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environmental consultants

Noise Impact Assessment

Bedhampton Waterworks BESS, Meyrick Road, Havant, PO9 3HB

E101 Hub 4 Ltd

SHF.3055.001.NO.R.004

'Experience and expertise working in union'

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Noise Impact Assessment

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1 Introduction

1.1 Project Introduction

1.1.1 Enzygo Limited (Enzygo) has been commissioned by E101 Hub 4 Ltd ('the Applicant') to undertake a noise impact assessment to support a planning application for the construction, operation, and decommissioning of a battery energy storage system (BESS) comprising battery containers and associated infrastructure on land at Bedhampton Waterworks, Meyrick Road, Havant, Portsmouth, PO9 3HB ('the Site').

1.1.2 The noise impact assessment has been undertaken to assess the potential impacts of the proposed development, in accordance with the relevant standards and guidance, at the nearest noise-sensitive properties to the site, and to provide outline mitigation advice if considered necessary.

1.1.3 Details of the assessment methodology employed, together with the results of the noise predictions, assessment and conclusions are presented within this assessment.

1.2 Site Description

1.2.1 The proposed development is located on land within Bedhampton Waterworks, Meyrick Road, Havant to the south of the West Coastway Line railway. The site is located approximately at grid reference SU 70533 06315.

1.2.2 To the north of the Site is the West Coastway Railway line with residential properties beyond. Bidbury Mead Recreation Ground lies to the north-northwest beyond Bidbury Lane. To the northeast, within the waterworks, is a small solar farm and a storage area. Beyond this are commercial enterprises on Palk Road. Further residential properties are located to the east, on Doyle Close, Ranelagh Road and Knox Road. To the south, beyond Hermitage Stream, is open land to the Fatface warehouse and the A27 Havant Bypass with Havant Business Park beyond. To the west is the continuation of the West Coastway Line railway with open land, allotments, and residential properties on either side of Mill Lane.

1.2.3 The nearest identified noise-sensitive receptors, residential properties in proximity to the site, are shown in Figure 1-1, namely:

1. Keepers House, King's Croft Lane;
2. Bridge House, Mill Lane; and,
3. Properties on Abrams Way.

1.2.4 It is understood that planning applications have been submitted for two new residential developments close to the site. Application ref. APP/22/01231 for apartment blocks off Palk Road to the northeast of the site and application ref. APP/22/00669 for residential dwellings on land at Kingscroft Farm to the south.

1.3 The Proposed Development

1.3.1 The proposed BESS would store electricity during periods of low power demand and return power to the local grid during peak periods. The BESS would also provide balancing services to help maintain grid stability. The operating hours of the BESS are governed by demand on the DNO network. BESS can store energy from intermittent power sources like solar and wind energy and release the power when it is needed most. Otherwise, batteries will typically charge during the night and discharge to the grid during the day when demand is higher.

1.3.2 The development, which would be surrounded by a 3.5m high acoustic fence and is shown in Figure 1-2, would comprise the following, and has been designed to avoid adverse impact at the nearest noise-sensitive receptors:

- 30no. Battery Units;
- 15no. Medium Voltage Power Stations (MVPS);
- 1no. DNO;
- 1no. Transformer;
- 1no. Auxiliary Transformer; and
- 1no. 132kv Substation.

Figure 1-1: Site Location Plan

Figure 1-2: Site Layout

1.4 Noise Assessment Methodology

1.4.1 The assessment has been undertaken in accordance with the guidance contained in British Standard 4142:2014+A1:2019 *Method for rating and assessing industrial and commercial sound* (BS4142) with reference made to the internal noise criteria outlined in British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings* (BS8233).

1.4.2 Noise levels generated by the proposed development, at the nearby noise-sensitive receptors, has been predicted using the calculation methodology outlined in ISO9613:2024 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors* (ISO9613) using the proprietary noise modelling software CadnaA.

1.4.3 The noise impact assessment is based upon the results of a baseline noise survey undertaken at locations representative of the nearest residential receptors to the site over representative daytime and night-time periods.

2 Standards and Guidance

2.1 Planning Practice Guidance: Noise

2.1.1 The Planning Practice Guidance (PPG): Noise[1] is the Government's online guidance on managing potential noise impacts from new developments.

2.1.2 The PPG includes a noise exposure hierarchy table which relates response to noise and example outcomes to effect levels. The table also identifies actions required for each effect level.

2.1.3 Particularly relevant to this assessment are the No Observed Effect Level and the No Observed Adverse Effect Level (NOAEL) to which the PPG states:

Table 2-1: Noise Hierarchy Table Excerpt

Response	Example 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

2.2 British Standard 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*

2.2.1 BS4142 provides a methodology for rating and assessing sound associated with both industrial and commercial premises. The purpose of the Standard is clearly outlined in the opening section where it states that the method is appropriate for the consideration of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

[1] Planning Practice Guidance: Noise, Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government, published on 6th March 2014 and updated on 22nd July 2019

2.2.2 The methods described in the Standard 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 upon which sound is incident.

2.2.3 The Standard states that sound of an industrial/commercial nature does **not** include sound from the passage of vehicles on public roads and railway systems.

2.2.4 The Standard is based around the premise that the significance of the noise impact of an industrial/commercial facility can be derived from the numerical subtraction of the background noise level (not necessarily the lowest background level measured, but the typical background at the receptor) from the measured/calculated rating level of the specific sound under consideration. This comparison will enable the impact of the specific sound to be concluded based upon the premise that typically "*the greater this difference, the greater the magnitude of the impact*". This difference is considered as follows:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5dB is likely to be an indication of an adverse impact, depending upon context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.

2.2.5 BS4142 further 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,*" again depending upon the specific context of a site. The Standard further qualifies the assessment protocol by outlining conditions to a comparative assessment and stating that "*not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact*", thus implying that all sites should be assessed on their own merits and specifics.

2.2.6 The Standard goes on to states that *"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"*.

2.2.7 The Standard quantifies the typical reference periods to be used in a NIA namely:

Typical Daytime	07:00 – 23:00	1-hr assessment period
Typical Night-time	23:00 – 07:00	15-min assessment period

2.2.8 The Standard outlines methods for defining appropriate "character corrections" within the rating levels to account for tonal qualities, impulsive qualities, other sound characteristics and/or intermittency. These are a) the Subjective Method, b) the Objective Methods for tonality and c) the Reference Method. It is noted by the Standard that where multiple features are present the corrections should be added in a linear fashion to the specific level.

2.2.9 The Subjective Method is based on the following corrections:

Table 2-2: BS4142 Subjective Method Rating Corrections

Level of Perceptibility	Tonal Correction	Impulsivity Correction	Correction for "Other sound characteristics"	Intermittency Correction
No Perceptibility	+0 dB	+0 dB	Where neither tonal nor Impulsive but clearly identifiable +3 dB	If intermittency is readily identifiable +3 dB
Just Perceptible	+2 dB	+3 dB		
Clearly Perceptible	+4 dB	+6 dB		
Highly Perceptible	+6 dB	+9 dB		

2.3 British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings*

2.3.1 BS8233 provides guidance and recommendations for the control of noise from outside sources to maintain an internal acoustic environment appropriate for the intended use. The Standard suggests appropriate criteria and limits for differing situations which are, primarily, intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes to the external noise climate. However, it is considered that the guidance provides suitable criteria for the assessment of internal noise levels in this instance.

2.3.2 The Standard suggests suitable guidance values for residential dwellings shown in Table 2-3.

Table 2-3: BS8233 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 Hours	23:00 to 07:00 Hours
Resting	Living room	35dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$

2.3.3 Whilst it is considered desirable to achieve these internal noise levels with the windows open, it is not stipulated within the Standard which states:

"If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

2.3.4 The Standard suggests that the level of noise reduction provided by a partially open window would be approximately 15dB.

2.3.5 BS8233 also sets out a design-criteria for external noise in external amenity spaces such as gardens and patios stating:

"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."

2.3.6 These guideline design-criteria values are meant for new residential development rather than for assessing new noisy development being introduced into a residential area. However, the guideline values provide good noise limits to attain in this instance.

2.1 ISO9613 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors*

2.1.1 The noise levels generated by the operation of the proposed development have been predicted using the calculation methodology set out in ISO9613-2. The methodology considers the distance between the sources and the receptors and applies the amount of attenuation due to atmospheric absorption and other site-specific characteristics.

2.1.2 The methodology assumes downwind propagation, i.e., a wind direction that assists the propagation of noise from the source to all receptors.

3 Baseline Survey Information & Results

3.1 Introduction

3.1.1 An environmental baseline noise survey was undertaken, at locations approximating the nearest noise-sensitive receptors shown in Figure 1-1.

3.1.2 Due to ongoing inclement weather the surveys were spilt to gather data during the best weather windows available. Therefore, baseline monitoring was undertaken during the night on Saturday 27th January 2024, during the night on Friday 2nd February 2024 and during the day on Saturday 10th February 2024.

3.1.3 The survey was undertaken for 2-hours during the day, avoiding rush hour, and for 2-hours during the quietest night-time period.

3.1.4 The monitoring locations in both instances are detailed in Table 3.1 and shown on Figure 1.1.

Table 3-1: Noise Monitoring Locations

Monitoring Location	Approx. Distance from the centre of the Site	Reflecting Surfaces between Source & Receptor	Topography of Intervening Ground	Justification for Choice of Measurement Location
MP1	95m	Railway line and site buildings	Open land and slightly elevated railway.	Location representative of the nearest residential receptor to the north – Keepers House
MP2	225m	Railway line and site buildings	Open land and slightly elevated railway.	Location representative of the nearest residential receptor to the west – Bridge House
MP3	215m	Site buildings	Open land and Hermitage Stream	Location representative of the nearest residential receptor to the east – Doyle Close properties

3.2 Weather Conditions

3.2.1 Weather conditions during the survey periods are detailed in Table 3-2.

Table 3-2: Weather Conditions

Date/Period	Wind Speed & Direction	Rain	Fog or Mist	Ground Conditions	Cloud Cover	Temp
27/01/2024 Night	0m/s	None	None	Frosty	Clear	0°C
02/02/2024 Night	0m/s	None	None	Dry	Clear	3° to 5°C
10/02/2024 Day	0 to 2m/s	None	None	Dry	25% to 75%	9° to 11°C

3.2.2 The prevailing meteorological conditions were within appropriate limits for baseline noise monitoring and would have no detrimental impact on the measured noise data.

3.3 Measuring Equipment

3.3.1 The noise monitoring equipment used during both surveys is shown in Table 3-3 and was set to record the $L_{Aeq,T}$, L_{A90}, L_{A10} and L_{Afmax} parameters.

3.3.2 The following set-up parameters were used on the sound level meter during all the noise measurements undertaken:

Time Weighting: Fast
Frequency Weighting: "A"

3.3.3 The sound level meters were field calibrated, using the acoustic calibrator, prior to, and upon completion of the overall survey. No drifts in calibration were noted.

Table 3-3: Noise Monitoring Equipment

Location	Equip. Make & Model	Class	Calibration Level, dB	Serial No.	Calibration Date Prior to Survey
All (day) & MP1 (night)	NTi XL2 SLM	1	94.0	A2A-09328-E0	January 2023
MP2 (night)	NTi XL2 SLM	1	94.0	A2A-15954-E0	July 2023
MP3 (night)	NTi XL2 SLM	1	94.0	A2A-13193-E0	July 2022
All	LD Cal200 Calibrator	-	-	13872	June 2023

3.3.4 The external calibration documentation for the equipment used is available upon request.

3.4 Survey Details and Results

3.4.1 The results of the baseline survey are summarised in Table 3-4 below. The data set can be found in full in Appendix A.

Table 3-4: Summary of June Baseline Survey Results, dB

Location	Period	Duration Hh:mm	Average[1)] $L_{Aeq,T}$	L_{Afmax}[2)]	L_{A90}[3)]	L_{A10}[3)]
MP1 – Keepers House	Day	02:00	60.7	82.0	52.6	57.0
	Night	02:00	42.6	60.8	39.4	44.6
MP2 – Bridge House	Day	02:00	56.0	74.4	52.6	55.9
	Night	02:00	51.9	67.9	46.8	54.9
MP3 – Doyle Close	Day	02:00	57.6	80.4	55.1	59.0
	Night	02:00	49.9	60.8	45.9	52.4

Note:
1) Logarithmic average of the L_{Aeq} parameter.
2) Maximum recorded L_{Afmax} value reported.
3) Arithmetic average value reported.

3.5 Existing Context

3.5.1 The daytime noise climate comprised road traffic noise from the A27, which was the dominant noise source during the surveys, regular local road traffic, regular rail traffic, aircraft, and natural sound such as dogs barking and birdsong. At MP1 and MP2 children playing in the playground at the nearby park were also audible. Industrial noises from the businesses located on Palk Road were also audible at MP1 and MP3.

3.5.2 During the night the noise climate was again dominated by road traffic noise from the A27. Some noise associated with distant roadworks was noticeable at times which was considered to come from the east of the site. Birdsong became audible from approximately 03:30 hours.

4 Assessment of Impacts

4.1 Introduction

4.1.1 Specific sound levels generated by the proposed development have been predicted to the site-facing façade or site-facing outdoor amenity space of the nearest noise-sensitive receptors identified using the calculation methodology outlined in ISO9613.

4.1.2 The resulting predicted specific sound levels have then been assessed in accordance with the guidance contained in BS4142, with reference made to sleeping conditions in bedrooms at night in accordance with the guidance contained in BS4142 and BS8233.

4.2 Sources Being Assessed

4.2.1 The potential noise generating sources of the proposed development include the chillers and air conditioning units of the battery units, the MVPS units and the transformers (including the substation transformer).

4.2.2 The noise source data used in the noise modelling assessment are presented in Table 4-1. The data is taken from client supplied manufacturers' datasheets (battery and MVPS units) and/or Enzygo library data (transformers and substation).

Table 4-1: Modelled Sound Levels

Sound Source	Octave Band (Hz) Sound Pressure Level @ 1m, dB (unless specified)								Overall Sound Power Level dB(A)
	63	125	250	500	1k	2k	4k	8k	
Battery Unit (Chillers)	31.8	40.6	47.9	54.6	53.5	55.2	55.5	49.6	75.1
Battery Unit (AirCon)	31.0	45.5	48.0	55.3	54.2	57.8	55.0	49.4	75.0
MVPS (L_{WA})	-	-	-	-	-	-	-	-	91.0
Transformer ($L_{W,linear}$)	62	72	82	72	62	52	42	32	75.0
POC Substation ONAF ($L_{W,linear}$)	73	79	75	75	74	62	54	47	76.9

4.3 Noise Modelling Protocols

4.3.1 The model was constructed using the proprietary noise modelling software package CadnaA utilising Google Earth geo-referenced 1:1 scaled aerial photography, openstreetmap.org mapping data, OS ground height data, and noise sources and source data from manufacturers specification sheets via the client.

4.3.2 It is assumed that the ground between the site and the noise-sensitive receptors would be at least 90% soft ground. Wind and temperature gradient assisted sound propagation has been assumed to all noise-sensitive receptors.

4.4 Predicted Sound Levels

4.4.1 For the purposes of this noise impact assessment the predicted sound levels assume that all plant would be operating simultaneously and at 100% capacity during either a charge or discharge period providing a worst-case assessment.

4.4.2 Specific sound levels have been predicted to heights of 1.5m for outdoor amenity space and 4.0m for an upstairs window. The results are shown in Table 4-2.

Table 4-2: Predicted Specific Sound Levels at the Receptors

Receptor Location	Period (hrs)	Receptor Height (m)	Predicted Specific Sound Level, $L_{Aeq,T}$, dB
Keepers House	07:00 – 23:00	1.5 (back garden)	39.7
	23:00 – 07:00	4.0	41.6
Bridge House	07:00 – 23:00	1.5 (front garden)	32.9
	23:00 – 07:00	4.0	36.8
Abrams Way*	07:00 – 23:00	1.5 (back garden)	33.2
	23:00 – 07:00	4.0	38.7
APP/22/00669 Kingscroft Farm proposed development	07:00 – 23:00	1.5	40.9
	23:00 – 07:00	4.0	43.2
APP/22/01231 Palk Road Proposed Development	24	1.5	38.6
		4.0	41.3
		6.5	42.3
		9.0	42.7
* includes the attenuation provided by proposed properties in planning application ref. APP/22/00669 (Kingscroft Farm)			

4.5 Subjective Impressions at the Receptors

4.5.1 As the proposed development is at a planning stage, there are currently no specific noise sources at site. As such, the ambient sound level and residual sound level are considered equal and are taken as the measured $L_{Aeq,T}$. There have been no corrections applied to the measured sound levels. The specific sound level will be predicted using the proprietary noise modelling software CadnaA.

4.6 Sound Rating Levels

Existing Context

4.6.1 The identified nearest noise-sensitive receptors are in an urban location close to major transport infrastructure, i.e., the A27 Havant Bypass and the West Coastway Line railway. There is also significant commercial development nearby including Havant Business Park and commercial development on Palk Road. There is also a small solar farm within the waterworks. The noise-sensitive receptors are therefore subject to background noise levels and acoustic

characteristics of such environments, i.e., constant distant drone of road traffic, rail traffic movements and commercial sounds through the day and night.

Derived Sound Rating Levels

4.6.2 The proposed development would not generate any noise which would have an intermittent or impulsive feature which would be noticeable against the prevailing ambient noise climate. Therefore, no corrections have been made to the specific sound source for these characteristics.

4.6.3 The receptors are subject to the constant drone of road traffic using the A27 Havant Bypass and local road network, frequent rail traffic movements and some commercial/industrial noise which would mask any tonal content of the proposed development. At night, when residents are likely to be indoors sleeping, it is considered that the residual sound within the dwelling would likely provide adequate masking sound to render any tonal content from the proposed development imperceptible. Therefore, no correction has been added for tonality.

4.7 Assessment of the Impacts

4.7.1 BS4142 states:

"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."

4.7.2 A comparative assessment has been undertaken to determine the potential impact of the predicted sound rating levels at the nearest noise-sensitive receptors. The average measured background sound levels are considered typical and have been used in the assessment.

4.7.3 The background noise levels measured at MP3 are considered representative and suitable for use for the proposed new residential developments to the south and northeast of the site. Table 4-3 summarises the results of the assessment.

Table 4-3: BS4142 Assessment – Worst-case

Location	Period	Rating Level dB $L_{Aeq,T}$	Background Noise Level, dB L_{A90}	Difference, dB
Keepers House	Day (07:00 – 23:00 hrs)	40	53	-13
	Night (23:00 – 07:00 hrs)	42	39	+3
Bridge House	Day (07:00 – 23:00 hrs)	33	53	-20
	Night (23:00 – 07:00 hrs)	37	47	-10
Abrams Way	Day (07:00 – 23:00 hrs)	33	55	-22
	Night (23:00 – 07:00 hrs)	39	46	-7
APP/22/00669 Kingscroft Farm proposed development	Day (07:00 – 23:00 hrs)	41	55	-14
	Night (23:00 – 07:00 hrs)	43	46	-3
APP/22/01231 Palk Road Proposed Development	Day (07:00 – 23:00 hrs)	41	55	-14
	Night (23:00 – 07:00 hrs)	41	46	-5

4.7.4 The results in Table 4-3 show that predicted daytime rating levels would be below the average background noise levels at all receptors assessed indicating that the specific sound would have a low impact depending on the context.

4.7.5 Table 4-3 also shows that the predicted night-time rating levels would be below the average background noise levels indicating that the specific sound would have a low impact depending on the context at all receptors except Keepers House. At Keepers House the predicted rating levels would be 3dB above the average background noise levels indicating a less than adverse impact, again depending on the context.

4.8 Context

4.8.1 BS4142 states that where the initial estimate of impact needs to be modified due to the context, all pertinent factors should be taken into consideration.

Sensitivity of the Receptors

4.8.2 The nearest noise-sensitive receptors identified are residential in nature and as such are sensitive to noise impacts during both the day and overnight.

The Absolute Level of Sound

4.8.3 The worst-case specific sound levels generated by the proposed development are predicted to be below the prevailing average ambient $L_{Aeq,1hr}$ noise levels at the noise-sensitive receptors assessed during both the day and night.

The Character and Level of the Residual Sound

4.8.4 The specific sound levels are predicted to be below the measured background noise level at the identified noise-sensitive receptors during the day. As such, the character and level of the sound are likely to be indistinguishable against the residual noise climate.

4.8.5 During the night-time period the background noise level is comparatively lower. Therefore, there is potential for noise from the proposed development to be audible outside during quieter portions of the night-time period at the most sensitive receptor. However, residents are unlikely to be outdoors during this period and the residual noise level inside dwellings will likely provide masking sound from the proposed development.

Summary of Context

4.8.6 The context should not affect the initial estimate of impact during the daytime as predicted noise levels would be below the prevailing background noise levels.

4.8.7 During the night, it is unlikely that residents would be using outdoor amenity spaces therefore an assessment of internal noise levels using the guidance contained in BS8233, as suggested by BS4142, has been made, specifically those relating to sleeping conditions in bedrooms.

4.8.8 Based on the findings and context of the assessment, mitigation measures above those incorporated into the design of the site are considered unnecessary.

4.9 BS8233 Assessment

4.9.1 As referred to in BS4142, at night the residents of the nearest receptors are likely to be indoors with windows open and where residual sound within the dwelling will likely further mask the sound from the proposed development.

4.9.2 BS8233 states that a window left partially open for ventilation would give a sound reduction of approximately 15dB. An assessment has been made against the guideline values for internal ambient noise levels for sleeping in bedrooms at night, i.e., 30dB $L_{Aeq,8hr}$. Table 4-4 details the results of the assessment.

Table 4-4: BS8233 Assessment of Internal Noise Levels at Night

Location	Predicted External Noise Level, dB $L_{Aeq,T}$	Predicted Internal Noise Level, dB $L_{Aeq,T}$	Guidance Levels dB $L_{Aeq,8hr}$	Difference, dB
Keepers House	42	27	30	-3
Bridge House	37	22		-8
Abrams Way	39	24		-6
APP/22/00669 Kingscroft Farm proposed development	43	27		-2
APP/22/01231 Palk Road Proposed Development	41	26		-4

4.9.3 Table 4-4 shows that predicted internal noise levels at night would meet the guideline value for sleeping in bedrooms at all receptors assessed. This would indicate that operation of the proposed development during the night-time period would not result in any adverse loss of amenity.

4.9.4 Based on the findings of the assessment, mitigation measures beyond those included in the design of the proposed development, are considered unnecessary.

4.10 Low Frequency Noise, LFN

4.10.1 Only a relatively small number of individuals are affected by low frequency noise (LFN) and in many cases (typically 50 to 80% of cases) no environmental sound that could account for the affected individual's reaction to LFN can be found and the cause remains unknown.

4.10.2 LFN complaints are particularly difficult to assess and mitigate for various reasons. Firstly, existing noise criteria are not appropriate for the evaluation of LFN; in almost all other situations the established noise descriptors are based on the A weighted sound level which effectively filters out LFN. Secondly, LFN cannot be reliably evaluated based on the investigators experience as they may not be able to hear LFN over the ambient sound at the receptor as LFN is known to occur only slightly higher than the threshold of hearing. Thirdly, the measurement of LFN can be technically difficult.

4.10.3 Based on the above, a criterion curve for the acceptable level of LFN has been derived at the request of DEFRA by the University of Salford. The criterion curve is shown in Table 4-5 below.

Table 4-5: Proposed Reference Curve

Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB L_{Aeq}	92	87	83	74	64	56	49	43	42	40	38	36	34

4.10.4 At this stage, only partial 1/3rd octave band noise emission data between 50Hz and 160Hz is available for the battery units and therefore the assessment of LFN is based on those frequency bands for the battery units only. Table 4-6 details the results of the assessment.

Table 4-6: Assessment of LFN against the Reference Curve

Frequency Hz	50	63	80	100	125	160
Reference Curve, dB	43	42	40	38	36	34
Battery Unit, dB @1m	31	32	41	52	41	43
Battery Unit, dB @ nearest receptor (42m)	-	-	9	20	9	11

4.10.5 Table 4-6 shows that, although the battery unit does contain a LFN element at, or close to the source, it is unlikely that this would be audible at the receptors when considering distance attenuation, etc.

4.10.6 It is therefore considered that LFN would not affect nearby residents.

4.11 Assessment Summary

4.11.1 The BS4142 assessment undertaken in subsection 4.7 indicates that, at worst, the noise impact arising during operation of the facility would be 'less than adverse' in accordance with the standard.

4.11.2 Further to this, calculations to the sensitive internal spaces of the identified residential receptors indicates that noise levels would fall comfortably below the level at which sleep disturbance or loss of amenity would occur and is therefore considered acceptable.

4.11.3 Overall, it is considered that the facility may be audible outside during the quieter portions of the night-time period. However, residents are likely to be indoors during this period and the residual noise level inside dwellings will likely provide masking sound from the proposed development. Therefore, it would not necessitate any changes in behaviour, i.e., closing windows, etc.

4.11.4 Although the battery units have a low frequency noise element to them at source, it is unlikely that this would be audible at the nearest receptors when considering distance attenuation, etc.

4.11.5 As such, the assessments demonstrate that the facility would operate at the No Observed Effect Level during the daytime and night in accordance with the Planning Practice Guidance: noise.

5 Conclusion

5.1.1 Enzygo Limited has been commissioned by E101 Hub 4 Ltd to undertake a noise impact assessment to support a planning application for the operation of a battery energy storage system comprising battery containers and associated infrastructure on land at Bedhampton Waterworks, Meyrick Road, Havant, Portsmouth, PO9 3HB.

5.1.2 This noise impact assessment has been undertaken to assess the potential impacts of the proposed development, in accordance with the relevant standards and guidance, at the nearest noise-sensitive receptors to the site and to provide outline mitigation requirements if necessary.

5.2 Noise Assessment Outcomes

5.2.1 Sound levels generated by the proposed development have been predicted to the identified receptors using CadnaA and assessments have been made in accordance with the guidance contained in BS4142:2014+A1:2019.

5.2.2 The BS4142 assessment has shown that daytime predicted sound rating levels would be below prevailing background noise levels at the nearest receptors assessed. Within the context of local noise climate, i.e., predicted specific sound levels being below the prevailing ambient noise levels, the specific sound would have a low impact. This is considered to fall within the 'No Observed Effect Level' detailed in the PPG.

5.2.3 At night the BS8233 assessment, made in accordance with the guidance outlined in BS4142, has shown that the guideline internal noise level of 30dB $L_{Aeq,8hr}$ for sleeping in bedrooms would be easily met at the nearest receptors assessed. This is considered to fall within the 'No Observed Effect Level' detailed in the PPG.

5.2.4 An assessment of low frequency noise has shown that although the battery units have a low frequency noise element to them at source, it is unlikely that this would be audible at the nearest receptors when considering distance attenuation, etc. It is therefore considered that LFN would not affect nearby residents.

5.2.5 It is considered that the proposed development would operate without adversely affecting nearby sensitive receptors in terms of acoustic impact and there are no reasons, on noise grounds, why planning consent for the proposed BESS facility cannot be granted.

Glossary of Terminology

Noise is defined as unwanted sound. The range of audible sound is known to be from 0dB (threshold of hearing) to 140dB (threshold of pain). Examples of typical noise levels relating to 'everyday' occurrences are given in Table G-1 below.

Table G-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Gun shot	160	Perforation of eardrum
Military Jet take-off	140	Threshold of pain
Jet Aircraft at 100m	120	Very Loud
Rock Concert, front seats	110	Threshold of Sensation
Pneumatic Drill at 5m	100	Very Loud
Heavy goods vehicle from pavement	90	
Traffic at kerb edge	70 – 85	Loud
Vacuum Cleaner, Hair Dryer	70	
Normal conversation at 1m	60	Moderate
Typical Office	50 – 60	
Residential area at night	40	Quiet
Rural area at night, still air	30	
Leaves Rustling	20	
Rubbing together of fingertips	10	
	0	Threshold of hearing

The frequency response of the human ear to noise is usually taken to be around 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level; it is more sensitive in the mid-frequency range than lower and higher frequencies and, because of this when undertaking the measurement of noise, the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurement.

For variable noise sources within an area an increase of 3dB(A) would be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regards to environmental noise levels (in the open air), these are rarely steady but rise and fall according to the activities being undertaken within the surrounding area at any given time. Attempting produce a figure that relates this variable nature of noise to human subjective response, various statistical noise metrics have been developed. These and other useful terminology and descriptors are presented in Table G-2 below.

Table G-2: Terminology

Term	Definition
Sound	Pressure fluctuations in a fluid medium within the audible range of amplitudes and frequencies which stimulate the organs of hearing.
Noise	Unwanted sound emitted from a source and received by the sensitive receptor.
Decibel (dB)	Unit most often used to describe the sound pressure level. A logarithmic number, it correlates closely to the way in which humans perceive sound. Its wide range of values helps quantify sound pressures from a large variety of magnitudes.
A-Weighting (dB(A))	Human perception of sound is frequency dependant. A-weighting applies a range of corrections at each frequency to provide a 'human-averaged'. Can be frequency band or broadband values.
Frequency (Hz)	The number of cycles per second, for sound this is closely related (and often mistaken for) pitch.
Frequency Spectrum	A more detailed analysis of the frequency components that comprise a sound source.
$L_{A10,T}$	The 10th statistical percentile of a measurement period, i.e., the level that is exceeded for 10% of the measurement duration. Closely correlates with traffic sources, A-weighted.
$L_{A90,T}$	The 90th statistical percentile of a measurement period, i.e., the level that is exceeded for 90% of the measurement duration. Used to describe background sound levels, as this value is affected less by short, transient sound sources, A-weighted.
L_{Amax}	The root mean square (RMS) maximum sound pressure level within a measurement period, A-weighted.
Ambient Sound	The total sound climate of all noise sources incident at one location, both in the near- and far-field (*The ambient sound comprises the residual sound and the specific sound when present)*.
Ambient Sound Level $L_a = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level $L_{A90,T}$	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.
Equivalent Continuous A-weighted Sound	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 – t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

Term	Definition
Pressure Level $L_{Aeq,T}$	$$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t1}^{t2}\left[p_A\frac{(t)^2}{{p_0}^2}\right]dt\right\}$$ Where p_0 is the reference sound pressure (20µPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t.
Measurement Time Interval T_m	Total time over which measurements are taken (*This may consist of the sum of several non-contiguous, short-term measurement time intervals)*
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over time, T.
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (This is 1hr during the day from 07:00 to 23:00 hours and a shorter period of 15-min at night from 23:00 to 07:00 hours).
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T.
Sound Pressure Level	The level of fluctuation in air pressure, caused by airborne sound sources. Measured in Pascals (Pa).
Sound Power Level	The rate at which sound is radiated by a source. This parameter is useful as it describes sound energy before environmental or decay factors. Quantified in dB and notated usually as L_w or SWL.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T.
Specific Sound Source	Sound source being assessed.

Statement of Uncertainty

This report is based upon a range of measurements, a system of calculations and noise predictions. As such, this report attempts to quantify fluctuations in air pressure and is subject to the effects of meteorology, physical and perceived anomalies, tolerances within the measuring and monitoring equipment and accuracy margins within the noise modelling software. In the interests of repeatability, this report must be considered as being affected by common factors involved in the measurement and calculation of noise propagation.

All measurement values, outcomes and assumptions are subject to a margin of uncertainty. This has been quantified and assessed as follows:

- Rounding errors – systemic tolerance of ±1dB;
- Meteorology – allowance of ±1.9dB; and
- CadnaA noise propagation modelling software – operational accuracy of ±2.1dB

The most influential uncertainty factors for the assessment of noise are deemed to be equipment tolerances, meteorology and software accuracy. A root-sum-square statistical average has been used to provide an overall margin of uncertainty of ±3dB.

Statement of Competency

The assessment has been undertaken by, or under the supervision of, Mr. Darren Lafon-Anthony who is the Director of Acoustics at Enzygo Limited. Mr. Lafon-Anthony holds a Master of Science Degree in Applied Acoustics and has been a Corporate Member of the Institute of Acoustics since July 2004 having previously been an Associate Member of the institute since October 2001. Mr. Lafon-Anthony is also a Fellow of the Institute of Quarrying based on his contribution to minerals and mining noise assessment and mitigation, a qualification he has held since September 2014.

Mr. Lafon-Anthony has worked in acoustics since January 1981. Initially as an engineer designing and overseeing manufacture of noise control equipment for the water industry, standby power diesel generator and power generation markets for several noise control equipment manufacturers and, since February 2004, as an environmental noise consultant in various sectors, including mineral and mining sites, waste disposal and recycling sites, large industrial developments, energy supply projects (EfW, STOR and Battery Energy sites) and residential developments in the UK, Europe and sub-Saharan Africa.

The assessment has been reviewed by Mr Mark Harrison, Principal Acoustic Consultant at Enzygo Limited. Mr Harrison holds a Batchelor of Science degree in Music Technology and a post graduate Diploma in Acoustics and Noise Control.

Mr Harrison has worked in acoustic consultancy since 2007 and has worked on noise and vibration assessments in several sectors including industrial/commercial developments; power generation and distribution; residential developments; transport schemes; and mineral extraction and processing.

Table A-1: Location MP1, Keepers House

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A90}	L_{A10}
2024-02-10 12:00:00	60.2	81.0	52.4	56.2
2024-02-10 12:15:00	61.0	80.3	52.3	56.6
2024-02-10 12:30:00	61.3	82.0	52.1	57.8
2024-02-10 12:45:00	60.2	80.9	51.5	55.8
2024-02-10 13:00:00	59.8	79.0	51.9	54.6
2024-02-10 13:15:00	60.5	80.1	52.7	57.3
2024-02-10 13:30:00	61.3	79.7	54.1	59.5
2024-02-10 13:45:00	60.9	79.7	54.1	58.0
Overall (Daytime)	**60.7**	**82.0**	**52.6**	**57.0**
2024-02-02 02:00:00	42.5	52.6	39.2	44.8
2024-02-02 02:15:00	42.3	56.7	38.8	44.4
2024-02-02 02:30:00	42.5	60.8	39.2	44.5
2024-02-02 02:45:00	41.0	50.8	38.0	43.2
2024-02-02 03:00:00	41.6	49.0	38.6	43.8
2024-02-02 03:15:00	42.3	50.8	39.0	44.4
2024-02-02 03:30:00	43.9	52.7	40.9	46.1
2024-02-02 03:45:00	44.1	51.9	41.5	45.8
Overall (Night-time)	**42.6**	**60.8**	**39.4**	**44.6**

Table A-2: Location MP2, Bridge House

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A90}	L_{A10}
2024-02-10 09:45:00	53.3	66.2	51.7	53.7
2024-02-10 10:00:00	55.6	73.7	50.8	55.6
2024-02-10 10:15:00	55.0	70.6	51.0	54.3
2024-02-10 10:30:00	54.9	68.2	51.7	54.9
2024-02-10 10:45:00	57.2	74.4	53.5	57.1
2024-02-10 11:00:00	56.1	73.2	53.8	57.1
2024-02-10 11:15:00	56.5	72.6	53.8	56.5
2024-02-10 11:30:00	57.6	70.2	54.6	58.2
Overall (Daytime)	**56.0**	**74.4**	**52.6**	**55.9**
2024-01-27 02:00:00	52.6	67.9	48.4	54.4
2024-01-27 02:15:00	52.8	63.1	49.3	55.3
2024-01-27 02:30:00	49.9	57.4	45.7	53.0
2024-01-27 02:45:00	50.9	67.6	44.7	54.4
2024-01-27 03:00:00	52.3	63.2	46.4	55.7
2024-01-27 03:15:00	51.7	61.0	47.0	54.7
2024-01-27 03:30:00	52.6	64.2	46.9	55.9
2024-01-27 03:45:00	51.7	66.8	45.8	55.4
Overall (Night-time)	**51.9**	**67.9**	**46.8**	**54.9**

Table A-3: Location MP3, Abrams Way

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A90}	L_{A10}
2024-02-10 14:15:00	58.8	64.9	57.6	60.0
2024-02-10 14:30:00	58.3	68.9	56.4	60.0
2024-02-10 14:45:00	57.7	79.1	55.0	58.3
2024-02-10 15:00:00	56.5	62.6	54.9	57.8
2024-02-10 15:15:00	56.5	74.0	53.5	57.9
2024-02-10 15:30:00	58.8	80.3	55.3	60.5
2024-02-10 15:45:00	57.1	80.4	54.3	58.3
2024-02-10 16:00:00	56.7	69.9	53.7	58.9
Overall (Daytime)	**57.6**	**80.4**	**55.1**	**59.0**
2024-01-27 01:45:00	50.1	58.2	47.3	52.3
2024-01-27 02:00:00	50.0	58.5	46.3	52.6
2024-01-27 02:15:00	49.4	57.1	45.0	52.0
2024-01-27 02:30:00	48.5	57.5	44.3	51.1
2024-01-27 02:45:00	49.0	60.8	44.3	51.4
2024-01-27 03:00:00	50.7	59.8	46.3	53.5
2024-01-27 03:15:00	50.6	58.8	46.9	53.0
2024-01-27 03:30:00	50.7	60.3	46.5	53.4
Overall (Night-time)	**49.9**	**60.8**	**45.9**	**52.4**

Appendix B – Noise Contour Plots

Figure B-1: Worst-case Daytime Noise Contour Plot

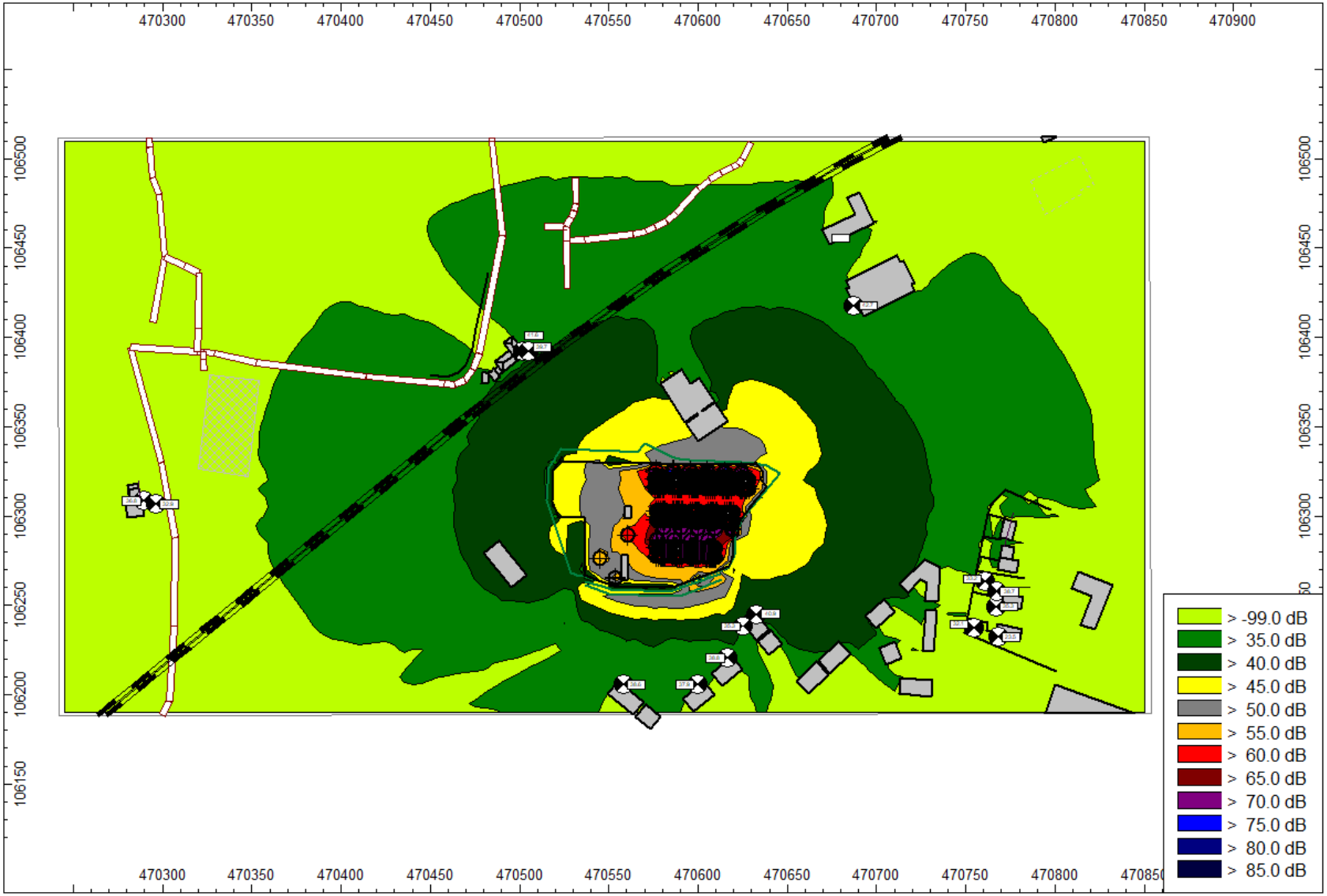

Figure B-2: Worst-case Night-time Noise Contour Plot

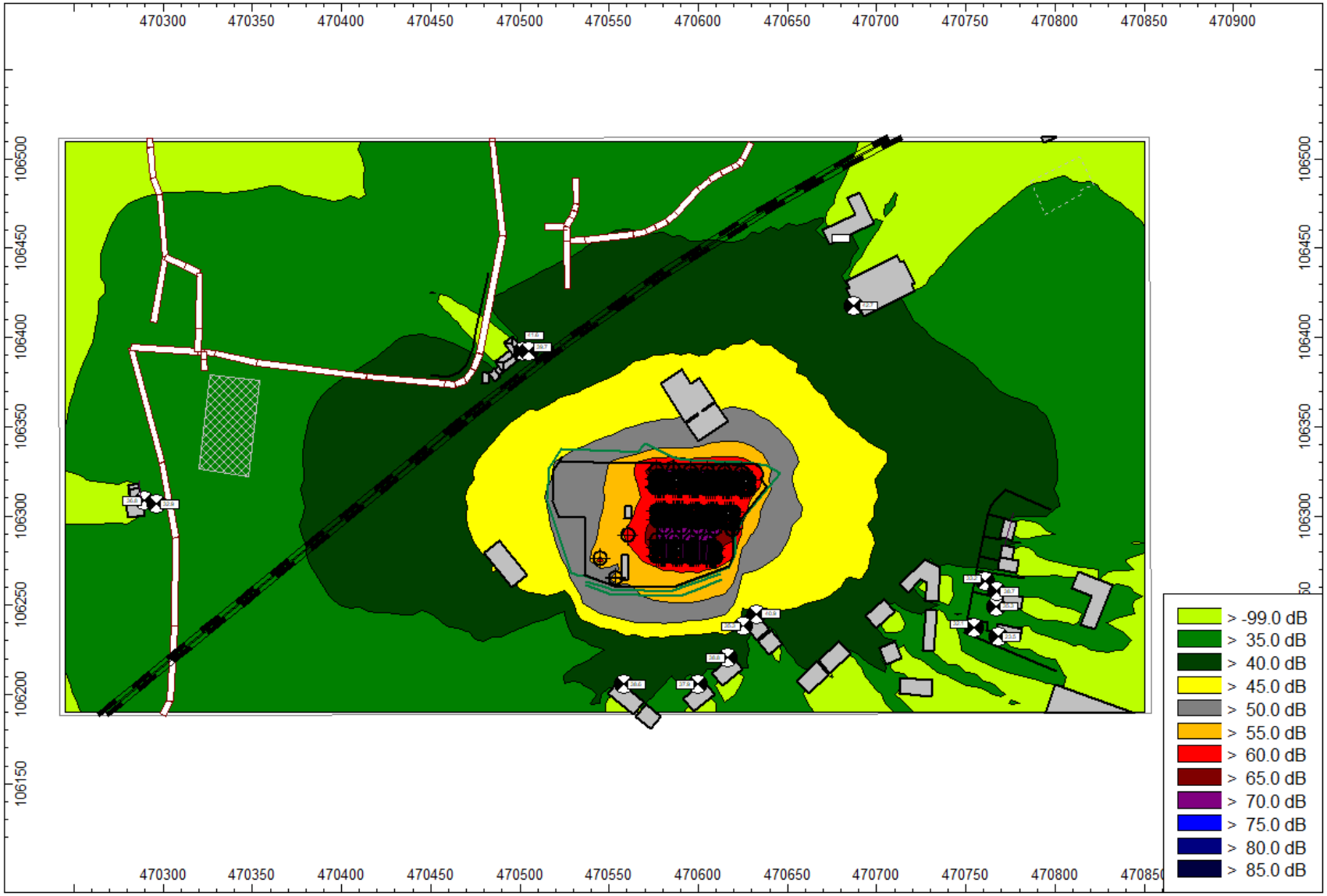

Table C-1: Battery Unit Test Data & Tonal Content Review

Frequency, Hz	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10k
Battery Test Data	31.0	31.8	40.5	52.0	40.6	42.6	46.3	47.9	47.7	55.8	54.6	51.0	51.9	53.5	54.9	57.5	55.2	58.3	58.9	55.5	53.2	54.0	49.6	48.3
Adj. Band Diff	-0.8	-8.7	-11.5	11.4	-2.0	-3.7	-1.6	0.2	-8.1	1.2	3.6	-0.9	-1.6	-1.4	-2.6	2.3	-3.1	-0.6	3.4	2.3	-0.8	4.4	1.3	-1.3

Annex C of BS4142 states that for a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third octave band of interest is required to exceed the time-averaged sound pressure level of both adjacent one-third octave bands by some constant level difference.

The level difference between adjacent one-third octave bands that identify a tone are:

- 15dB in the low-frequency one-third octave bands (25Hz to 125Hz)
- 8dB in the middle-frequency one-third octave bands (160Hz to 400Hz)
- 5dB in the high-frequency one-third octave bands (500Hz to 10000Hz)

Table C-1 indicates that the differences in each adjacent one-third octave band are well within the level differences that would identify a tone. Therefore the battery units do not contain any tonal features.

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