

**NOISE ASSESSMENT**

on behalf of

**ROOT-POWER (SOUTH) LTD**

for the site at

**LAND ADJOINING NEW HOUSE FARM, LUZLOW,  
BAGNALL, STOKE ON TRENT, ST9 9JZ**

**REPORT DATE: 27 JUNE 2025**

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## Summary

A noise assessment has been undertaken to predict the potential impact of fixed plant associated with a proposed battery energy storage system (BESS) development at Land Adjoining New House Farm, Luzlow, Bagnall, Stoke On Trent, ST9 9JZ. This was requested by Root-Power (South) Ltd to accompany a planning application for the site.

An environmental sound survey has been undertaken to establish the existing sound climate at nearby residential noise sensitive receptors (NSRs).

A baseline computer noise model of the proposed development and surrounding site has been assembled based on the proposed site layout and current candidate plant specifications. The likely noise levels at the nearest NSRs due to emissions from the site have been predicted and are presented within this report.

The predicted noise levels and data from the environmental sound survey have been used to assess the potential impact at the most affected NSR during the night-time period when existing background sound levels are at their lowest. The baseline assessment based on the candidate plant with baseline mitigation and the proposed layout indicates that noise emissions from the site may exceed acceptable levels at the most affected NSR when considered in the context of a traditional BS4142 assessment. However, in relation to fixed, absolute levels, the noise impact is likely to be acceptable. To provide further comfort to SMDC, further noise modelling has been undertaken to provide indicative mitigation recommendations should they be necessary.

Indicative mitigation has been proposed in terms of specifying reduced source noise levels for the proposed BESS plant. The indicative mitigation has been simulated in the noise model to demonstrate that acceptable noise levels may be achievable by design.

The assessment recommends that prior to commissioning of the development, a pre-commencement noise assessment should be undertaken, based on the detailed BESS plant specification and any associated changes to the site layout, to demonstrate that acceptable noise levels are likely to be achieved.

An assessment of low-frequency noise has been undertaken. The results of the assessment indicate that low frequency noise is unlikely to cause disturbance or complaints in the mitigated scenario.

An indicative cumulative assessment has been undertaken with consideration of the potential cumulative impact with other BESS application sites in the Cellarhead Green Belt area.

The assessment considers that, provided the pre-commencement acoustic design is undertaken as recommended, the impact of noise associated with the proposed development is likely to be low. The assessment concludes that the proposed development should be considered acceptable to Staffordshire Moorlands District Council (SMDC) in terms of the likely noise impact.

|              |                                                                                   |              |                                                                                     |
|--------------|-----------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|
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| Signed:      |  | Signed:      |  |
| Date:        | 17 December 2024                                                                  | Date:        | 17 December 2024                                                                    |

| Version | Date             | Change                                                         | Initials |
|---------|------------------|----------------------------------------------------------------|----------|
| 1       | 17 December 2024 | First issue                                                    | DE       |
| 2       | 14 February 2025 | Reference to site cross section plans                          | DE       |
| 3       | 27 June 2025     | Site layout update, Updated Assessment, Low Frequency Analysis | WW       |

Advisory Note

The suitability of all recommended noise mitigation measures should be approved by the relevant architects, structural engineers, building contractors, fire consultants and material manufacturers constituting the wider design team, prior to procurement and field application. This must ensure that when the recommended noise control measures are implemented on site they will satisfy the requirements of all disciplines, therefore should not cause any health and safety issues.

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# 1 Introduction

- 1.1 Miller Goodall Ltd has, on behalf of Root-Power (South) Ltd, undertaken a noise assessment to accompany a planning application for a proposed battery energy storage system (BESS) at Land Adjoining New House Farm, Luzlow, Bagnall, Stoke On Trent, ST9 9JZ.
- 1.2 The scope of this report is to assess the potential impact of operational noise from fixed plant associated with the proposed BESS at nearby residential noise sensitive receptors (NSRs).
- 1.3 Version 3 of this report accounts for the most up-to-date site layout, for which 3D noise modelling has been updated and the noise impact reassessed.
- 1.4 Following comments from the Environmental Health Officer (EHO) at SMDC in response to version 2 of this report, additional context for the baseline assessment has been provided, in particular the resulting noise levels from operation of the plant has been considered in relation to absolute limit criteria in BS8223. The recommended mitigation, i.e. maximum plant levels specified for final plant selection (**Section 10.1**), has been determined based on the predicted rating level matching the background (**Section 9.3**).
- 1.5 Also following comments from the EHO at SMDC, a low frequency noise analysis has been undertaken to determine whether disturbance due to low frequency noise resulting from proposed operations is likely (**Section 9.6**).
- 1.6 The EHO has expressed concern regarding the way in which the required reduction in plant noise is to be achieved. Version 3 of this report makes it clearer that this is to be achieved via quieter plant selection and now recommends that the pre-commencement noise assessment be stipulated in a suitably worded planning condition (**Section 10.1**).

# 2 Site Description

- 2.1 The site is located at Land Adjoining New House Farm, Luzlow, Bagnall, Stoke On Trent, ST9 9JZ. The site location is indicated on the figure presented in **Appendix 1: Site Location, Monitoring Positions and Noise Sensitive Receptors**.
- 2.2 The site is located in a rural location surrounded by agricultural land and scattered dwellings. The site is bounded to the north by agricultural land with a dwelling at New House Farm to the north-east. To the east lies agricultural land with Luzlow Lane beyond, to the south is agricultural land with

a dwelling on Armshead Road to the south-east, and a dwelling at Little Armshead Farm to the south. The dwellings at New House Farm, Armshead Lane and Little Armshead Farm, lie at distances of approximately 160 m, 280 m and 160 m, from the proposed BESS compound, respectively.

### 3 Proposed Development

- 3.1 The proposed development is for a 99 MW battery energy storage system (BESS) consisting of;
- 12 clusters of BESS battery containers;
  - 12 pairs of BESS inverters, each coupled with an associated transformer;
  - 132 kV substation and associated transformer;
  - 33 kV/415 V site supply transformer; and
  - associated infrastructure including substation switch rooms, BESS switch rooms, an LV switch room and welfare building, water tanks, access roadways and fencing.
- 3.2 The proposed layout plan is presented in **Appendix 2: Proposed Site Layout**.

### 4 Policy, Standards and Guidance

- 4.1 The following planning policy and acoustics standards and guidance have been considered in this assessment. Further detail is provided in **Appendix 3: Policy, Standards and Guidance**.
- Noise Policy Statement for England (NPSE).
  - National Planning Policy Framework (NPPF).
  - BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'.
  - BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings.

### 5 Environmental Sound Survey

#### 5.1 Measurements Procedure

- 5.1.1 Unattended environmental sound monitoring was undertaken at a position to the south of the site outside the redline boundary from 11:00 hrs on Friday, 10 May 2024 to 11:00 hrs on Monday 14 May 2024. The unattended monitoring position, MPI, is indicated in the figure presented in **Appendix 1: Site Location, Monitoring Positions and Noise Sensitive Receptors**. The microphone was mounted in the free-field at a height of 1.5 m. The position is considered to be representative of the existing environmental sound climate at the nearest NSRs to the site.

- 5.1.2 Additional short term attended environmental sound monitoring was undertaken for comparative purposes, at two positions outside the redline boundary on Friday, 10 May 2024. The attended monitoring positions, MP2 and MP3 are indicated in the figure presented in **Appendix 1: Site Location, Monitoring Positions and Noise Sensitive Receptors**. The microphone was mounted in the free-field at a height of 1.5 m.
- 5.1.3 Measurements were undertaken in accordance with BS 7445-1: 2003<sup>1</sup>, with installation and collection of the equipment undertaken by Will Wright being employed by Miller Goodall Ltd.
- 5.1.4 The calibration of the sound level meter was checked before and after the measurements, with negligible deviation recorded. Details of the equipment used are set out in **Table 1**.

Table 1: Noise monitoring equipment

| Equipment Description                                                          | Type Number | Manufacturer | Serial No. | Date Calibrated | Calibration Certification Number |
|--------------------------------------------------------------------------------|-------------|--------------|------------|-----------------|----------------------------------|
| Class 1 <sup>[4], [5]</sup><br>Integrating Real Time 1/3 Octave Sound Analyser | NOR 140     | Norsonic     | 1406017    | 13/09/2023      | 06431/4                          |
| Microphone                                                                     | NOR 1225    | Norsonic     | 358159     | 13/09/2023      | 06431/4                          |
| Pre-amplifier                                                                  | NOR 1209    | Norsonic     | 14448      | 13/09/2023      | 06431/4                          |
| Outdoor Microphone Housing                                                     | NOR1217     | Norsonic     | 12175738   | N/A             | N/A                              |
| Class 1 Field Calibrator                                                       | Type 4231   | Brüel & Kjær | 2478249    | 13/09/2023      | 06431/3                          |

- 5.1.5 Each measurement period consisted of sequential 100 ms samples. The data has been analysed, to determine the 15 minute  $L_{Aeq}$ ,  $L_{A90}$  and  $L_{AF,max}$  sound levels. The 100 ms sound levels have not been presented in this report but are kept on file for future reference.

5.2 Environmental Sound Climate

- 5.2.1 During the installation of the equipment at MPI, the residual sound climate was observed to consist of distant road traffic noise, distant air traffic flyovers, and birdsong. During the attended

<sup>1</sup> BS 7445-1: 2003 Description and measurement of environmental noise – Part 1: Guide to quantities and procedures

measurements at MP2 and MP3 the residual sound climate was observed to be similar with the addition of noise from occasional localised road traffic pass-bys on Armshead Road and Luzlow Lane respectively, and at MP3, noise from a dog howling in the adjacent farmyard was observed. During the collection of the equipment at MP1, the residual sound climate was observed to be similar, with the addition of noise from moving farm vehicles in the locality of Little Armshead Farm.

### 5.3 Weather Conditions

- 5.3.1 Weather conditions were observed when the equipment was installed and collected. Weather forecasts were checked and weather history data has been reviewed for the period for which the monitoring was unattended.
- 5.3.2 In general, the recorded weather conditions are considered to have been suitable for environmental sound monitoring, with wind speeds less than  $5\text{ms}^{-1}$  throughout the survey period. Weather history data indicates that there may have been thunderstorms and light rain between 18:50 hrs and 20:50 hrs on Sunday 12 May. However, wind speeds remained below  $5\text{ms}^{-1}$  during the same period.
- 5.3.3 Based on a comparison of the daytime and night-time sound levels recorded across the survey period, any adverse weather conditions that may have occurred between 18:50 hrs and 20:50 on Sunday 12 May are not considered to have adversely affected the results.

### 5.4 Monitoring Results

- 5.4.1 A time history graph for the full unattended monitoring period at MP1, plotted in 15-minute time intervals, is presented in **Appendix 4: Environmental Sound Survey Results**. All data are sound pressure levels in dB re  $20\text{ }\mu\text{Pa}$ .
- 5.4.2 A summary of the broadband measurement data for the unattended monitoring at MP1 is provided in **Table 2**.

**Table 2: Summary of unattended environmental sound monitoring results at MPI**

| Date                           | Day                       | Period        | Start Time<br>hr:mm    | Elapsed Time, T<br>hh:mm:ss                  | $L_{Aeq,T}^{*1}$<br>dB | $L_{AFmax,T}^{*2}$<br>dB | $L_{A90,T}^{*3}$<br>dB |
|--------------------------------|---------------------------|---------------|------------------------|----------------------------------------------|------------------------|--------------------------|------------------------|
| 10/05/2024<br>to<br>11/05/2024 | Friday<br>to<br>Saturday  | Night-time    | 23:00                  | 08:00:00                                     | 45                     | 79                       | 27                     |
| 11/05/2024                     | Saturday                  | Daytime       | 07:00                  | 16:00:00                                     | 49                     | 80                       | 38                     |
| 11/05/2024<br>to<br>12/04/2024 | Saturday<br>to<br>Sunday  | Night-time    | 23:00                  | 08:00:00                                     | 47                     | 75                       | 30                     |
| 12/05/2024                     | Sunday                    | Daytime       | 07:00                  | 16:00:00                                     | 47                     | 82                       | 37                     |
| 12/05/2024<br>to<br>13/05/2024 | Sunday<br>to<br>Monday    | Night-time    | 23:00                  | 08:00:00                                     | 47                     | 75                       | 21                     |
| 13/05/2024                     | Monday                    | Daytime       | 07:00                  | 16:00:00                                     | 51                     | 86                       | 40                     |
| 13/05/2024<br>to<br>14/05/2024 | Monday<br>to<br>Tuesday   | Night-time    | 23:00                  | 08:00:00                                     | 48                     | 78                       | 36                     |
| 14/05/2024<br>/<br>10/05/24*4. | Tuesday<br>/<br>Friday*4. | Daytime*4.    | 07:00<br>/<br>11:00*4. | 04:00:00<br>/<br>12:00:00*4.<br>T = 16:00:00 | 47                     | 80                       | 34                     |
| 10/05/2024<br>to<br>14/05/2024 | Friday<br>to<br>Tuesday   | Night-time*5. | 23:00                  | 32:00:00                                     | 47                     | 79                       | 30                     |
| 10/05/2024<br>/<br>14/05/24*4. | Friday<br>to<br>Tuesday   | Daytime*5.    | 07:00                  | 64:00:00                                     | 49                     | 86                       | 38                     |

\*1. The values presented for the  $L_{Aeq,T}$  are the log average of the  $L_{Aeq,15min}$  values recorded within the corresponding period, of length T.

\*2. The values presented for the  $L_{AFmax,T}$  are the maximum  $L_{AFmax,15min}$  values recorded within the corresponding period, of length T.

\*3. The values presented for the  $L_{A90,T}$  have been calculated using the histogram method as detailed in BS 4142:2014+A1:2019, from the  $L_{A90,15min}$  values recorded within the corresponding period, of length T. The value

presented is the most commonly occurring  $L_{A90,15min}$  value during the period, for which no less than 45% of the total histogram data occurs below.

\*4. Measurements recorded on Friday afternoon and Tuesday morning have been concatenated to represent a 16 hour weekday period..

\*5. The measurement time stated is for the concatenation of disaggregated measurements obtained for the 4 respective 8 hour night-time periods, Friday through to Tuesday; or 5 respective daytime periods, Friday 11:00 hrs through to Tuesday 11:00 hrs.

5.5 A summary of the broadband measurement data for the attended monitoring at MP2 and MP3 is presented in **Table 3**.

**Table 3: Summary of attended environmental sound monitoring results on Friday 10 May 2024**

| Monitoring Position | Period  | Start Time<br>hh:mm | Elapsed Time, T<br>hh:mm:ss | $L_{Aeq,T}$<br>dB | $L_{AFmax,T}$<br>dB | $L_{A90,T}$<br>dB |
|---------------------|---------|---------------------|-----------------------------|-------------------|---------------------|-------------------|
| MP2                 | Daytime | 10:10               | 00:15:00                    | 48                | 66                  | 34                |
|                     | Daytime | 10:25               | 00:15:00                    | 46                | 67                  | 36                |
| MP3                 | Daytime | 09:35               | 00:15:00                    | 46                | 61                  | 36                |
|                     | Daytime | 09:50               | 00:15:00                    | 48                | 68                  | 36                |

5.6 The daytime background  $L_{A90,15min}$  sound levels presented in **Table 3** corresponding to attended measurements at MP2 and MP3, are approximately 2 dB lower than the typical background  $L_{A90,15min}$  daytime sound levels presented in **Table 2** corresponding to the attended measurements at MP1. Based on observations at the time of installation of the equipment at MP1, it is considered that the slight elevation of daytime background sound levels at MP1 is likely to be due to activity noise from Little Armshead Farm. Since such activity would be unlikely to occur during the night-time period, the unattended night-time measurements undertaken at MP1 are considered to be representative of the sound climate across the site, for the purpose of this assessment.

5.7 **Background Sound Level**

5.7.1 Based on the results of the environmental sound monitoring at MP1 presented in **Table 2**, the lowest modal average night-time background sound level was 21 dB  $L_{A90,15min}$ , corresponding with the night-time of Sunday 12 May 2024 to Monday 13 May 2024. The highest modal average night-time background sound level was 36 dB  $L_{A90,15min}$ , corresponding with the night-time of Monday 13 May to

Tuesday 14 May. The modal average night-time background sound level across the four respective night-time periods, Friday 10 May 2024 through Tuesday 14 May 2024, was 30 dB  $L_{A90,15min}$ .

5.7.2 Consideration has been given to the selection of a representative background sound level based on guidance provided in BS 4142.

5.7.3 Referring to absolute sound levels, BS 4142:2014+A1:2019 gives the following guidance:

*'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.'*

5.7.4 Whilst BS 4142:2014+A1:2019 does not quantify what constitutes a low background sound level or low rating level, the previous edition of the standard, BS 4142:1997, advised that:

*'The method [comparing rating levels with background sound levels] is not suitable ... when the background and rating noise levels are both very low*  
*NOTE: For the purpose of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low'*

5.7.5 Based on this, the modal average background sound level of 21 dB, corresponding with the night-time of Sunday 12 May to 2024 to Monday 13 May 2024, is considered to be very low.

5.7.6 Referring to the background sound level, BS 4142:2014+A1:2019 gives the following guidance:

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

5.7.7 The standard goes on to advise:

*'To obtain a representative background sound level, a series of either sequential or disaggregated measurements should be carried out for the period(s) of interest, possibly on more than one occasion. A representative level should account for the range of background sound levels and should not automatically be assumed to be either the minimum or modal value'*

- 5.7.8 A histogram is presented in **Appendix 4: Environmental Sound Survey Results**, corresponding to the modal analysis of the night-time background sound level obtained from disaggregated measurements at MP1 across the four respective night-time periods, Friday 10 May 2024 through Tuesday 14 May 2024.
- 5.7.9 Based on the histogram and time history graph presented in **Appendix 4: Environmental Sound Survey Results**, and considering the likely operating times of the plant associated with the proposed development, a representative background sound level has been derived. Further information regarding the likely operating times is outlined in Section 8.1.
- 5.7.10 The background sound level used in the BS 4142 assessment is 30 dB  $L_{A90,15min}$ . This is considered to be representative of the typical background sound level at the most affected NSR and is categorised as very low?.

## 6 Baseline Modelling of Noise from the Proposed Development

- 6.1 A baseline noise model has been assembled using CadnaA noise modelling software.
- 6.2 The general horizontal plan information of the area surrounding and including the proposed development site was imported from Google Earth. This was used to determine road positions, building footprint areas and relative locations and is considered accurate to within 5%. Topography was imported from the DEFRA LIDAR dataset, and existing building height information was input based on site observations. The site level for the BESS compound area was set to a fixed height corresponding with the proposed site cross section plans.
- 6.3 The following parameters were assigned to the model:
- Propagation of noise using algorithms within ISO 9613: 2024 *Acoustics – Attenuation of sound during propagation outdoors*.
  - Default ground absorption  $G = 0.8$ . Representing soft ground surrounding the site.
  - No adverse meteorological effects.
  - Two orders of reflection.
  - Buildings are reflecting with smooth non-structured facades.
  - Receiver heights of 4 m for first floor receivers.
  - Grid height for noise contour plots of 4 m, to be representative of the worst-case night-time scenario at the NSRs.

6.4 Details of the proposed site layout, the proposed site cross sections and the associated plant have been obtained from drawings, CAD files and data sheets provided by the client.

6.5 **Table 4** summarises the documents provided and the information obtained.

**Table 4: Technical documentation**

| Document Title                                                                                                          | Document Author                           | Information obtained                        |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------|
| 99 MW BESS ES Figure 1.2<br>Proposed Site Layout                                                                        | Root-Power                                | Layout of proposed plant and buildings      |
| 99MW BESS Proposed Cross<br>Section Plan                                                                                | Root-Power                                | Site level of proposed BESS compound        |
| 0.5P-0.67P_SolBank Noise Level<br>Testing Report, Rev A                                                                 | CSI Energy Storage Technologies Co., Ltd. | Battery container noise levels              |
| White Paper BU-LS-001: Sunny<br>Central UP – Sound Power<br>Measurements on Sunny Central<br>UP (-US) central inverters | SMA Solar Technology                      | Inverter noise levels                       |
| Noise Reduction Kit, Sunny<br>Central UP-US                                                                             | SMA Solar Technology                      | Details of noise reduction kit              |
| Noise Reduction Kit: Update<br>November 2023                                                                            | SMA Solar Technology                      | Attenuation provided by noise reduction kit |

6.6 All plant is assumed to operate in a steady state with a one hundred per cent on-time, providing a conservative assessment as this is not likely to occur in reality. Therefore, the specific  $L_{Aeq,Tr}$  cumulative noise level from the proposed development would be equal for the daytime or night-time period at a given receptor location, irrespective of the chosen reference period, Tr.

6.7 The baseline noise modelling includes the following baseline mitigation:

- Attenuation to the inverters based on the manufacturer's data and information sheets for the noise reduction kit.

6.8 **Table 5** summarises the baseline modelling methodology for the plant associated with the proposed development. Further details of the acoustic properties associated with the baseline modelling are provided in **Appendix 5: Noise modelling parameters**.

**Table 5: Summary of baseline CadnaA modelling methodology for proposed plant**

| Proposed Plant                                                                                                                               | Methodology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 48 No. battery containers, laid out in 12 clusters.                                                                                          | <ul style="list-style-type: none"> <li>Containers modelled as buildings 2.9 m high.</li> <li>Point source located centrally on outward facing facade at a height of 2 m.</li> <li>Sound power level of point source derived from measured 1/3 octave band sound pressure level data provided in manufacturer's test report, with the test report stating the SolBank HVAC and chiller were manually set to the maximum cooling power operation.</li> </ul>                                                                                                                                                                                                                 |
| 24 No. inverters, laid out in 12 pairs, each pair coupled with associated transformer to centre. Noise reduction kit installed to inverters. | <ul style="list-style-type: none"> <li>Modelled as point sources at a height of 2m at each inverter location.</li> <li>Dominant source noise assumed to be from the inverters.</li> <li>Sound power level of point source derived from sound power level of inverter provided in manufacturer's data sheet, with the test report stating measurements were taken under nominal operating conditions for the inverters, with all inverter fans operating at maximum speed. 5 dB reduction applied based on manufacturer's data and information sheet for the inverter noise reduction kit. Octave band spectrum derived from indicative inverter spectrum shape.</li> </ul> |
| 1 No. 33 kV/415 V site supply transformer.                                                                                                   | <ul style="list-style-type: none"> <li>Modelled as a point source at height of 2m.</li> <li>Sound power level of point source derived from indicative worst-case single figure sound power level for a similar transformer type. 1/3 octave band spectrum derived from indicative transformer spectrum shape.</li> </ul>                                                                                                                                                                                                                                                                                                                                                   |
| 1 No. 132 kV substation transformer.                                                                                                         | <ul style="list-style-type: none"> <li>Modelled as a point source at height of 2m.</li> <li>Sound power level of point source derived from indicative worst-case single figure sound power level for a similar transformer type. 1/3 octave band spectrum derived from indicative transformer spectrum shape.</li> </ul>                                                                                                                                                                                                                                                                                                                                                   |

## 7 Baseline Modelled Noise Levels at Noise Sensitive Receptors

- 7.1 A figure showing the output from the baseline noise model at a height of 4 m is presented in **Appendix 6: Noise Model Outputs**. The figure shows the predicted noise levels at receiver locations and corresponding noise contours for the baseline modelling.
- 7.2 **Table 6** sets out the noise sensitive receptors (NSRs) considered within the assessment and included within the noise model. The modelled noise levels at the NSRs due to emissions from the proposed development with baseline mitigation included are presented.

**Table 6: Modelled noise levels and noise sensitive receptors – Baseline**

| Noise Sensitive Receptor (NSR) |                                                                                                                | Modelled Height<br>m | Modelled Specific Noise Level<br><i>dB L</i> <sub>Aeq,Tr</sub> |
|--------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------|
| Reference                      | Description                                                                                                    |                      |                                                                |
| NSR1                           | First floor facade at the north side of the dwelling at Little Armshead Farm                                   | 4                    | 42                                                             |
| NSR2                           | First floor facade at the west side of a dwelling at Armshead Road to the south-east of the proposed BESS site | 4                    | 37                                                             |
| NSR3                           | First floor facade at the west side of the dwelling at New House Farm                                          | 4                    | 40                                                             |

- 7.3 Based on the results presented in **Table 6** and the background sound level of 30dB  $L_{A90,15min}$  obtained from measurements at MP1, and consideration of the likely background sound level at NSR locations further from the site than MP1, the most affected NSR is likely to be NSR 1 and then NSR3. Since NSR3 corresponds to the landowner's property, it is considered that NSR1 is likely to be the most affected receptor. As such, NSR1 is considered to be the most affected receptor for the purpose of this assessment.
- 7.4 Analysis of the modelled noise levels contributing to the overall specific noise level at NSR1, indicates that noise levels are likely to be driven by the inverters. The modelled cumulative inverter noise level is approximately 41 dB at NSR1. The modelled cumulative battery container noise level is approximately 36 dB at NSR1. The modelled cumulative noise level contribution from the transformers associated with the site is approximately 19 dB.

## 8 Baseline BS 4142:2014+A1:2019 Assessment

### 8.1 Impact Assessment

8.1.1 A BS 4142 noise impact assessment has been undertaken to assess the potential impact of noise from the baseline development proposal at NSR1. The assessment has been undertaken for the night-time period when the background sound level is lower to present a worst-case assessment. The first floor has been selected for the assessment as this floor is more likely to be inhabited at night-time.

8.1.2 The potential for operating characteristics of the plant have been considered further since the V2 report of February 2025. In terms of the application of an acoustic feature correction for intermittency and based on information provided by the client, it is understood that:

- HVAC associated with the battery containers and the inverters would be operational the majority of the time.
- There would be periods when HVAC would operate at lower duty or may enter standby mode due to periods of inactivity.
- The HVAC is likely to operate at the highest capacity during charge and discharge periods, with the most activity typically expected during daytime hours between 15:00 and 23:00 hrs. However, the battery can be charged or discharged at any time during the day or night, subject to the electricity system operator's requirements, as well as market activity. Ultimately, for an intermittency penalty to be a valid addition, plant noise would be required to cycle between on and off multiple times in a perceptible way within any given assessment period (1-hour for daytime and 15-minutes for night-time).

8.1.3 Based on the information provided regarding the proposed plant operations, it is not considered that the application of an intermittency penalty to the rating level is appropriate.

8.1.4 The acoustic feature correction for tonality has been reconsidered for the proposed plant as follows:

- Battery containers - The one-third octave band spectrum provided in the manufacturer's test report was analysed based on the one-third octave method of BS 4142 and determined not to be tonal. Therefore, no acoustic feature correction for tonality has been applied based on the battery container noise levels.

- Site Supply Transformer and Substation Transformer – The modelling is based on indicative spectra as the spectra of the proposed plant were not available. As such, the presence of potential tonality cannot be determined objectively. However, based on the difference between the modelled specific transformer noise level and the measured residual sound level of approximately 16 dB, any tonality from the installed transformers is unlikely to be perceptible at NSR1.
- Inverters – The modelling is based on indicative spectra as the spectra of the proposed plant were not available. As such, the presence of potential tonality cannot be determined objectively. The modelled cumulative specific noise level of the inverters is approximately 14 dB greater than the residual sound level and is approximately 19 dB greater than the background sound level. This indicates that were any tonality present in the installed inverters, and were several of the inverters operating to full capacity simultaneously, it may be perceptible during quieter night-time periods.

#### 8.1.5 Based on the above:

- An acoustic feature correction of + 2 dB has been applied for tonality as a conservative estimate of a scenario where several of the inverters that potentially produce tonal sound operate to full capacity simultaneously, which may be perceptible during night-time periods.

#### 8.1.6 The BS 4142 assessment of noise impact at the most affected NSR is presented in **Table 7**.

**Table 7: BS 4142:2014 numerical night-time assessment at NSR1 – Baseline**

| Parameter                       | Results                          | Commentary                                                                                                                                                                     |
|---------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measured Background Sound Level | $L_{AF90,15min} = 30 \text{ dB}$ | Representative background sound level during night-time periods.                                                                                                               |
| Measured Residual Sound Level   | $L_{Aeq,15min} = 35 \text{ dB}$  | Typical $L_{Aeq,15min}$ sound level measured during night-time periods.                                                                                                        |
| Modelled Specific Noise Level   | $L_{Aeq,15min} = 42 \text{ dB}$  | Modelled noise level at NSR1.                                                                                                                                                  |
| Acoustic Feature Correction     | + 2 dB                           | Potential high perceptibility of inverter tonality and potentially distinctive intermittency at NSR1 during the quietest night-time periods. Worst-case conservative estimate. |
| Rating Level                    | $L_{Ar,15min} = 44 \text{ dB}$   | Sum of Modelled Specific Noise Level and Acoustic Feature Correction                                                                                                           |

| Parameter                                          | Results                                                            | Commentary                                                                                  |
|----------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Excess of Rating Level over Background Sound Level | + 14 dB                                                            | The rating level is 14 dB greater than the background sound level.                          |
| Outcome                                            | Indication of significant adverse impact, depending on the context | Context detailed in section 9.4 for indicative assessment with further mitigation included. |

8.1.7 It can be seen from **Table 7** that the outcome of the initial numerical BS 4142 assessment indicates a significant adverse impact at the most affected NSR during night-time periods, depending on the context.

## 8.2 Context

8.2.1 In terms of the operational characteristics of the plant, these are not yet known. Therefore, the following was modelled, despite the unlikely event of this happening in practice;

- BESS plant source noise levels corresponding to full capacity operation; and,
- All BESS plant operating to capacity simultaneously during and the night-time assessment periods

8.2.2 As stated above, at the time of undertaking the noise assessment, the manufacturer and model of BESS plant proposed for installation at the site are still to be confirmed. Plant data from a potential partner was, therefore, used. It is understood that BESS technology is constantly evolving and as such sound power levels of plant are altering. Further reductions in impact may also, therefore, be achievable by the time this facility comes to fruition.

8.3 BS 4142:2014 makes the following points:

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

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

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

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

*2- The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/ or commercial nature is likely to be perceived and how people react to it.*

**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."**

- 8.3.1 As discussed, earlier versions of BS 4142:2014 advise that a background level of 30 dBL<sub>A90</sub> (or lower) may be considered 'objectively low'. BS 4142 advises in such situations, particularly during the night time period, that reference to fixed criteria may be more appropriate. As such, it is considered prudent to assess internal habitable rooms against the internal criterion given in BS 8233:2014.
- 8.3.2 The standard provides noise limits for rooms within buildings by type of use ie bedroom, living room etc and by time of day. Target noise levels within habitable rooms (bedrooms and living rooms) are 35 dB during the daytime period and 30 dB during the night-time period.
- 8.3.3 A partially open window gives attenuation of at least 10 dB and up to 15 dB and thus noise levels within dwellings will be less than 30dB L<sub>Aeq(8 hour)</sub> within the bedroom of worst case affected receptor at night. As the specific noise levels at the façade of the worst affected receptor is 42 dB L<sub>A,15min</sub> at night, these internal noise levels will be met

## 8.4 Outcome

- 8.4.1 Based on the numerical BS 4142 assessment presented in **Table 7**, it is considered that the impact of noise emissions due to the baseline development proposal is unlikely to be acceptable to SMDC in terms of the likely noise emissions when considered in the context of a traditional BS4142 assessment. However, in relation to fixed, absolute levels, the noise impact is likely to be acceptable. To provide further comfort to SMDC, further noise modelling has been undertaken to provide indicative mitigation recommendations should they be necessary.

# 9 BS 4142 Assessment with Indicative Mitigation

## 9.1 Noise Modelling

- 9.1.1 Based on the current BESS plant and layout, a total blanket reduction of 14 dB in BESS plant noise levels is likely to be required to achieve a rating level that matches the background sound level at the most affected NSR. This would lead to a BS 4142:2014+A1:2019 assessment indicating a low impact. Based on discussions with the client, it is considered that this may be achievable by design, as BESS technology is evolving quickly with a plethora of options available on the market.
- 9.1.2 In order to demonstrate the potential feasibility of the scheme in terms of noise emissions, this attenuation has been simulated in the noise model. This has been implemented in the model by the application of 15 dB of attenuation specifically to the battery container and inverter noise levels in each octave band from 63 Hz to 8 kHz, resulting in 28 dB(A) at NSR 1.

## 9.2 Modelled Noise Levels at Noise Sensitive Receptors

- 9.2.1 A figure showing the output from the noise model with indicative mitigation is presented in **Appendix 6: Noise Model Outputs**. The figure shows the predicted noise levels at receiver locations and corresponding noise contours for the proposed development with indicative mitigation included.
- 9.2.2 Analysis of the modelled noise levels contributing to the overall specific noise level at NSR1, indicates that noise levels are likely to be driven by the inverters. The modelled cumulative inverter noise level is approximately 28 dB at NSR1. The modelled cumulative battery container noise level is approximately 25 dB at NSR1. The modelled cumulative noise level contribution from the transformers associated with the site is approximately 19 dB.

### 9.3 Mitigated BS 4142:2014+A1:2019 Impact Assessment

9.3.1 The BS 4142 noise impact assessment has been updated based on the modelled noise levels with the indicative mitigation included within the noise model.

9.3.2 An acoustic feature correction for tonality has been considered for the proposed plant as follows:

- Battery containers – No change from baseline modelling. The one-third octave band spectrum provided in the manufacturer's test report was determined not to be tonal. Therefore, no acoustic feature correction for tonality has been applied based on the battery container noise levels.
- Site Supply Transformer and Substation Transformer – No change from baseline modelling. Based on the difference between the modelled specific transformer noise level and the measured residual sound level of approximately 16 dB, any tonality from the installed transformers is unlikely to be perceptible at NSR1. Therefore, no acoustic feature correction for tonality has been applied based on the transformer noise levels.
- Inverters – The modelled cumulative specific noise level of the inverters is approximately 7 dB below the residual sound level and 2 dB below the background sound level. Since the contribution from the inverters is within 2 dB of the existing background sound level, it is considered that were any tonality present in the installed inverters, and were several of the inverters operating to full capacity simultaneously, this may be just barely perceptible during night-time periods. This is considered to be a conservative estimate based on a worst-case scenario.

9.3.3 Based on the above:

- An acoustic feature correction of + 2 dB has been applied for tonality as a worst-case conservative estimate of potential perceptibility of inverter tonality during the quietest night-time periods.

9.3.4 The BS 4142 assessment of noise impact at the most affected NSR is presented in **Table 8**.

**Table 8: BS 4142:2014 numerical night-time assessment at NSR1 – With indicative mitigation**

| Parameter                                          | Results                                              | Commentary                                                                                                                    |
|----------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Measured Background Sound Level                    | $L_{A90,15min} = 30 \text{ dB}$                      | Representative background sound level during night-time periods.                                                              |
| Measured Residual Sound Level                      | $L_{Aeq,15min} = 35 \text{ dB}$                      | Typical $L_{Aeq,15min}$ sound level measured during night-time periods.                                                       |
| Modelled Specific Noise Level                      | $L_{Aeq,15min} = 28 \text{ dB}$                      | Modelled noise level at NSR1.                                                                                                 |
| Acoustic Feature Correction                        | + 2 dB                                               | Potential perceptibility of inverter tonality at NSR1 during worst-case night-time periods. Worst-case conservative estimate. |
| Rating Level                                       | $L_{Ar,15min} = 30 \text{ dB}$                       | Sum of Modelled Specific Noise Level and Acoustic Feature Correction                                                          |
| Excess of Rating Level over Background Sound Level | + 0 dB                                               | The rating level matches the background sound level.                                                                          |
| Outcome                                            | Indication of a low impact, depending on the context | Context detailed below.                                                                                                       |

9.3.5 It can be seen from **Table 8** that the outcome of the initial numerical BS 4142 assessment indicates a likelihood of a low noise impact at the most affected NSR during night-time periods.

## 9.4 Mitigated Assessment Context

9.4.1 The assessment presented in **Table 8** details the results of the initial numerical assessment of noise levels at the most affected NSR. It is important to note that the numerical assessment of impact is influenced by the context of the proposals including the surrounding environment and the operating characteristics.

9.4.2 The surrounding environment is a rural area with low background sound levels. As such, occupants of dwellings may not be accustomed to industrial noise sources.

9.4.3 Considering the operating characteristics, tonality and intermittency have been considered in the numerical assessment. A total acoustic characteristic correction of 2 dB has been added to the specific noise level based on potential audibility of inverter tonality during the quietest periods. However, the specific noise level for the numerical assessment has been based on a worst-case assumption of all plant operating at capacity with one hundred percent on-times. Based on information regarding operating characteristics provided by the client, there is a likelihood of lower capacity operation during night-time periods. It is therefore likely that the specific cumulative

operational noise emissions from the development would be lower than the levels on which the numerical assessment is based. In turn, this would likely reduce the audibility of acoustic characteristics. As such, the acoustic feature correction applied to the numerical assessment is considered to be a conservative worst-case estimate. In practice, the rating level may be lower.

9.4.4 Considering the noise impact of the development during the night-time period, it is likely that occupants of dwellings associated with the NSRs would be in bedrooms sleeping. The numerical assessment is based on modelled incident façade noise levels, at first floor level, in order to represent sound incident on bedroom facades, during the night-time period. The worst-case scenario for noise ingress to bedrooms would likely be during night-time periods when windows were open for ventilation. Assuming an open window provides 13 dB of attenuation, and based on the worst-case modelled incident facade level at NSR1, the internal noise level due to noise emissions from the proposed development would likely be approximately **15 dB**. Other contributors to the internal noise level would likely be external residual sound level ingress, and any noise from household equipment, appliances and occupants. Internal noise levels would be likely to remain below the 30 dB criteria for bedrooms specified in BS 8233:2014. This is considered to be an indication that the overall impact is likely to be low during night-time periods.

9.4.5 The assessment has been undertaken at NSR1, considered likely to be the most affected receptor. Considering the other NSRs, the background sound level of 30 dB is considered to remain representative. The modelled specific noise level at NSR3 is similar, therefore a similar overall assessment of impact is considered to apply. The modelled specific noise level at NSR2 is lower, which is an indication that the overall impact is likely to be low.

## 9.5 Outcome

9.5.1 Based on the numerical BS 4142 assessment presented in **Table 8** and with consideration of the context described above, it is considered that the overall impact of noise emissions due to the proposed development is likely to be low, with the indicative mitigation included.

## 9.6 Low Frequency Analysis to NANR45 Design Targets

9.6.1 To assess potential low frequency noise impact from the proposed BESS, octave-band sound levels at the most affected receptor (NSR1) have been compared against external design targets derived from **NANR45 internal thresholds**, assuming partially open windows and a typical 13 dB façade attenuation across the 31.5–125 Hz octave bands.

9.6.2 The following external sound pressure level targets represent the maximum allowable levels at the façade of NSR1 to ensure that internal LFN does not exceed NANR45 complaint thresholds or conservative design goals:

**Table 9: Derived NANR45 threshold design targets**

| Octave Band Centre Frequency (Hz) | Internal complaint threshold (dB) | Design Target (-5 dB) | Façade Attenuation (dB) | External Design Target |
|-----------------------------------|-----------------------------------|-----------------------|-------------------------|------------------------|
| 31.5                              | 49                                | 44                    | +13                     | 57                     |
| 63                                | 40                                | 35                    | +13                     | 48                     |
| 125                               | 34                                | 29                    | +13                     | 42                     |

9.6.3 The following table presents the predicted façade incident sound levels at NSR 1 from the proposed BESS (post-mitigation), based on octave-band results from the CadnaA model:

**Table 10: Modelled 3 – 125 Hz LFN received at NSR 1 façade**

| Octave Band Centre Frequency (Hz) | 31.5  | 63    | 125  |
|-----------------------------------|-------|-------|------|
| Predicted $L_{Aeq}$ (dB)          | 38.2  | 37.1  | 35.9 |
| Predicted – Design Target (dB0)   | -18.8 | -10.9 | -6.1 |

9.6.4 The predicted levels at 31.5 Hz (38.2 dB), 63 Hz (37.1 dB), and 125 Hz (35.9 dB) are all significantly below both the NANR45-derived external complaint thresholds and conservative design targets.

9.6.5 The margin of compliance ranges from ~6 to 18 dB below the conservative design target levels.

9.6.6 Given the lack of dominant tonal peaks and the broad spectral character of the source, the risk of low-frequency noise complaints is considered low.

9.6.7 Provided the recommended mitigation outlined in the following section is implemented, low-frequency noise achieves robust compliance with NANR45 low frequency noise guidance and is unlikely to cause disturbance at the noise sensitive receptors.

## 10 Recommended Mitigation Scheme

### 10.1 Pre-commencement Noise Assessment

10.1.1 Based on the current BESS plant layout, a reduction of 15 dB in BESS plant noise levels based on currently proposed units is likely to be required to prevent rating levels breaching background levels at the most affected NSR, which may be acceptable to the local authority. Based on the current layout and plant geometry, this could be achieved by meeting the following indicative maximum BESS plant noise limits, at source:

- Battery containers: 72 dB(A) broadband sound power level
- Inverters: 76 dB(A) broadband sound power level.

10.1.2 The noise levels stated above are presented to demonstrate potential feasibility. The exact plant noise level specification requirements would also be dependent on other factors such as the final plant layout, number of plant items, and plant geometry.

10.1.3 It is recommended that a pre-commencement noise assessment is undertaken of the final layout, including the detailed battery container, inverter and transformer specifications. This should be submitted to SMDC to demonstrate that acceptable noise levels are likely to be achieved. A suitably worded planning condition requiring this pre-commencement noise assessment is recommended and suggested wording for this is provided below;

*The rating level of noise arising from the operational phase of the development shall not exceed the existing typical background noise level at Little Armshead Farm at any time.*

*The development shall not commence, save for the permitted preliminary works, until a scheme has been submitted to and approved in writing by the local planning authority, for ensuring that the noise levels do not exceed the limits set out above.*

*All works which form part of the approved scheme shall be completed before the approved use commences and shall be retained throughout the life of the development.*

10.1.4 This condition would ensure that the development can't be built out or operated until this condition has been discharged. This is a common practice with battery energy storage planning permissions.

# 11 Cumulative Assessment

## 11.1 Background

11.1.1 An indicative cumulative impact assessment has been undertaken as requested by SMDC in an EIA scoping opinion dated 19 November 2024.

## 11.2 Methodology

11.2.1 A plan of application sites for green belt energy schemes at Cellarhead has been reviewed. The plan is presented in **Appendix 7: Plan of Green Belt Energy Schemes at Cellarhead**. A schedule summarising the reviewed schemes is presented in **Table 11**.

**Table 11: Schedule of Green Belt Energy Schemes**

| Application Reference | Site Name                              | Description | Status                                       |
|-----------------------|----------------------------------------|-------------|----------------------------------------------|
| SMD/2023/0523         | Land at Rownall Farm                   | Solar Farm  | Under Assessment                             |
| SMD/2022/0548         | Land Adjacent to Cellarhead Substation | BESS        | Approved                                     |
| SMD/2022/0574         | Land Adjacent to Armshead Farm         | BESS        | Approved on Appeal                           |
| SMD/2023/0639         | Land at Greenfields Farm               | BESS        | Screening Opinion / EIA Required and Pending |
| SMD/2024/0019         | Land at Newfields Farm                 | BESS        | Refused                                      |

11.2.2 The sites summarised in **Table 11** have been considered with respect to likely noise generation and likely cumulative effects. Documentation associated with the planning applications has been reviewed. Where associated noise assessment reports have been available, common receptors with the potential for cumulative effects have been considered.

11.2.3 **Table 12** summarises the review of previous noise assessment reports. Where common receptors have been assessed, these are set out in **Table 12**. The locations of the common receptors are indicated on the figure in **Appendix 1: Site Location, Monitoring Positions and Noise Sensitive Receptors**.

**Table 12: Summary of Previous Noise Assessment Review**

| Application Reference | Noise Assessment Report                                  | Common Receptors | Summary of Review                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------|----------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SMD/2023/0523         | 24 Acoustics,<br>R9097-1 Rev 1,<br>31 January<br>2022    | N/A              | <ul style="list-style-type: none"> <li>The nearest common receptor reported is Bettany Horse Boxes at a distance of over 800 m from the proposed New House Farm BESS.</li> <li>The previous report presents daytime noise levels and a daytime assessment only.</li> <li>The predicted specific noise level reported for Bettany Horse Boxes is 4 dB below the reported background sound level.</li> <li>This site has been scoped out of the cumulative assessment due to the distance of the nearest common receptor from the proposed New House Farm BESS, and the previous assessment of low daytime specific noise level. Cumulative effects unlikely to be significant.</li> </ul> |
| SMD/2022/0548         | NoiseAssess<br>Ltd,<br>13269.02.v5,<br>September<br>2022 | N/A              | <ul style="list-style-type: none"> <li>The nearest common receptor reported is to the east of the Land Adjacent to Cellarhead Substation application site. The proposed New House Farm BESS is to the west.</li> <li>The nearest common receptor is approximately 1 km from the proposed New House Farm BESS.</li> <li>Land Adjacent to Armshead Farm and Land at Newfields Farm are in closer proximity to the proposed New House Farm BESS.</li> <li>This site has been scoped out of the cumulative assessment as other sites have common receptors in closer proximity to the proposed New House Farm BESS.</li> </ul>                                                               |
| SMD/2022/0574         | InAcoustic,<br>22-282,<br>09/08/2022                     | NSR5<br><br>NSR7 | <ul style="list-style-type: none"> <li>The common receptors are within relatively close proximity to the proposed New House Farm BESS.</li> <li>Scoped in due to the proximity of common receptors to the proposed New House Farm BESS.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| SMD/2023/0639         | N/A                                                      | N/A              | <ul style="list-style-type: none"> <li>No noise data available at the time of writing.</li> <li>This site has been scoped out of the cumulative assessment as no noise data is available.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Application Reference | Noise Assessment Report            | Common Receptors | Summary of Review                                                                                                                                                            |
|-----------------------|------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SMD/2024/0019         | Hepworth Acoustics, P23-129-R01v5, | NSR4             | <ul style="list-style-type: none"><li>The common receptors are within relatively close proximity to the proposed New House Farm BESS in comparison to other sites.</li></ul> |
|                       | January 2024                       | NSR6             | <ul style="list-style-type: none"><li>Scoped in due to proximity of common receptors to the proposed New House Farm BESS.</li></ul>                                          |

- 11.2.4 Based on the summary presented in **Table 12**, common receptors NSR 4 through NSR 6 have been assessed. Whilst the current planning application status of the Newfields farm site is refusal, it is considered that utilising the previously reported noise data for this site, in parallel with the previously reported noise data for the approved Armshead Farm site, enables an indicative worst-case assessment of potential cumulative effects.
- 11.2.5 The change in noise level at common receptors, due to the addition of the proposed New House Farm BESS site, is calculated and assessed.

11.3 **Assessment**

- 11.3.1 **Table 13** summarises the results of the cumulative assessment undertaken. The table sets out the baseline results, the modelled noise level from the New House Farm BESS, the calculated cumulative noise level, and the change from baseline due to cumulative effects.
- 11.3.2 The baseline results correspond to the reported predicted specific noise level contributions from the respective previous application sites at corresponding receptors. The baseline results are taken from the respective noise assessment reports, for the previous applications sites.
- 11.3.3 The specific noise level contribution at each receptor due to emissions from the proposed New House Farm BESS have been obtained from the noise model. A figure showing the output of the noise model, indicating the specific noise level at corresponding receptors due to contributions from the proposed New House Farm BESS, is presented in **Appendix 6: Noise Model Outputs**.
- 11.3.4 The cumulative noise level and change from baseline have been calculated.

**Table 13: Cumulative Assessment Results**

| Common Receptor | Specific Noise Level<br><i>dB L<sub>Aeq</sub></i> |                                                |                                                |            | Change from Baseline dB |
|-----------------|---------------------------------------------------|------------------------------------------------|------------------------------------------------|------------|-------------------------|
|                 | Baseline                                          |                                                | Contribution from proposed New House Farm BESS | Cumulative |                         |
|                 | Contribution from proposed Armshead Farm BESS     | Contribution from proposed Newfields Farm BESS |                                                |            |                         |
| NSR4            | -                                                 | 28                                             | 11                                             | 28         | 0.1                     |
| NSR5            | 23                                                | -                                              | 18                                             | 24         | 1.2                     |
| NSR6            | -                                                 | 27                                             | 8                                              | 27         | 0.1                     |
| NSR7            | 23                                                | -                                              | 15                                             | 24         | 0.6                     |

11.3.5 The results presented in **Table 13** indicate that the potential cumulative effects at NSR4, NSR6 and NSR7 would likely be negligible. The potential cumulative effect at NSR5 would likely be minor.

11.3.6 The results for NSR4 and NSR6 indicate that were the proposed BESS development at Land at Newfields farm to be granted permission, the impact at receptors NSR4 and NSR6, due to the addition of the proposed New House Farm BESS, would likely be negligible. It is considered that this is an indication that the potential cumulative effect at receptors further from the site would also be negligible. As such, the potential cumulative impact with other green belt energy schemes further from the site would likely be negligible.

11.3.7 The results at NSR5 and NSR7 indicate that, if the proposed BESS development at Land Adjacent to Armshead Farm were to be commissioned, the impact at receptors NSR5 and NSR7, due to the addition of the proposed New House Farm BESS, would likely be negligible to minor. Considering absolute noise levels, the most affected common receptor would likely be NSR5. Based on a night-time background sound level of 30 dB  $L_{Aeq}$ , and the predicted cumulative specific noise level at NSR5 of 24 dB  $L_{Aeq}$ , the cumulative impact would likely be low.

11.3.8 It is considered that based on above, and considering the worst-case assessment approach undertaken for the site as detailed in preceding sections of this report, the overall cumulative impact would likely be low.

## 12 Summary and Conclusion

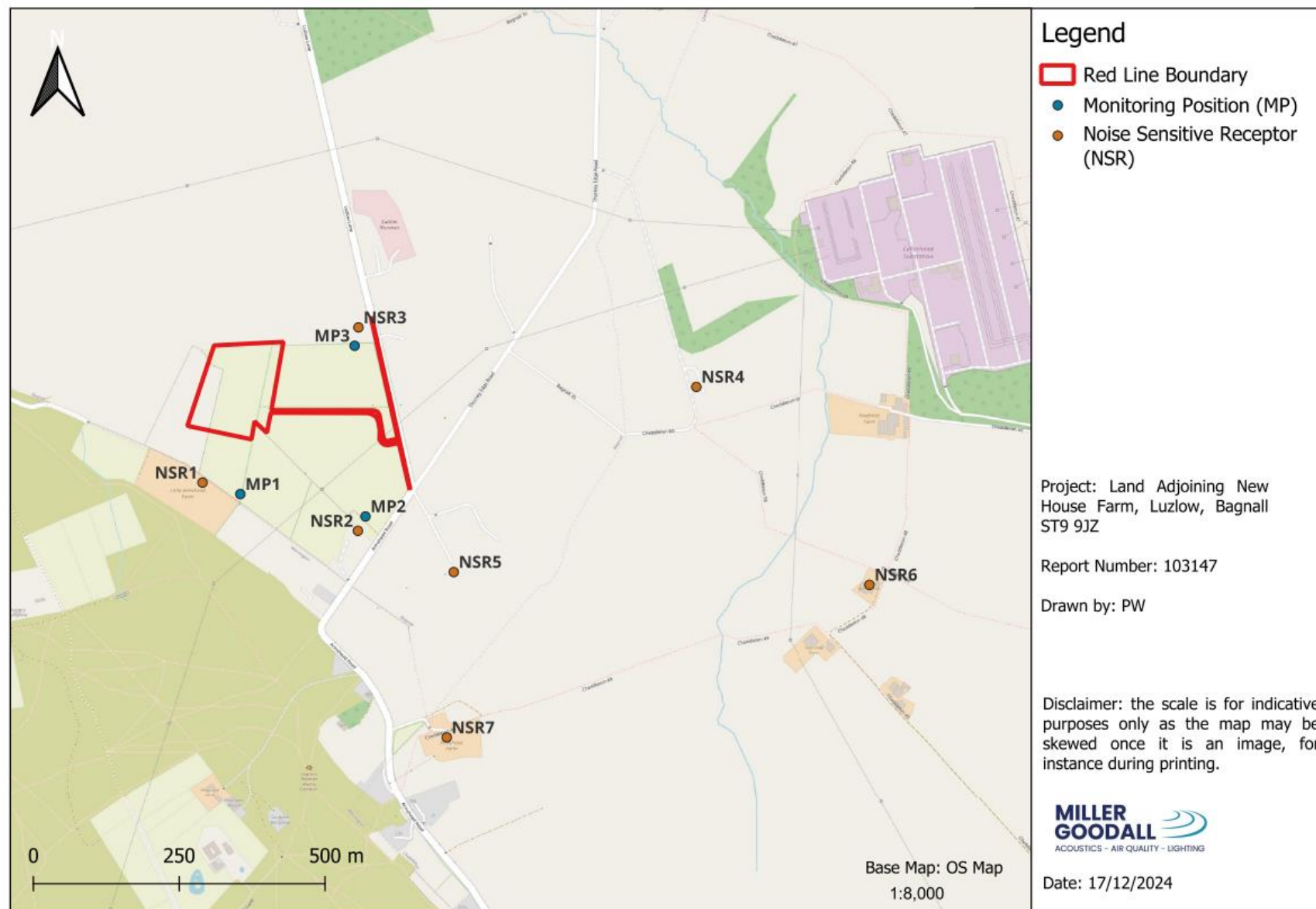
- 12.1 A noise assessment has been undertaken, on behalf of Root-Power (South) Ltd, to predict the potential impact of a proposed battery energy storage system (BESS) at Land Adjoining New House Farm, Luzlow, Bagnall, Stoke On Trent, ST9 9JZ.
- 12.2 An environmental sound survey has been undertaken at the site, to establish the existing sound climate at the nearby residential noise sensitive receptors (NSRs).
- 12.3 A baseline computer noise model of the proposed development and surrounding site has been assembled, based on the proposed site layout and candidate plant specifications.
- 12.4 A baseline BS 4142 assessment has been undertaken based on the measured background sound levels and the modelled noise levels due to emissions associated with the baseline development proposals. The assessment indicates that noise emissions from the baseline development proposal may exceed acceptable levels at the most affected NSR when considered in the context of a traditional BS4142 assessment. However, in relation to fixed, absolute levels, the noise impact is likely to be acceptable. To provide further comfort to SMDC, further noise modelling has been undertaken to provide indicative mitigation recommendations should they be necessary.
- 12.5 Further indicative mitigation has been proposed in terms of specifying reduced source noise levels for the proposed BESS plant. The indicative mitigation has been simulated within the model and the context of the site has been considered in terms of the existing acoustic environment, the operating characteristic of the plant and the likely internal noise levels during worst-case night-time periods. The overall outcome of the assessment indicates that acceptable noise levels would likely be achievable by design through selection of quieter plant.
- 12.6 It is recommended that a pre-commencement noise assessment should be undertaken of the final layout, including the detailed battery container, inverter and transformer specifications. This should be submitted to Staffordshire Moorlands District Council (SMDC) to demonstrate that acceptable noise levels will be achieved by the final design.
- 12.7 An indicative cumulative impact assessment has been undertaken based on a review of proposed Cellarhead green belt energy sites and noise reports associated with the respective planning applications, where available. The assessment considers that, were local applications sites to be granted permission, the potential cumulative effects would likely be negligible to minor.

- 12.8 An assessment of low frequency noise has found that resultant internal sound levels will be significantly below the NNR45-derived stringent design criteria. Low frequency noise should not cause disturbance, and there is unlikely to be an audible low frequency hum.
- 12.9 Based on the assessments undertaken and provided the recommended acoustic design and any associated mitigation measures are implemented, the assessment concludes that the impact of noise emissions from the proposed development is likely to be low. As such, and with the reassurance of the recommended condition for a pre-commencement noise assessment, the proposed development should be considered acceptable to SMDC in terms of noise emissions.

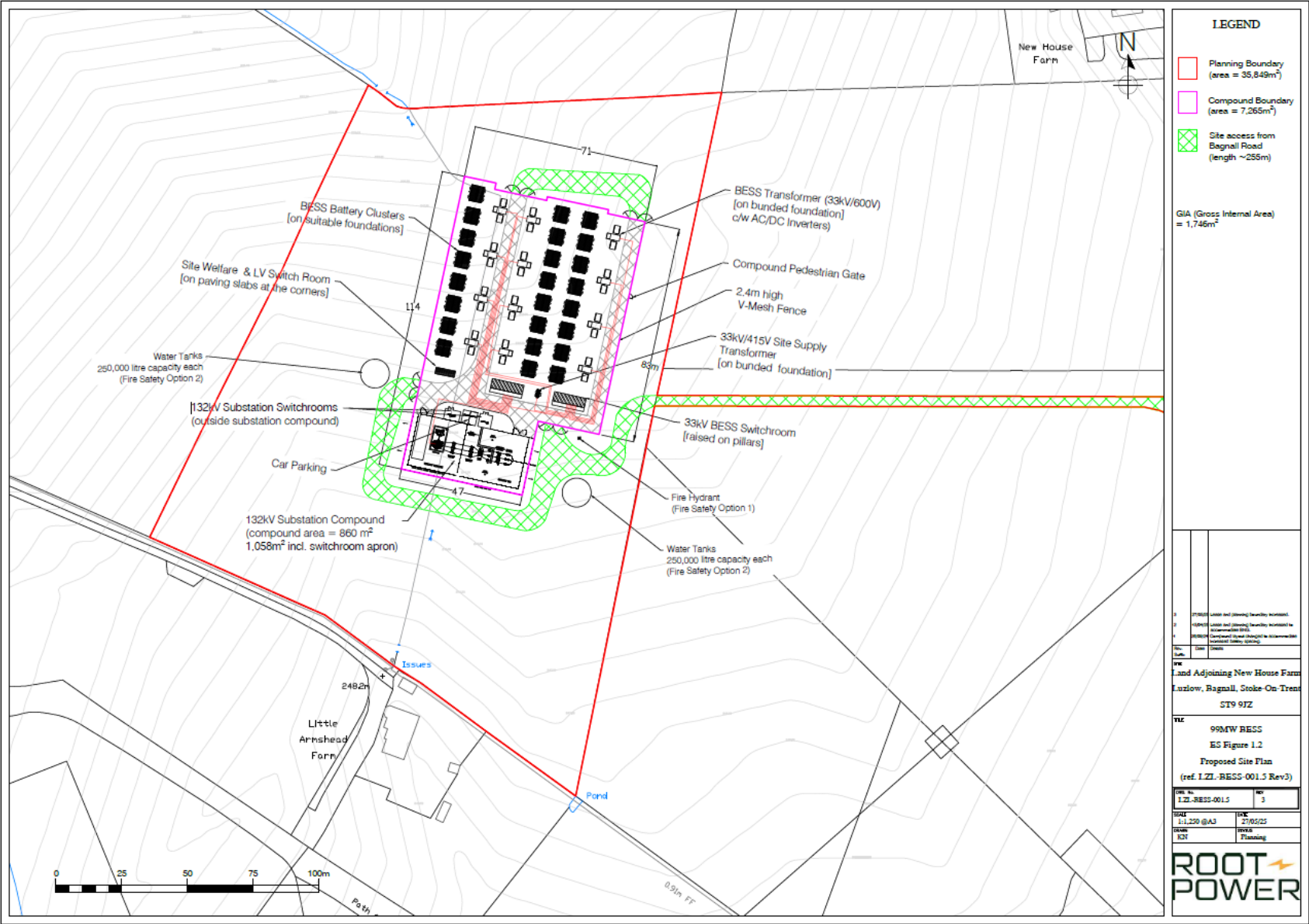
**APPENDICES**

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# Appendix 1: Site Location, Monitoring Positions and Noise Sensitive Receptors



# Appendix 2: Proposed Site Layout



## Appendix 3: Policy, Standards and Guidance

### Noise Policy Statement for England

The Noise Policy Statement for England (NPSE<sup>2</sup>), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are:

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

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

The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and the quality of life occur.

The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the Statement). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case:

“...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development”.

Importantly, the NPSE goes on to state:

“This does not mean that such adverse effects cannot occur”.

The Statement does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that:

“Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available”

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<sup>2</sup> Noise Policy Statement for England, Defra, March 2010

It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

## National Planning Policy Framework

The National Planning Policy Framework (NPPF<sup>3</sup>) initially published in March 2012, was updated most recently in December 2023. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise"<sup>4</sup>.

The revised NPPF advises that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives). One of these is an environmental objective which is described in par. 8 (c):

*"to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."*

At par. 180 we are advised that:

*"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. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans..."*

Par. 191 goes on to state:

*"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*

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<sup>3</sup> National Planning Policy Framework, Ministry of Housing, Communities and Local Government, December 2023

<sup>4</sup> Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994

*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; ...”*

Par. 193 seeks to ensure that any development does not prejudice the legally permitted operations and activities of other, existing non-residential uses, stating:

*“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.”*

## **BS 4142:2014+A1:2019 ‘Methods for rating and assessing industrial and commercial sound’**

BS 4142:2014+A1:2019<sup>5</sup> provides guidance on the assessment of the likelihood of complaints relating to noise from industrial sources. It replaced the 1997 edition of the Standard in October 2014 and was amended in June 2019. The amended version corrected a number of printing errors and further clarified that the standard is used to assess external noise levels, and not internal noise levels (although this can form part of the discussion regarding context). The key aspects of the Standard are summarised below.

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<sup>5</sup> BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

The standard presents a method of assessing potential noise impact by comparing the noise level due to industrial sources (the Rating Level) with that of the existing background noise level at the nearest noise sensitive receiver in the absence of the source (the Background Sound Level).

The Specific Noise Level – the noise level produced by the source in question at the assessment location – is determined and a correction applied for certain undesirable acoustic features such as tonality, impulsivity or intermittency. The corrected Specific Noise Level is referred to as the Rating Level.

In order to assess the noise impact, the Background Sound Level is arithmetically subtracted from the Rating Level. The standard states the following:

- *Typically, the greater this difference, the greater the magnitude of the impact,*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context,*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context,*
- *The lower the Rating Level is relative to the 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.*

In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014+A1:2019 edition places emphasis upon an appreciation of the context, as follows:

*An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.*

## **BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings**

This standard provides recommended guideline acoustic design criteria for new dwellings and is supported by guidance contained within WHO GCN<sup>6</sup>. The guideline noise design criteria of BS 8233 apply

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<sup>6</sup> World Health Organisation Guidelines for Community Noise, 1999

to external noise “*without a specific character*” (previously and sometimes termed or referred to as “*anonymous noise*”) such as that associated with road and rail traffic.

### Internal Amenity

The Standard states that for external noise without a specific character, such as road traffic, it is desirable that the internal ambient noise level does not exceed the guideline values shown in **Table 14**, below.

The note to paragraph 7.7.1 states that where noise has a specific character (i.e. it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content) “*lower noise limits might be appropriate*”.

**Table 14: BS 8233: 2014 guideline indoor ambient noise levels for dwellings**

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

Note 7 to Table 4 of BS 8233 states:

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

Guidance on reasonable acoustic design criteria for individual noise events are also provided, and the Standard advises that:

*“regular individual noise events...can cause sleep disturbance. A guideline value may be set in terms of  $SEL^7$  or  $L_{Amax,F}$  depending on the character and number of events per night. Sporadic noise events could require separate values”.*

<sup>7</sup> Sound exposure level or  $L_{AE}$

For Internal spaces, the Standard states that;

*“..to avoid sleep disturbance, sound pressure levels at the outside facades of living spaces should not exceed 45 dB  $L_{Aeq}$  (taken as a façade level, and equating to a free-field external level of 42 dB  $L_{Aeq}$ ) and 60 dB  $L_{AFmax}$  so that people may sleep with bedroom windows open.”*

### External Amenity

BS 8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens, patios and private outdoor amenity spaces. BS 8233:2014 adopts guideline external noise level limits provided in WHO for external amenity areas such as gardens and patios. The standard states that it is “*desirable*” that the external noise does not exceed 50 dB  $L_{Aeq,16hr}$  with an upper guideline value of 55 dB  $L_{Aeq,16hr}$  whilst recognising in paragraph 7.7.3.2 that development in higher noise areas, such as urban areas or those close to the transport network, may require a compromise between elevated noise levels (i.e., above 55 dB  $L_{Aeq,16hr}$ ) and other factors that determine if development in such areas is warranted. In such circumstances, the development should be designed to achieve the lowest practicable noise levels in external amenity areas, but should not be prohibited.

The standard also states:

*“Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB  $L_{Aeq,T}$  or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.”*

# Appendix 4: Environmental Sound Survey Results



Land Adjoining New House Farm, Luzlow

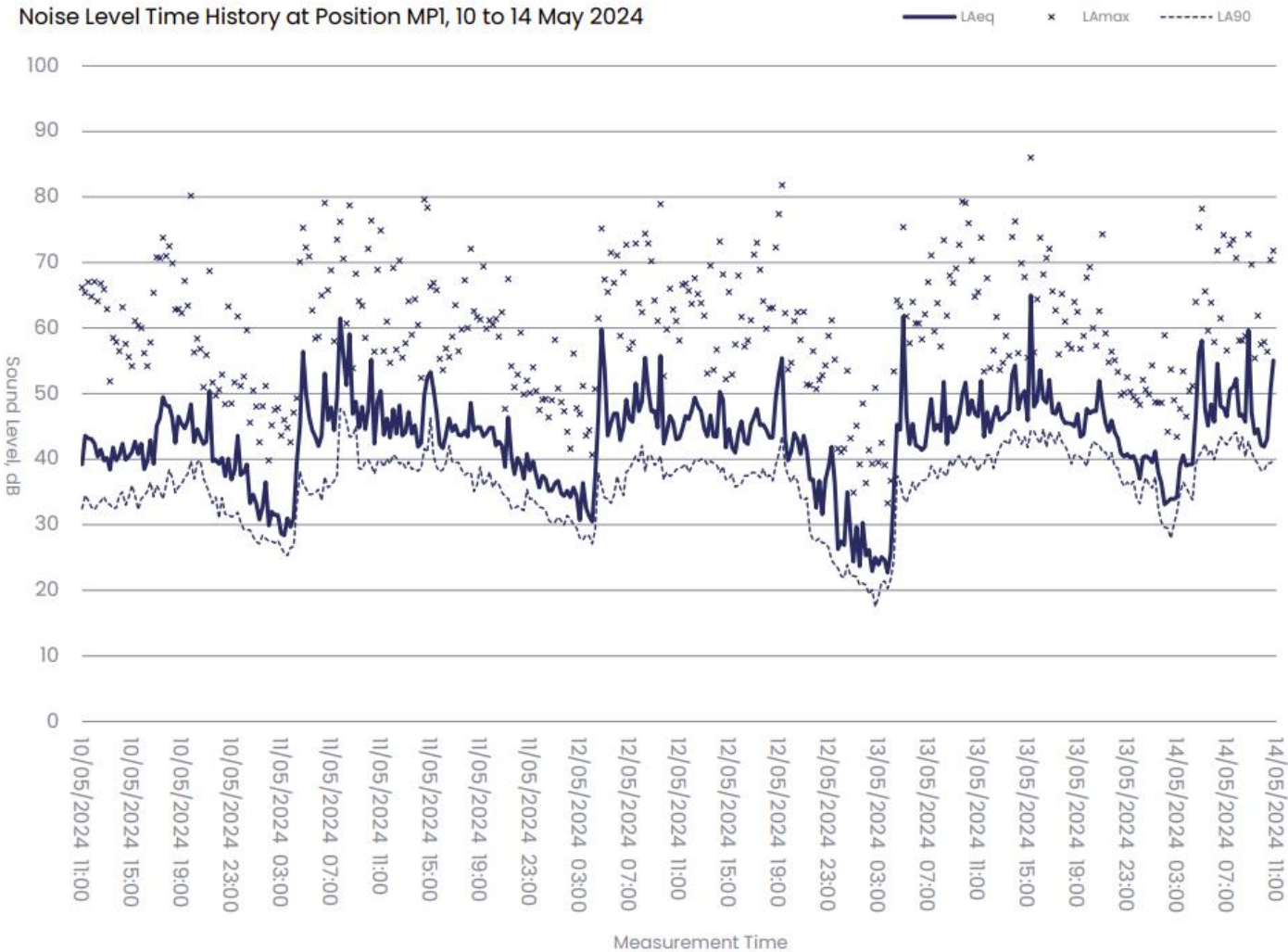
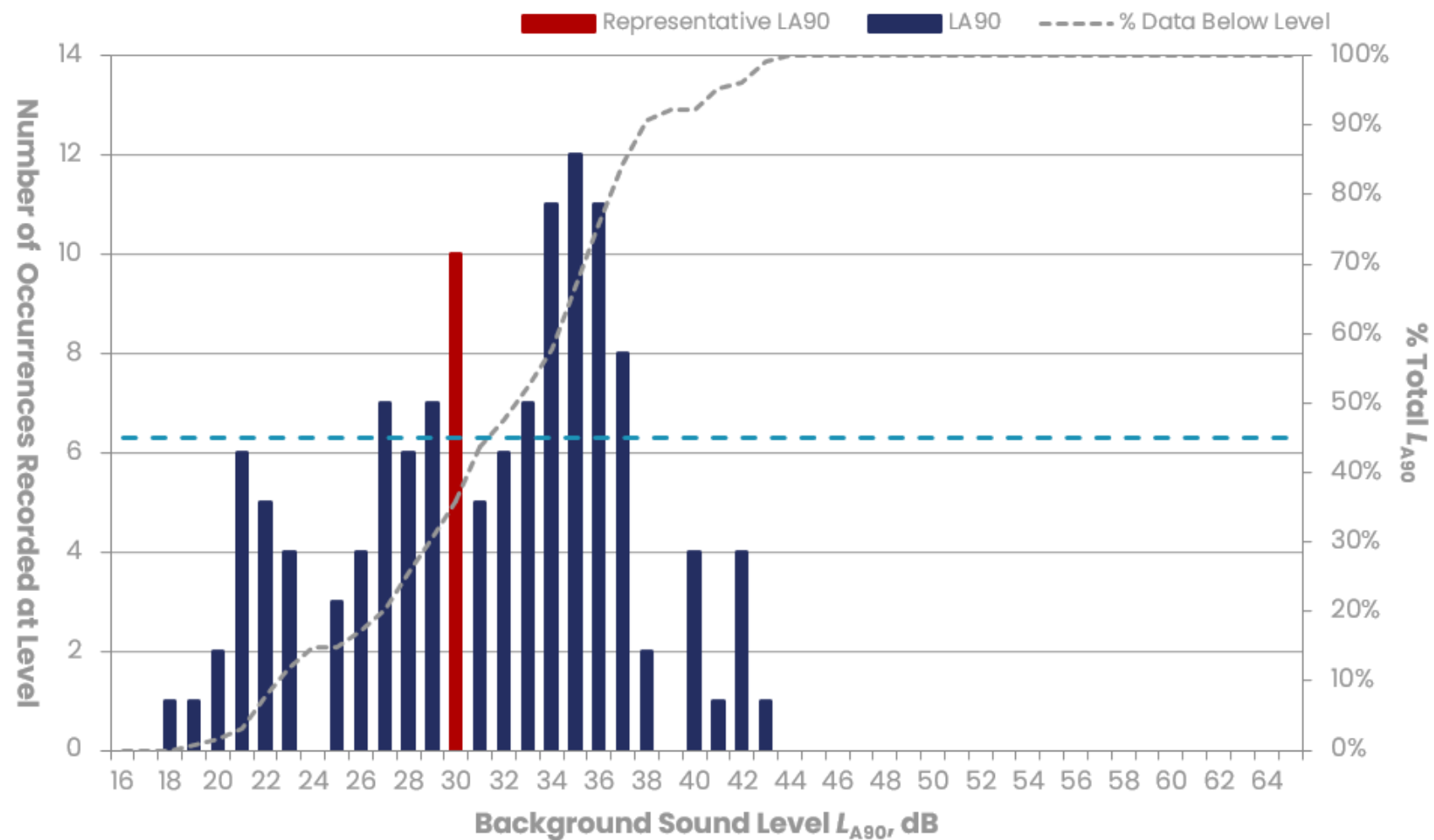


Figure 103147/TH01

### Night-time Background Sound Level Histogram, LA90,15min (dB) 23:00 – 07:00



## Appendix 5: Noise modelling parameters

| Parameter                                                                                                    | Octave Band Centre Frequency, Hz                              |      |      |      |      |      |      |      | dB(A) |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|------|------|------|------|------|------|------|-------|
|                                                                                                              | 63                                                            | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k   |       |
| Candidate Battery Container Sound Power level, $L_w$ (dB) <sup>8</sup>                                       | 91.9                                                          | 86.9 | 82.7 | 80.5 | 78.1 | 75.6 | 72.3 | 68.4 | 83.7  |
| Candidate Inverter Sound Power Level, $L_w$ (dB) <sup>9</sup>                                                | 82.7                                                          | 86.6 | 84.1 | 83.7 | 82.5 | 80.3 | 80.5 | 70.6 | 88.0  |
| Indicative Sound Power Level of Site Supply Transformer and Substation Transformer, $L_w$ (dB) <sup>10</sup> | 77.4                                                          | 82.3 | 80.8 | 68.7 | 59.4 | 45.3 | 38.6 | 35.9 | 73.0  |
| Indicative Battery Container Sound Power level, $L_w$ (dB) <sup>11</sup>                                     | Direct 15 dB subtraction from Candidate Battery Container SWL |      |      |      |      |      |      |      |       |
| Indicative Inverter Sound Power level, $L_w$ (dB) <sup>12</sup>                                              | Direct 15 dB subtraction from Candidate Inverter SWL          |      |      |      |      |      |      |      |       |

<sup>8</sup> Sound power level calculated from third octave band sound pressure level values provided in manufacturer's test report, measured at a distance of 8 m radiating into a hemisphere (50% space), with the test report stating the SolBank HVAC and chiller were manually set to the maximum cooling power operation. Third octave band data available on request.

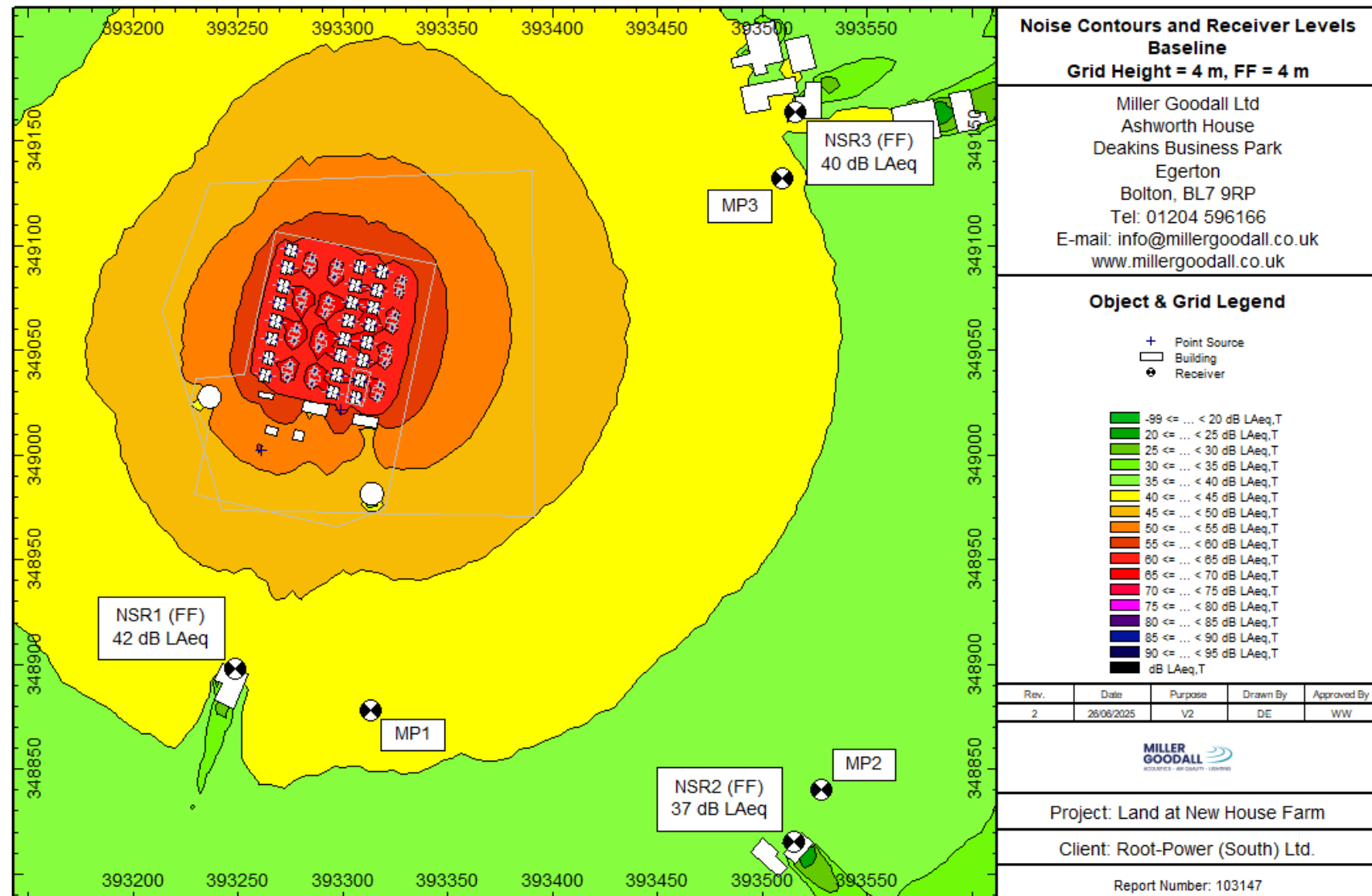
<sup>9</sup> Broadband sound power level of inverter taken from manufacturer's data sheet, with broadband attenuation of 5 dB taken from manufacturer's noise reduction kit information sheet. Indicative spectrum shape assumed, based on similar BESS inverter.

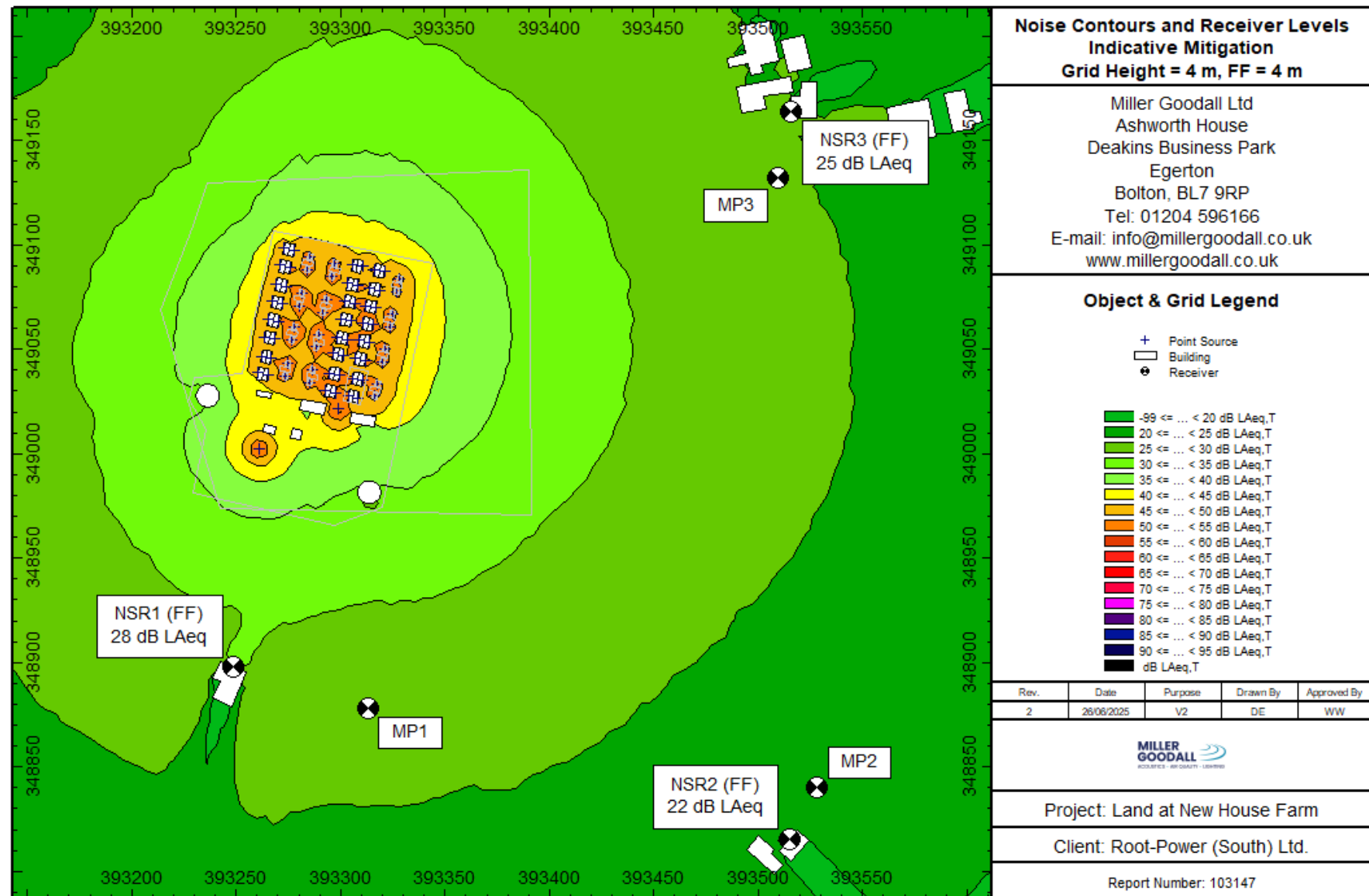
<sup>10</sup> Single figure sound power level of DNO transformer from a similar utility scale BESS site, 73 dB(A). Indicative spectrum shape assumed, based on 2000 kVA transformer from MGL data base.

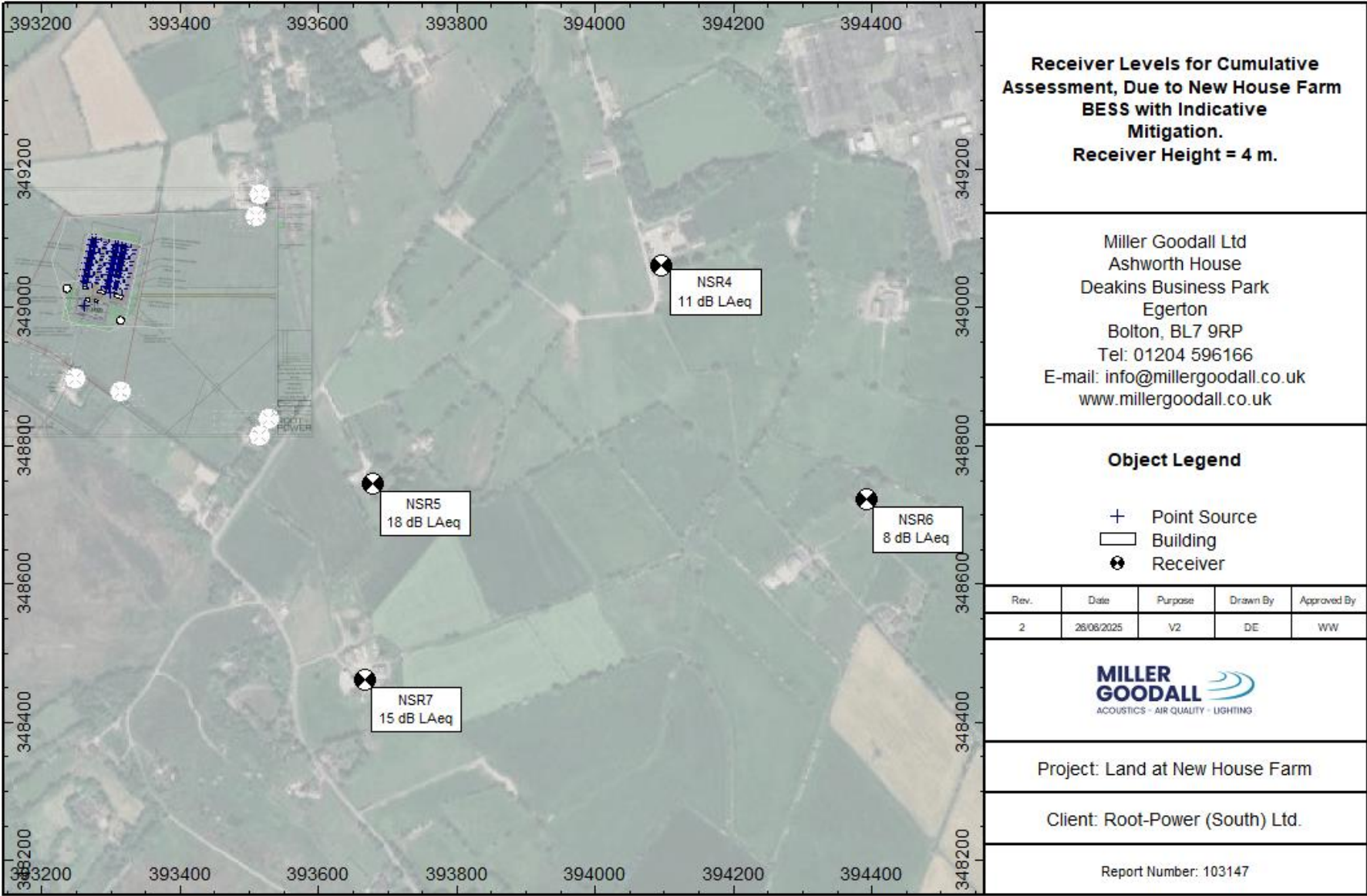
<sup>11</sup> Sound power level calculated from candidate battery container sound power level, with 14 dB attenuation applied to each octave band.

<sup>12</sup> Sound power level calculated from candidate inverter sound power level, with 14 dB attenuation applied to each octave band.

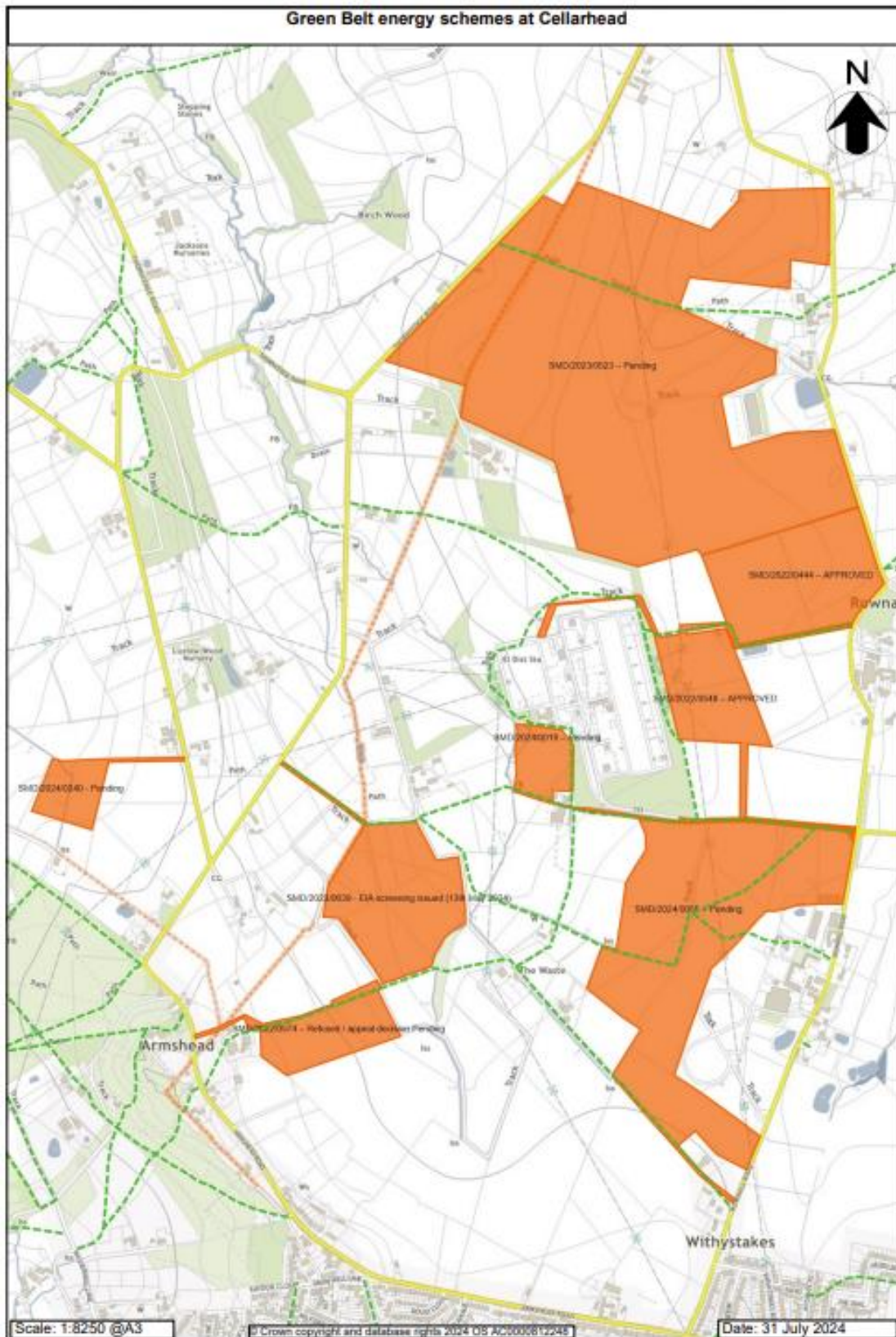
## Appendix 6: Noise Model Outputs







## Appendix 7: Plan of Green Belt Energy Schemes at Cellarhead



12.9.1

## Glossary of Terms

**Decibel (dB)** The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20  $\mu\text{Pa}$ , the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is usually only perceptible under controlled conditions.

**dB  $L_A$**  Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB  $L_A$  broadly agree with an individual's assessment of loudness. A change of 3 dB  $L_A$  is the minimum perceptible under normal conditions, and a change of 10 dB  $L_A$  corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB  $L_A$ ; normal conversation about 60 dB  $L_A$  at 1 meter; heavy road traffic about 80 dB  $L_A$  at 10 meters; the level near a pneumatic drill about 100 dB  $L_A$ .

**$L_{A90,T}$**  The A weighted noise level exceeded for 90% of the specified measurement period ( $T$ ). In BS 4142: 2014+A1:2019 it is used to define background noise level.

**$L_{Aeq,T}$**  The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period ( $T$ ).  $L_{Aeq,T}$  is used to describe many types of noise and can be measured directly with an integrating sound level meter.

**$L_{Amax}$**  The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

