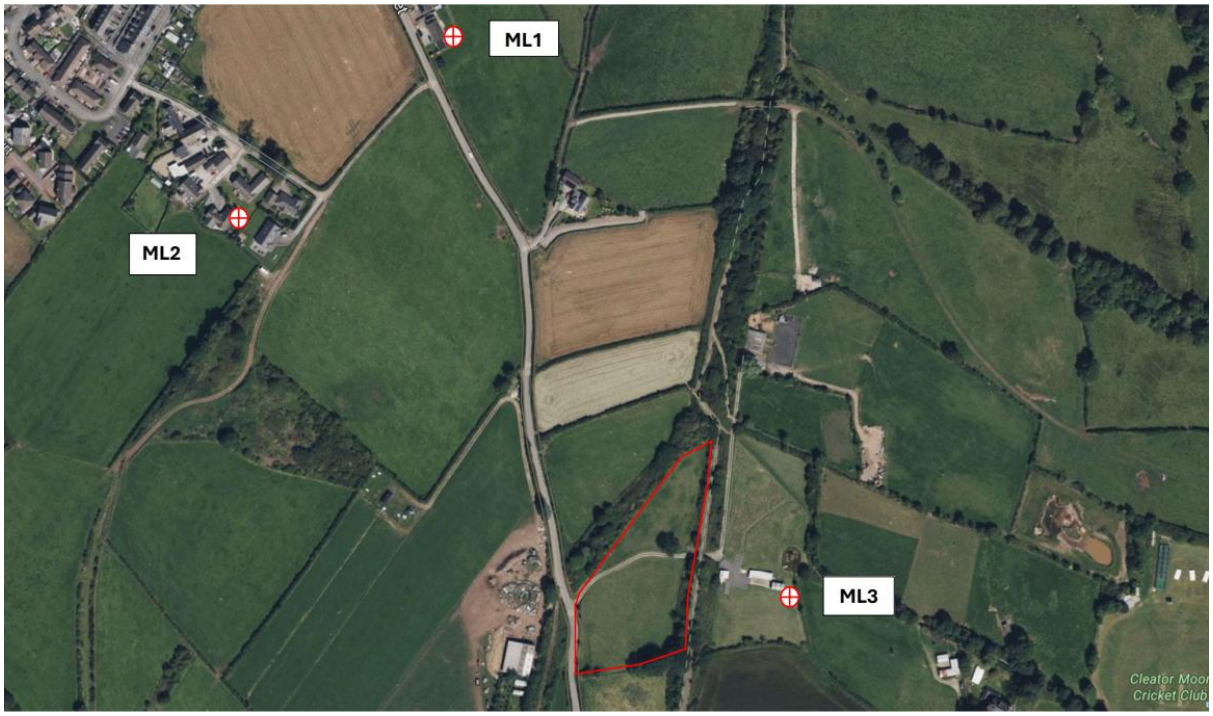


FIGURE 4

Meteorological Data, Weather Station ID:ICLEAT3, Cleator Moor

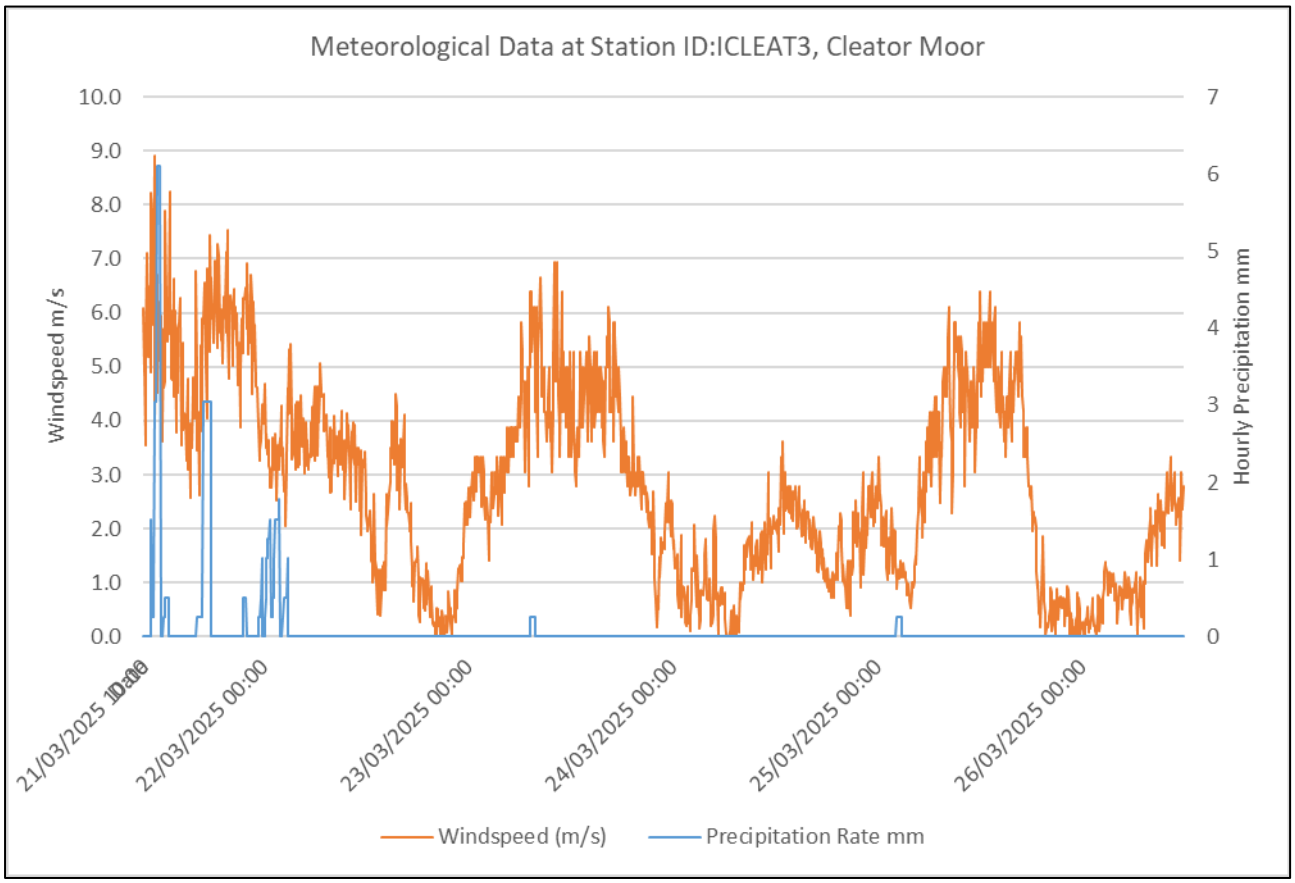
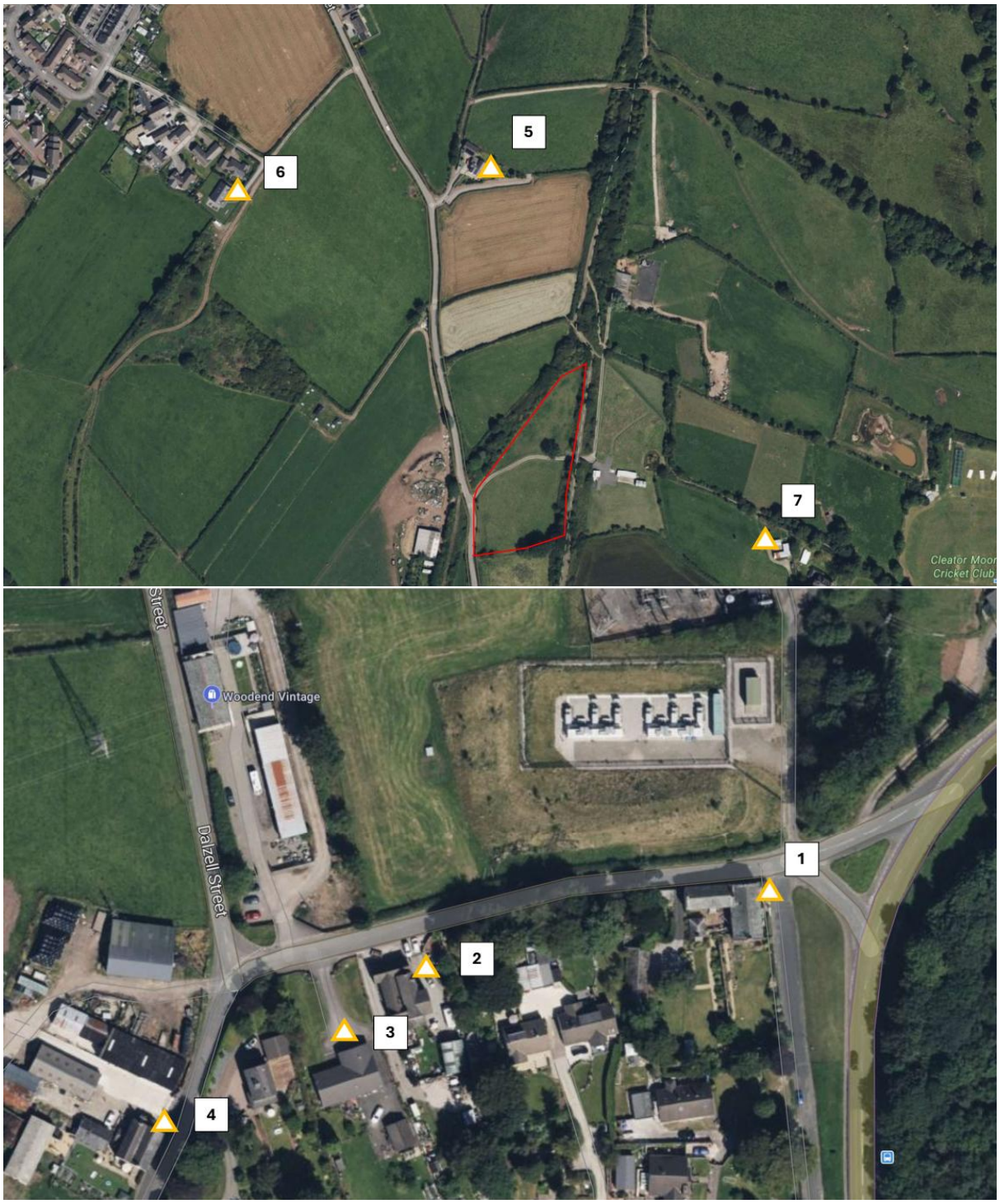


FIGURE 5

Construction Noise Sensitive Receptors



APPENDIX A

Acoustic Terminology

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure level. It is because of this wide range that a noise level scale based on logarithms is used in noise measurement. This is the decibel or dB scale.

Audibility of sound covers a range of about 0 to 140 decibels (dB) corresponding to the intensity of the sound pressure level. The ability to recognise a particular sound is dependent on the pitch or frequencies present in the source. Sound pressure measurements taken with a microphone cannot differentiate in the same way as the ear, consequently a correction is applied by the noise measuring instrument in order to correspond more closely to the frequency response of the ear which responds to sounds from 20 Hz to 20000 Hz. This is known as 'A-weighting' and written as dB(A).

The use of this unit is internationally accepted and correlates well with subjective annoyance to noise.

The logarithmic basis of noise measurements means that when considering more than one noise source their addition must be undertaken in terms of logarithmic arithmetic. Thus, two noise sources each of 40 dB(A) acting together would not give rise to 40 + 40 = 80 dB(A) but rather 40 + 40 = 43 dB(A). This 3 dB(A) increase represents a doubling in sound energy but would be only just perceptible to a human ear.

The following table gives typical noise levels in terms of dB(A) for common situations.

Approximate Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library
50	Quiet office, no machinery
60	Normal conversation
70	Inside a saloon car
80	Vacuum cleaner
100	Pneumatic drill
120	Threshold of pain

Noise levels can vary with time according to source activity and indices have been developed in order to be able to assign a value to represent a period of noise level variations and to correspond with subjective response.

The L_{Aeq} or A-weighted equivalent continuous noise level index is used to average the noise energy over a period of intermittent noise levels. It is the level of steady sound of equivalent energy and is usually referred to as the ambient noise level.

The L_{A90} index represents the noise level exceeded for 90% of the measurement period and is used to indicate the quieter sections of the measurement period. It is usually referred to as the background noise level.

The L_{Amax} index is the maximum root mean square A-weighted noise level occurring during the measurement period.

APPENDIX B

Noise Source Details – Construction Phase

Activity	Sound Power Level dB(A)	Data Source	Assumed On-time *
Excavator	104	BS 5228 Table C.2 Ref.15	75%
Dozer	107	BS 5228 Table C.2 Ref.13	50%
Compactor	108	BS 5228 Table C.2 Ref.37	25%
Tipping/Placing Materials	102	BS 5228 Table C.2 Ref.32	10%
Trenching	103	BS 5228 Table C.5 Ref.35	25%
Spreading	105	BS 5228 Table C.5 Ref. 12	25%
Concrete Mixing/Pumping	103	BS 5228 Table C.4 Ref.28	50%
Mobile Crane	99	BS 5228 Table C.4 Ref.41	25%
Fence Post Installation	96	BS 5228 Table C.3 Ref.20	50%
Concrete Mixer	96	BS 5228 Table C.4 Ref.24	25%
Telehandler	99	BS 5228 Table C.2 Ref.35	50%
Asphalt Paver	105	BS 5228 Table C.5.Ref.31	50%
Road Roller	103	BS 5228 Table C.5 Ref.20	25%
Diesel Generator	89	BS 5228 Table C.4 Ref.76	100%
HGV Movements	105	BS 5228 Table C.11 Ref.10	6 per hr Speed = 15mph

APPENDIX C

Acoustic Model Configuration Settings

The general configuration settings applied to the 3D acoustic model to account for noise generated by the operational plant at the Site are presented below.

Parameter	Input
Software	DataKustik GmbH CadnaA 2025 (build: 209.5501)
Calculation Standards/Guidelines	BS 5228-1:2009+A1:2014 (Construction) ISO 9613-2:2024 (Operation)
Model of Terrain	Triangulation
Max. Order of Reflection	2
Ground Attenuation	Spectral
Frequency Band Calculation	Octave Bands (63Hz – 8kHz)
Temperature and Rel. Humidity	10°C / 70%
Topographic data	3D contour data – 2.0m DTM EA LiDAR
Ground Absorption	Default 1.0 (Resolution 1.0m) 0.6 for application site – assuming 20mm stone/gravel and asphalt for vehicle routes
Receiver Heights	Daytime 1.5m a.g.l – ground floor/gardens, Night-time 4.0m a.g.l – bedroom windows

Table C-1

Sound Power Levels of Operational Fixed Plant Used in the 3D Acoustic Model

Equipment	Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
SMA MV Power Station 4000-S2 / 4200-S2 / 4400-S2 / 4600-S2	96.7	92.1	87.6	81.9	77.7	76.6	73.4	70.1
SolBank 3.0 / S-5016-2H-NA|S-5016-4H-NA	86.0	83.0	80.0	77.0	74.0	71.0	83.0	79.0
External Transformer	83.0	88.0	87.0	87.0	81.0	76.0	71.0	64.0

APPENDIX D

BS 4142:2014 + A1:2019 Uncertainty

Uncertainty is an unavoidable feature of measurements in the field, which can be subject to many factors; the weather typically being the most significant of which with respect to the measurement of sound. Uncertainty is also unavoidable in the prediction of sound levels, where naturally, before the scenario being considered becomes a reality, a number of assumptions need to be relied upon. There is also the uncertainty of people's reactions, which can be influenced by a number of factors, not just the magnitude or character of the sound in question.

In keeping with the scale of each project, Vibrock aim to minimise uncertainty at each stage as far as reasonably practicable.

Measurements have been undertaken by suitably qualified staff, using state of the art, in calibration equipment, over suitable periods and avoiding adverse weather conditions where possible.

The predictions have also been undertaken by suitably qualified staff and by using a broad spread of source data obtained through on-site measurements and where this was not safe to do so by using archived specific sound level measurements.

Notwithstanding this, naturally some uncertainty remains. Given the sheer number of factors involved, however, it is not always feasible to place a numerical value on the level of uncertainty, without resulting in an unhelpful range of possible outcomes.

In our professional opinion, we believe that the adopted background measurement locations are fully representative and justifiable; however, we cannot confirm with 100% certainty that there would not be any sort of deviation between the measured levels and those at any part of the residential demise.

The difference in distance between any nearby sound sources to the measurement locations compared to the equivalent distances to the residential dwellings is very small in terms of percentages and would likely be insignificant in terms of noise level.

It is our professional position that uncertainty has been kept to a realistic minimum and that the outcome of this assessment is sufficiently representative.