# REPORT TITLE:

**Blackford Energy Park – Baseline Noise Survey & Noise Impact Assessment**

# CLIENT DETAILS:

**Blackford Renewables Ltd**

# DATE:

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# REPORT REFERENCE:

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**Document Status and Revision Schedule**

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|---|---|---|---|---|
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| RevB | Updates made as per email from Blackford Renewables Ltd 07/1/25 | 13/01/25 | PY | MJ |

| | | | | |
|---|---|---|---|---|
| RevC | Site layout updated, construction noise assessment added and BS 4142 Assessment added | 24/04/25 | PY | MJ |
| RevD | Updates as per Noriker comments by email 25/04/25 | 25/04/25 | PY | MJ |
| RevE | Conclusion updated | 30/04/25 | PY | MJ |
| RevF | Figures 1 & 2 label corrected | | | |

# 1. Introduction

1.1.1. Pace Consult Limited was appointed and instructed by Blackford Renewables Ltd to complete a baseline noise survey & noise impact assessment for the proposed Blackford Energy Park development.

1.1.2. The site is located at Rothienorman, Aberdeenshire, AB51 8YN.

1.1.3. The development consists of the installation of a new battery energy storage system facility. The development will include battery units, inverters, back-up transformers and grid transformers.

1.1.4. There is unlikely to be any risk of noise impact *on* the site, so this report does not assess this aspect. However, due to the plant items being introduced there is a potential for noise impact to occur to nearby sensitive receptors.

1.1.5. In order to assess and mitigate these potential impacts a baseline noise survey and noise impact assessment has been completed by Pace Consult Ltd as part of the planning stage design. This technical report details the site, assessment criteria, baseline survey and an initial noise impact assessment.

1.1.6. This technical report details the baseline noise survey & noise impact assessment. The baseline survey has been completed following the guidance of BS4142:2014 + A1:2019 *Methods for rating and assessing industrial and commercial units* & BS 7445: *Description & Measurement of Environmental Noise (Parts 1-3)*.

1.1.7. Assessment of the potential noise impacts arising from the site have been completed following the guidance of BS BS4142:2014 + A1:2019 *Methods for rating and assessing industrial and commercial units* and noise rating curves as required by the local authority, following ISO 1996-1:2006.

# 2. The Site

## 2.1. Existing Site

2.1.1. The proposed development site is located on agricultural land adjacent to the existing Rothienorman Substation at Rothienorman, Aberdeenshire, AB51 8YN.

2.1.2. The site is bounded to the north, east and south by agricultural and pastureland, including residential dwellings in the form of farm cottages. The pre-existing Rothienorman sub-station site is adjacent to the site, to the west.

2.1.3. The closest noise sensitive receptors are located to the north and south-west of the site.

2.1.4. Figures 1 & 2 overleaf shows the existing site layout.

## 2.2. Proposed Development

2.2.1. The development consists of the installation of a new battery energy storage system facility. The development will include battery units, inverters, back-up transformers and grid transformers.

2.2.2. Figure 3 overleaf shows the proposed layout of the new development.

2.2.3. It is also noted that there is another BESS development immediately adjacent (Rothienorman 50MW BESS), to the west, to this proposed development. This site has also been previously surveyed by Pace Consult Ltd. The environmental noise monitoring results from the previous survey will be included in this report and the cumulative noise impact from both developments considered.

2.2.4. In addition, cumulative impacts from two other nearby sites, assessed by others, have also been considered. The two further sites are:

- Sweco Grid Stability Site
- Overhill Farm 50MW BESS

*Figure 1: Existing site layout*

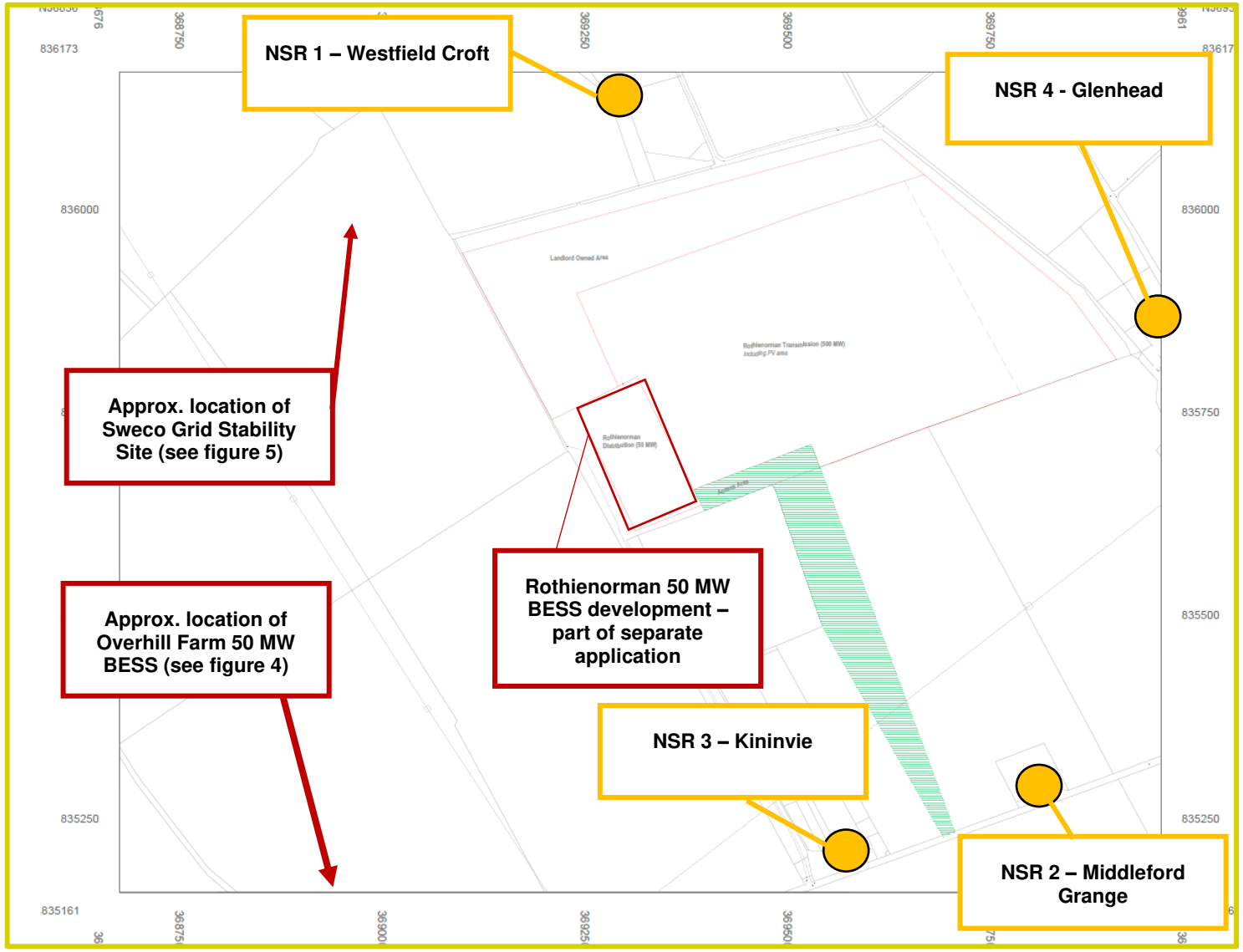


*Figure 2: Aerial image of existing site*

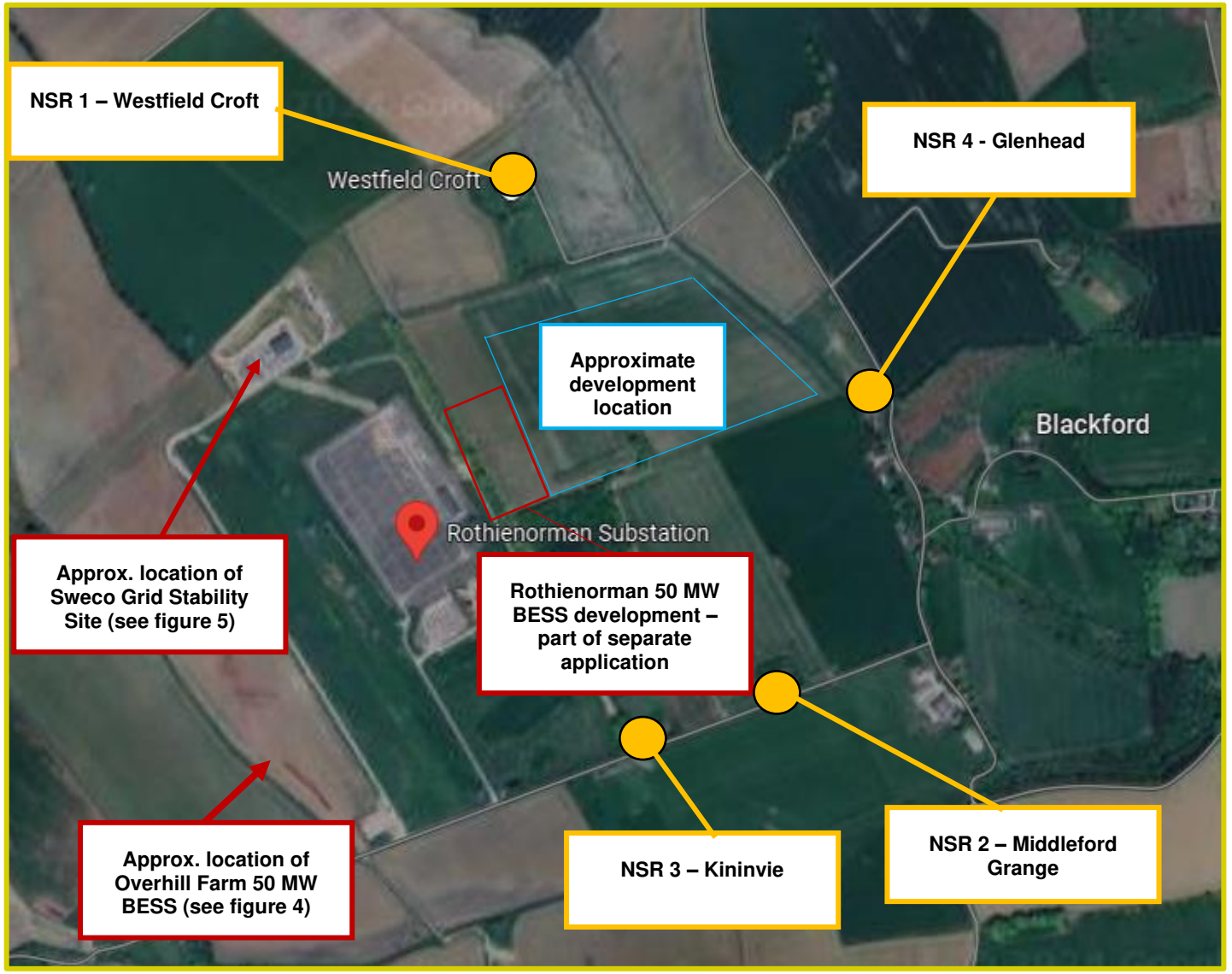


*Figure 3: Proposed site layout*

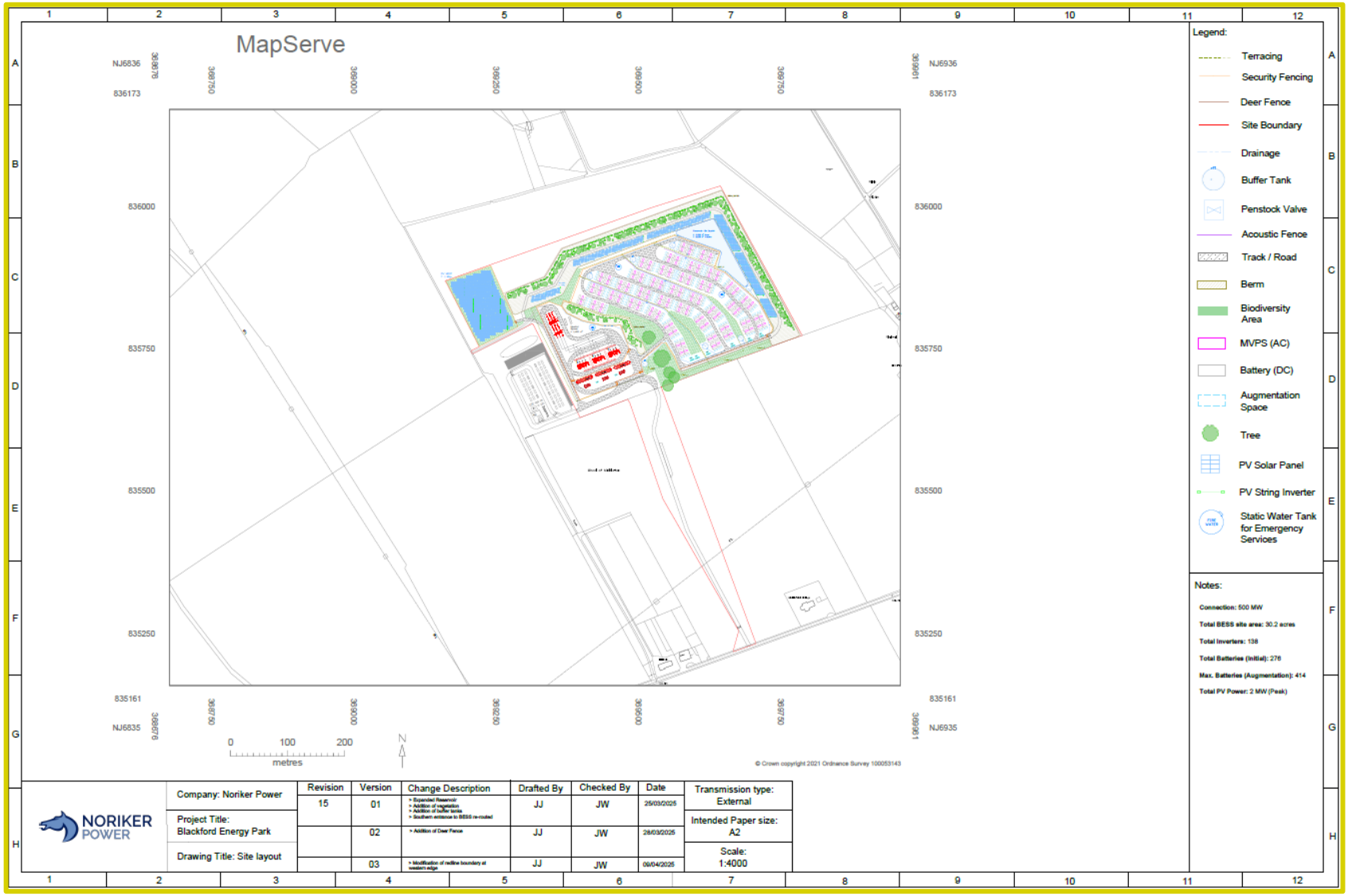


*Figure 4: Overhill Farm 50 MW BESS layout (extracted from Atmos Consulting report NOISE_IMPACT_ASSESSMENT-10211108*

*Figure 5: Sweco Grid Stability Site location (extracted from Sweco report ACOUSTIC_TECHNICAL_REPORT_-_UPDATED-9804709)*

Figure 5: Application boundary, nearest noise-sensitive receptors and monitoring positions (MP)

# 3. Assessment Methodology & Criteria

## 3.1. Local Authority Policy

3.1.1. The Local Authority's pre-application advice relating to noise impact is included below.

***Noise Impacts construction and operational***

*The applicant is expected to undertake a noise impact assessment to predict the impact on sensitive receptors and specify any necessary control measures. The assessment should be undertaken in accordance with BS4142:2014+A1:2019 for external noise with the aim of achieving a low impact depending on context when compared to background $L_{A90}$ and NR 25 and NR20 Curve assessment for internal noise during the daytime and nighttime respectively.*

*The applicant is also expected to consider a cumulative noise impact. The applicant is expected to demonstrate that the proposed development, when operating cumulatively with any other existing or consented development in the area, will meet NR 25 for daytime and NR20 nighttime.*

*The applicant is encouraged to engage with environmental health at an early stage regarding the methodology for any such assessment and can do so by submitting details to environmental@aberdeenshire.gov.uk.*

## 3.2. BS4142:2014+A1:2019

3.2.1. BS4142:2014 + A1:2019 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas provides a numerical means of assessing the significance of building plant noise. A key aspect of the BS 4142 assessment procedure is a comparison between the background noise level in the vicinity of noise sensitive receptors and the rating level of the noise source under consideration. The relevant parameters in this instance are as follows:

3.2.2. Background Sound Level, $L_{A90,T}$, defined in the Standard as the 'A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels'.

3.2.3. Specific Sound Level, $L_{Aeq,T}$ , the 'equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T (being 1 hour for assessments between 07:00-23:00hrs and 15 minutes for night time assessments 23:00-07:00hrs) ; and

3.2.4. Rating Level, $L_{Ar,Tr}$ , the specific sound level plus any adjustment made for the characteristic features of the sound'.

3.2.5. BS 4142 allows for, as an absolute worst case, a cumulative +15 dB correction to be applied to the specific sound level based upon the presence or expected presence of the following 'Acoustic Feature Corrections':

- Tonality – up to +6 dB penalty;
- Impulsivity – up to +9 dB penalty (this can be summed with tonality penalty)
- Intermittency – up to +3 dB penalty
- Other sound characteristics (neither tonal nor impulsive but still distinctive) – +3 dB penalty.

3.2.6. The amendment made to BS4142 in 2019 does however allow for the focus on one characteristic if it is dominant above others, reducing or even eliminating the corrections which would have otherwise been added together arithmetically, in a more reasonable approach to assessment.

3.2.7. BS 4142 provides guidance as to the likely response from sensitive residential receptors to new fixed noise sources (e.g. building plant or services) through comparison of the rating level of the new noise source with the existing background level. The higher the rating noise level in comparison to the background noise level, the greater the likelihood of complaints arising. BS 4142 requires separate analysis for day and night time periods.

3.2.8. The criteria for determining the significance of changes in noise levels from building services plant, based on guidance within BS 4142, and the potential effect on noise sensitive receptors are presented in below.

*Table 1: Adverse impact thresholds*

| **Difference Between Rating Level1 and Background Noise Level** | **Magnitude of Effect** |
|---|---|
| 10 dB(A) below | Very Low (NOAEL) |

| | |
|---|---|
| No difference | Low (LOAEL) |
| Low +5 dB(A) | Medium (SOEAL) |
| +10 dB(A) or more | High |

*1 - The Rating Level is the noise level attributable to the new source(s), plus penalties if the new source has tonal or intermittent characteristics;*

*2 - The Background Level is taken as the $L_{A90}$; this is the ambient noise level in the absence of the source which is exceeded for 90% of the time.*

*LOAEL – Lowest Observed Adverse Effect Level*

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

*SOAEL – Significant Observed Adverse Effect Level*

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

# 4. Baseline Noise Survey

## 4.1. Method

4.1.1. The baseline noise survey was completed between Friday 18th & Monday 21st October 2024 to measure representative noise levels at the site of the closest receptors to proposed development, during typical weekday and weekend periods.

4.1.2. The closest noise sensitive receptors are indicated in figure 1, on page 5 of this report.

4.1.3. Noise levels at the site and closest NSRs are primarily affected by:

- Distant local road traffic
- Underlying noise from the existing sub-station

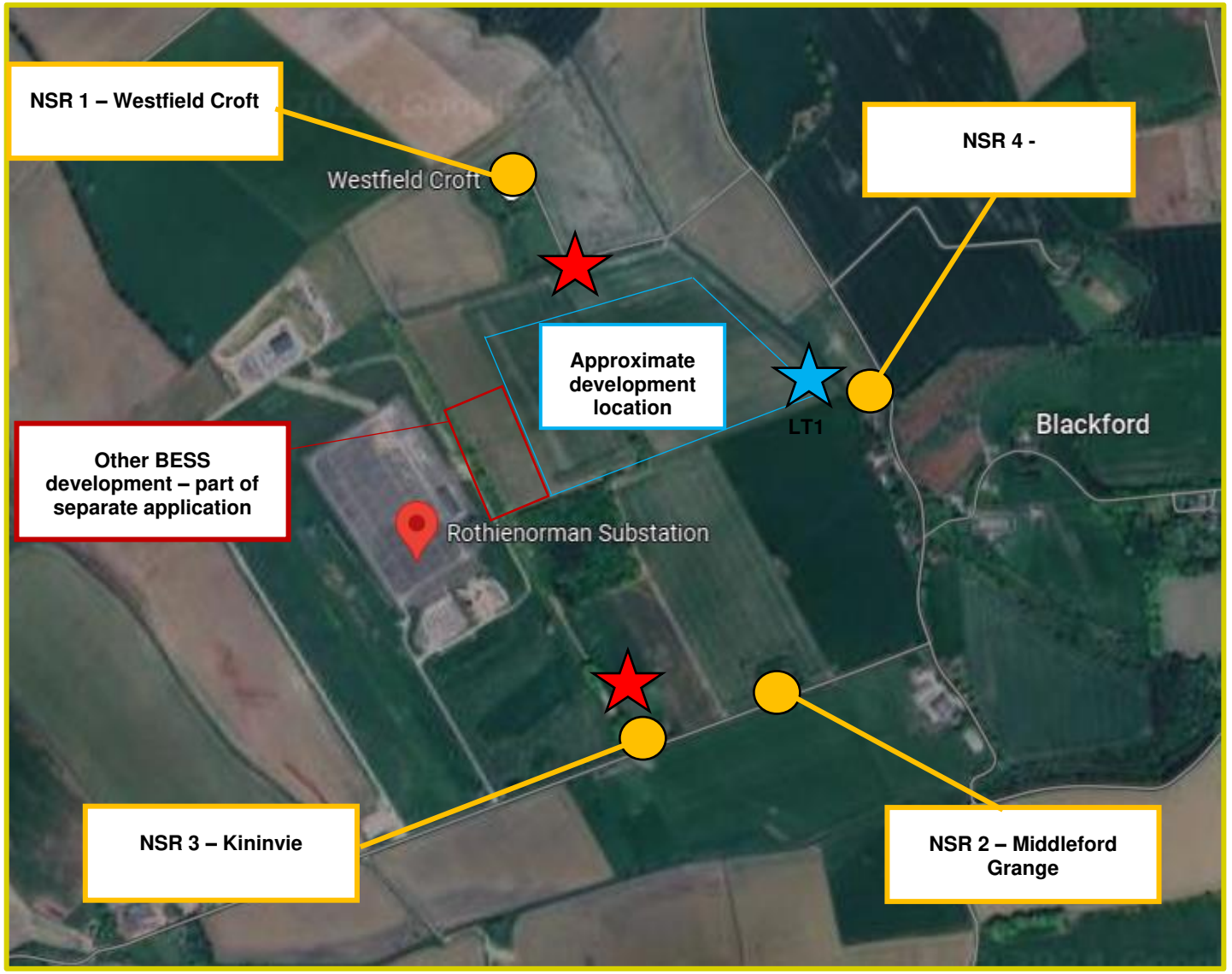
4.1.4. Long-term unattended measurements were utilized in order to accurately quantify noise levels at the closest noise sensitive receptors. In addition reference was also made to noise survey data previously gathered by Pace Consult 2023 for the separate 50MW site application.

4.1.5. The survey was carried out in accordance with the principles of BS 7445:1997 Parts 1-3, '*Description and Measurement of Environmental Noise'*, and British Standard BS4142: 2014 + A1:2019: *Methods for rating and assessing industrial and commercial sound*.

4.1.6. The figure overleaf shows the survey measurement positions and each is described below.

- LT1 – Long term unattended continuous measurement position. The microphone was tripod mounted at a height of 1.5m.

*Figure 6: Baseline noise survey measurement position (blue star – previous survey positions red stars)*



## 4.2. Measurement Parameters

4.2.1. The following measurement parameters were recorded, as a minimum:

- $L_{A90,T}$ dB

4.2.2. A 15-minute measurement period was used, with a 1s sampling time. The measurements at all survey positions comprised of consecutive measurement periods in terms of the most relevant standards and guidelines.

## 4.3. Equipment

4.3.1. All noise measurements were made with calibrated precision grade 1 sound level meters, which achieve the requirements of BS EN 61672:2003.

4.3.2. The equipment used for each survey position is shown in the table below.

*Table 2: Baseline noise survey equipment list*

| Measurement Position | Item Name | Serial Number | Calibration Certificate |
|---|---|---|---|
| LT1 | Norsonic Nor 118 | 31301 | U44177 |
| Calibrator | Norsonic Nor 1251 | 30998 | 49213 |

4.3.3. The sound level meters were calibrated before and after the survey. No significant drift was noted between the two reference checks.

## 4.4. Weather

4.4.1. In order to evaluate the weather conditions two weather checks measurements were undertaken on site; at the beginning and end of the survey. A handheld RS ProIM-740 weather monitor was used.

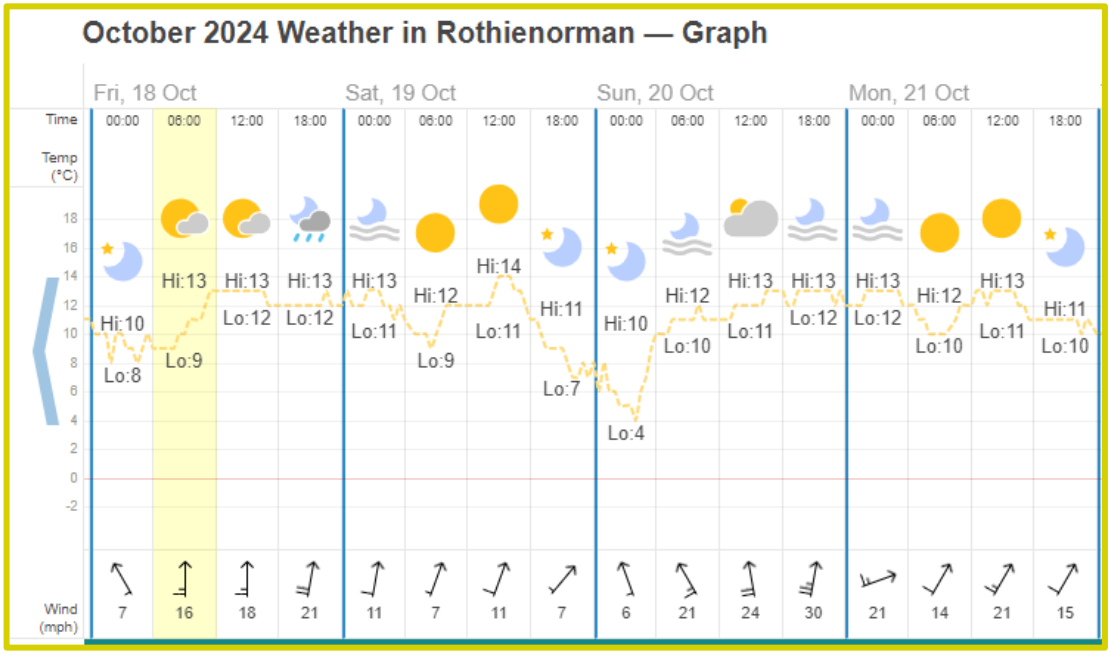
*Table 3: Baseline noise survey weather condition measurements*

| Date | Temperature $^0$C | Wind Speed (m/s) & Direction |
|---|---|---|
| 18/11/24 | $8^{0c}$ | 4.6 m/s |
| 21/11/24 | $9^{0c}$ | 2.5 m/s |

4.4.2. In addition, the surveyor also stayed in the vicinity of the site (30 minutes drive) and was able to monitor the weather conditions over the course of the weekend.

4.4.3. The figure below includes data from the closest weather monitoring station (Aberdeen – obtained from timeanddate.com)

*Figure 7: Aberdeen weather monitoring station data*




4.4.4. The surveyors observations were that weather conditions, primarily windspeed, at site were calm enough and conducive to environmental noise monitoring on both Friday 18th Saturday 19th and Monday 21st. During these times windspeeds were moderate, but within the typical reasonable limits (<12 mph). It is also noted that these windspeed are typical of the area. The end part of the survey period (early Sunday morning to late afternoon) was, however, affected by high windspeeds and rain from Storm Ashley.

4.4.5. It is considered that, by omitting those areas of noise data specifically affected by the adverse weather conditions and using the survey data previously measured by pace Consult for reference, a representative background noise level can be established.

## 4.5. Results

4.5.1. The measured baseline noise survey results are summarised in the tables below. The full set of survey data is provided graphically in Appendix A.

*Table 4: Measurement position LT1 environmental noise survey data*

| Date & Time | $L_{Aeq,T}$ (Log Average) | $L_{A90,T}$ dB (*Typical) |
|---|---|---|
| 18/11/24 14:00 to 23:00 | 49 | 34 (1 hour) |
| 18/11/24 23:00 to 19/11/24 07:00 | 42 | 26 (15 minutes) |
| 19/11/24 07:00 to 23:00 | 42 | 27 (1 hour) |
| 19/11/24 23:00 to 20/11/24 07:00 | 40 | 25 (15 minutes) |
| 20/11/24 07:00 to 23:00 | 66 | 43 (1 hour) |
| 20/11/24 23:00 to 21/11/24 07:00 | 62 | 46 (15 minutes) |
| 21/11/24 07:00 to 12:00 | 49 | 33 (1 hour) |

**Note: Following the guidance of BS4142:2014 + A1:2019 Methods for rating and assessing industrial and commercial units & The Association of Noise Consultants BS4142:2014 + A1:2019 Technical Note 2020 Ver 1.0, typical background noise levels for each period have been selected based on statistical analysis of the data. The statistical analyses are included in appendix B at the rear of this report.*

4.5.2. The environmental noise survey results from Pace Consult's previous survey are also included below.

| Table 2: Typical measured $L_{A90}$, dB levels during survey | | |
|---|---|---|
| MP1 | | |
| Time | $L_{Aeq,T}$ dB (Log average) | $L_{A90}$,dB Typical |
| Day (07:00 to 23:00) | 41 | 30 |
| | | |
| Night (23:00 – 07:00) | 41 | 20 |
| MP2 | | |
| Time | | |
| Day (07:00 to 23:00) | 36 | 26 |
| | | |
| Night (23:00 – 07:00) | 37 | 24 |

# 5. Noise Impact from the Proposed Development

## 5.1. Equipment Noise Level Information

5.1.1. Noise level information used in the assessment are detailed on the following pages.

5.1.2. There are 332 no. battery units, the noise level information used for these is detailed below.

**Batteries¶**

All·**batteries**·are·modelled·on·the·Samsung·SSB·version·1.5·profile·as·per·*SBB·1.5·Noise·Report·UL·Version.pdf*.¶

This·uses·the·"normal"·operation·mode,·i.e.·60%·Chiller/HVAC·fan·speed·which·corresponds·to·0.5P·operation.¶

This·also·assumes·that·an·attenuator·is·fitted·with·a·reduction·of·5.45·dB(A).¶

Each·battery·has·been·modelled·as·an·industrial·building·based·on·the·above·profiles.¶

The·total·number·of·batteries·is·**332**·(2·Batteries·per·Inverter·plus·20%·additional·for·future·augmentation·purposes).¤

1. The Noise Level at 1m Distance from SBB1.5 Enclosure

Normal Operation (Condenser Fan Speed : Chiller 60% / HVAC 60%)

[Table 6] Time-averaged Sound Pressure Level(*LAeq*) in Normal Operation

| Measuring Point | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 |
|---|---|---|---|---|---|---|---|---|---|
| Measured Value [dBA] | 61.5 | 64.3 | 64.4 | 64.9 | 59.9 | 66.9 | 65.8 | 67.7 | 64.7 |
| **Measuring Point** | **A10** | **A11** | **A12** | **A13** | **A14** | **A15** | **A16** | **A17** | **A18** |
| Measured Value [dBA] | 63.1 | 69.7 | 67.2 | 69.0 | 61.8 | 66.6 | 66.2 | 68.5 | 64.2 |
| **Measuring Point** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **B8** | **B9** |
| Measured Value [dBA] | 47.4 | 44.6 | 46.3 | 45.9 | 46.6 | 44.6 | 44.7 | 43.3 | 44.4 |
| **Measuring Point** | **B10** | **B11** | **B12** | **B13** | **B14** | **B15** | **B16** | **B17** | **B18** |
| Measured Value [dBA] | 46.2 | 43.9 | 42.8 | 44.6 | 46.6 | 46.2 | 45.7 | 45.0 | 45.2 |
| **Measuring Point** | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **C8** | **C9** |
| Measured Value [dBA] | 50.1 | 49.3 | 57.1 | 49.6 | 47.6 | 57.6 | 51.0 | 55.4 | 46.8 |
| **Measuring Point** | **C10** | **C11** | **C12** | | | | | **D1** | **D2** |
| Measured Value [dBA] | 49.9 | 55.7 | 47.4 | | | | | 47.0 | 46.3 |
| **Measuring Point** | **D3** | **D4** | **D5** | **D6** | **D7** | **D8** | **D9** | **D10** | **D11** |
| Measured Value [dBA] | 46.3 | 45.4 | 50.9 | 49.9 | 50.7 | 57.4 | 58.7 | 58.9 | 56.6 |

- Maximum Noisy Points and Noise Level by Enclosure Surfaces.

[Table 10] Mximum Noise Level and Noisy Points by Enclosure Surfaces

| Measuring Point | | Front | Rear | Left Side | Right Side | Top |
|---|---|---|---|---|---|---|
| Normal Operation Chiller 60% / HVAC 60% | Measuring Point | A11 | B1 | C6 | C11 | D10 |
| | *LAeq* [dBA] | 69.7 | 47.4 | 57.6 | 55.7 | 58.9 |
| Silent Operation Chiller 40% / HVAC 60% | Measuring Point | A17 | B1 | C6 | C8 | D9 |
| | *LAeq* [dBA] | 62.2 | 44.1 | 52.2 | 49.6 | 52.5 |
| Extreme Operation Chiller 80% / HVAC 80% | Measuring Point | A13 | B4 | C3 | C8 | D10 |
| | *LAeq* [dBA] | 76.0 | 54.1 | 63.9 | 62.0 | 64.7 |

5.1.3. There are 138 no. inverter units, the noise level information used for these is detailed below.

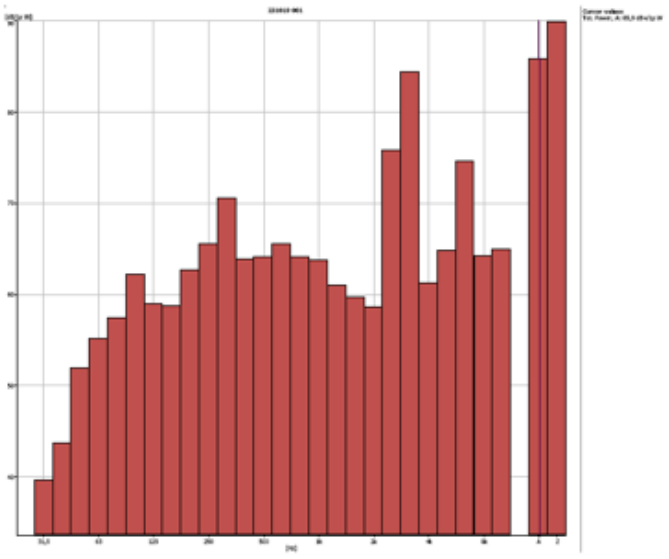
**Inverters¶**

All·inverters·are·modelled·on·the·SMA·'SCS3950UP-XT'·with·silencer·kit,·as·per·*TR_EMC_SCS3950UP-XT_Acoustic_11E1624.pdf*.·See·Measurement·No.·22·at·3940·kVA·with·Silencer·Kit·which·is·the·loudest·profile.·There·are·a·total·of·**138**·inverters.¶

SCS3950UP-XT SMA Solar Technology AG

**Measurement No. 22 at 3940 kVA with Silencer Kit**

**Sound Power Levels of the Third Octave Band Frequencies according to EN ISO 9614-2**



5.1.4. The silencer test results are included below.

**Result of Measurements**

The following sound power measurements performed with SCS 3950UP-XT with S_rated for grid-feed 4600kVA @25°C and with S_rated for charging 4129kVA @25°C.

| Apparent Power [kVA] | Sound Power [dB$_A$] without Noise Reduction Kit | Sound Power [dB$_A$] with Noise Reduction Kit | Difference |
|---|---|---|---|
| Grid-feed with 4600 (100%) | 91,85 | 83,20 | 8,65 |
| Charging with 4129 (100%) | 90,57 | 85,90 | 4,67 |

It is known from previous tests that the 2-stack device is 2 dB(A) quieter, although this was not the subject of the measurements.

The following tables show the sound power for the SCS UP-XT with noise reduction kit for grid-feed and charging at partial load.

| Apparent Power Grid-feed [kVA] | Apparent Power / Apparent Power_rated [%] | Sound Power [dB$_A$] with Noise Reduction Kit |
|---|---|---|
| 4600 | 100 | 83,2 |
| 4370 | 95 | 83,0 |
| 3680 | 80 | 82,3 |
| 3220 | 70 | 78,9 |
| 2760 | 60 | 75,6 |
| 1936 | 42 | 74,3 |
| 960 | 21 | 66,9 |

| Apparent Power Charging [kVA] | Apparent Power / Apparent Power_rated [%] | Sound Power [dB$_A$] with Noise Reduction Kit |
|---|---|---|
| 4129 | 100 | 85,9 |
| 3680 | 89 | 84,4 |
| 3220 | 78 | 83,2 |
| 2760 | 67 | 79,6 |
| 1840 | 45 | 73,5 |
| 960 | 23 | 71,1 |

The power derating caused by reduced airflow from Silencer airduct is 3%.

## Super-grid·Transformers·(SGT)¶

All·**SGTs**·are·based·on·Astor·SGT·data·provided·by·H&MV·as·per·*GB1063-HMV-XX-XX-SP-E-0001.pdf*.·This·assumes·a·total·loudness·(Lw)·value·of·100dB(A)·as·per·the·report.¶

No·frequency·spectrum·data·has·been·provided,·therefore,·the·octave·spectrum·pattern·has·been·utilised·from·similar·SGT·models·(with·total·cumulative·loudness·of·100dB(A)).¶

These·have·been·modelled·as·point·sources.¶

There·are·**3**·SGTs.¤

| | | | | | |
|---|---|---|---|---|---|
| 7 Sound Levels | | | | | |
| 7,1 No-load sound power level at 100% of rated excitation | Info | dBA(W) | | | 95 dB @no-load, Sound Power Level |
| 7,2 ONAF cooler sound power level | Info | dBA(W) | | | 100 dB @2m ONAF, Sound Power Level |
| 7,3 Maximum combined sound power level | Info | dBA(W) | | | 100 dB @2m ONAF, Sound Power Level |
| 7,4 Maximum combined sound pressure level | Req | dBA @ 1m | 78 | | 78 dB @1m ONAN, Sound Pressure Level |

5.1.5. Astor has separately confirmed that the noise from each SGT can be reduced to 96 dB $L_w$. This is not yet reflected in the calculations but will provide another small improvement in the final results.

5.1.6. There are also 138 no. PCS transformers. The noise level information is included below.

**PCS Transformers**

All PCS transformers are modelled on a singular 100Hz frequency at 60 dB(A) as per *SMA_MVPS_Transformer-Noise-Report_001_I.png*.

These have been modelled as point sources.

There are **138** PCS transformers, one for each inverter.

**3. Sound pressure level - measuring results Lp(A) [dB(A)] :**

| results [dB(A)] | measuring positions 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| background noise (beginning) | 25,6 | 26,8 | 23,3 | 16,9 | 23,6 | 24,8 | 18,5 | 23,6 | 24,5 | 25,3 | **24** |
| background noise (end) | | | | | | | | | | | |
| measured value | 42,6 | 50,2 | 42,0 | 46,8 | 47,5 | 37,7 | 50,2 | 43,2 | 46,0 | 48,1 | **47** |
| corrected value | | | | | | | | | | | **47** |

**4. Calculation of sound power level Lw(A) [dB(A)]:**

Lw(A) = Lp(A) + 10*lg S = **60** dB(A)

corrected value : **60** dB(A)

date 30.10.2020 [redacted]

**SÄCHSISCH-BAYERISCHE STARKSTROM-GERÄTEBAU GMBH**

**Ohmstraße 1 08496 Neumark**

## 5.2. Mitigation

**Acoustic Barriers**

All **acoustic barriers** are modelled on Gramm Barrier Systems' "GREENSoundBlok" profile as per *GREENSoundBlok-Main-Brochure.pdf*.

These have been modelled as noise protection walls.

**Berms**

All berms have been modelled as noise protection berms.

5.2.1. Furthermore, a ground absorption factor of G = 0.9 has been used for the surrounding land, while a factor of 0.4 has been used for the battery compound ground.

*Ground factor, G ISO 9613-2:*

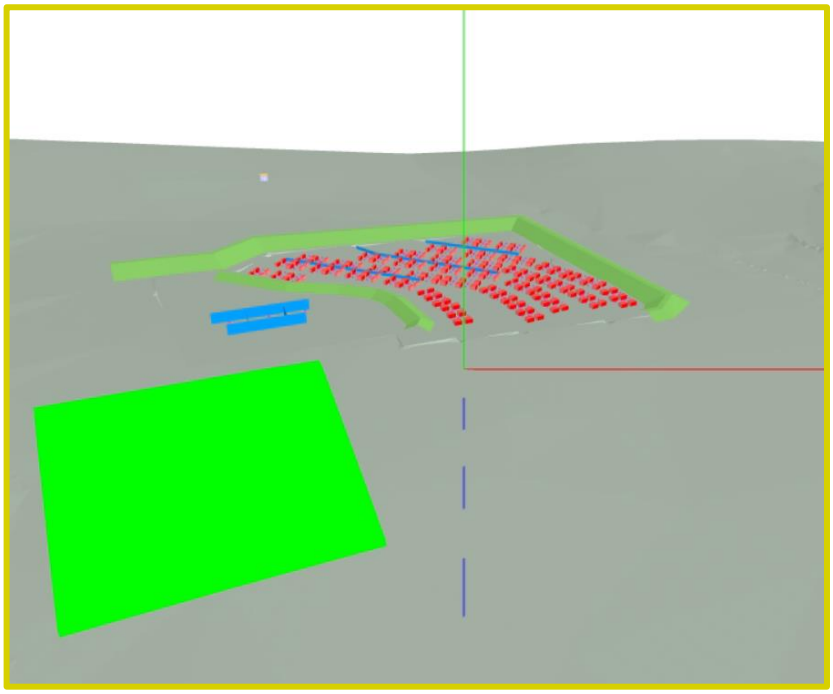
a) **Hard ground,** which includes paving, water, ice, concrete and all other ground surfaces having a low porosity. Tamped ground, for example, as often occurs around industrial sites, can be considered hard. For hard ground $G = 0$.

NOTE 10 It should be recalled that inversion conditions over water are not covered by this part of ISO 9613.

b) **Porous ground,** which includes ground covered by grass, trees or other vegetation, and all other ground surfaces suitable for the growth of vegetation, such as farming land. For porous ground $G = 1$.

5.2.2. The figure below indicatively shows the site landscaping and mitigation, as modelled in SoundPLAN. This is as per drawing NPL-RNT-LA-10-03.

*Figure 8: 3D image of noise model.*



## 5.3. Calculation methodology

5.3.1. The noise impact from the units at nearest residential receptors has been assessed using the methodology described in ISO 9613-2. The ISO 9613 calculates the sound propagation for outdoor noise sources for downwind situations, the equation below is used to evaluate the equivalent continuous downwind sound pressure level, as follows:

$$L_{fT}(\mathrm{DW}) = L_W + D_c - A$$

*Where: $L_w$: is the octave-band sound power level.*

*Dc: is the directivity correction.*

*A: Attenuation that occurs during propagation.*

4.3.1 Calculation of the attenuation terms

5.3.2. Geometrical divergence attenuation values are calculated as follow:

$$A_{div} = \left[20 \lg(d/d_0) + 11\right] \quad \mathrm{dB}$$

*Where: d: distance from the source to receiver, in meters*

*$d_o$: is the reference distance (1m).*

5.3.3. Atmospheric absorption. The attenuation due to atmospheric absorption is given by the following equation:

$$A_{atm} = \alpha d/1\,000$$

*Where α is the atmospheric attenuation coefficient, in decibels per kilometer, for each octave band at the mid-band frequency.*

5.3.4. Ground Effect. The calculation assumes soft ground G=0.9 for majority of areas (as it is agricultural land) and G=0.4 for the terracing around plant items.

4.3.2 Barrier attenuation. The calculation of the barrier attenuation is calculated as follows:

$D_z = 10 \log_{10} (3+(C_2/\lambda) C_3 z K_{met}$

5.3.5. For the single diffraction with a regular ground reflection, the formula above can be rewritten in terms of the Fresnel number.

$A_b = 10\ log_{10}\ (3+10\ NK_{met})$

5.3.6. The figure below includes the parameters used within the calculation.

[PARAMETERS]
Reflection order: 1
Maximum reflection distance to receiver 200 m
Maximum reflection distance to source 50 m
Search radius 5000 m
Weighting: dB(A)
Allowed tolerance (per individual source): 0.100 dB
Create ground effect areas from road surfaces: No

Standards:
Industry: ISO 9613-2: 1996
Air absorption: ISO 9613-1
regular ground effect (chapter 7.3.1), for sources without a spectrum automatically alternative ground effect
Limitation of screening loss:
single/multiple 20.0 dB /25.0 dB
Side diffraction: Side paths also around terrain (outdated)
Use Eqn (Abar=Dz-Max(Agr,0)) instead of Eqn (12) (Abar=Dz-Agr) for insertion loss
Environment:
Air pressure 1013.3 mbar
rel. humidity 70.0 %
Temperature 10.0 °C
Meteo. corr. C0(7-23h)[dB]=0.0; C0(23-7h)[dB]=0.0;
Ignore Cmet for Lmax industry calculation: No
Parameter for screening: C2=20.0
Dissection parameters:
Distance to diameter factor 8
Minimal distance 1 m
Max. difference ground effect + diffraction 1.0 dB
Max. number of iterations 4
Attenuation
Foliage: ISO 9613-2
Built-up area: ISO 9613-2
Industrial site: ISO 9613-2

## 5.4. Calculation Summary & Assessment

5.4.1. The table below shows the calculated sound levels at the nearest residential dwellings. The calculations assume the worst-case scenario, all proposed units at the BESS site are operating constantly at the same time.

*Table 5: Calculated sound pressure level dBA*

| Receptor | $L_{Aeq}$ dB |
|---|---|
| R1 | 34.5 |
| R2 | 33.7 |
| R3 | 28.0 |
| R4 | 33.7 |

## 5.5. Cumulative noise levels.

5.5.1. The noise levels from the nearby Rothienorman Grid Stability Site are extracted from the acoustic report completed by Sweco (ACOUSTIC_TECHNICAL_REPORT_-_UPDATED-9804709).

5.5.2. The noise levels from the nearby Overhill Farm BESS site are extracted from the acoustic report completed by Atmos Consulting (NOISE_IMPACT_ASSESSMENT-10211108).

5.5.3. The noise levels from the nearby Rothienorman 50 MW BESS have been extracted from the acoustic report completed by Pace Consult (PC-22-0289-RP1-RevI).

5.5.4. The table below includes the calculated noise levels at the assessed residential dwellings from the three additional sites.

*Table 6: Cumulative noise levels.*

| ID | Calculated sound levels Rothienorman Grid Stability Site (Sweco) | Calculated sound levels RND 50MW | Overhill Farm BESS (OFB (Atmos Consulting) | Cumulative Noise levels (Noise levels adding logarithmically) dBA |
|---|---|---|---|---|
| R1 | 29 | 29 | 24 | 33 |
| R2 | 24 | 28 | 24 | 31 |
| R3 | 28 | 29 | 24 | 32 |
| R4 | 25 | 25 | 24 | 30 |

5.5.5. As frequency noise data is not available for the other sites Pace Consult has adjusted the level calculated in our own assessment by the difference between the cumulative level for all four sites.

5.5.6. The cumulative noise levels by frequencies are included in the table below. These have been derived from the table above to evaluate the NR externally at each residential dwelling.

*Table 7: Cumulative noise levels (RNT, RGS & OFB) by centre frequency.*

| ID | 63 | 125 | 250 | 500 | 1k | 2k | 4k | dBA | NR |
|---|---|---|---|---|---|---|---|---|---|
| R1 | 32 | 32 | 25 | 27 | 31 | 25 | 4 | 33 | 31 |
| R2 | 30 | 30 | 23 | 24 | 29 | 23 | 4 | 30 | 29 |
| R3 | 32 | 32 | 25 | 26 | 30 | 25 | 4 | 32 | 30 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R4 | 43 | 31 | 21 | 24 | 27 | 22 | 4 | 30 | 27 |

5.5.7. The calculated octave band noise levels at each receptor for the Blackford Energy Park development are shown below.

5.5.8. The calculated noise levels at each receptor from this assessment are shown in the table below.

*Table 8: 500 MW noise levels by centre frequency.*

| ID | 63 | 125 | 250 | 500 | 1k | 2k | 4k | dBA | NR |
|---|---|---|---|---|---|---|---|---|---|
| R1 | 43.7 | 35.2 | 33.3 | 31.4 | 28.9 | 26.6 | 24.6 | 34.6 | 30 |
| R2 | 39.8 | 31.2 | 29.8 | 30.9 | 29.4 | 26.1 | 20.5 | 33.7 | 29 |
| R3 | 38.6 | 29.6 | 27.2 | 26.3 | 23 | 18.6 | 13.7 | 28.2 | 23 |
| R4 | 42.7 | 33.6 | 31.9 | 30.6 | 28.3 | 25.7 | 23.6 | 33.7 | 29 |

5.5.9. Again, these have been logarithmically added to the calculated levels in table 7 to give a total cumulative noise level for all three sites. The cumulative levels are shown below.

*Table 9: Cumulative noise levels (RNT, RGS & RND) by centre frequency.*

| ID | 63 | 125 | 250 | 500 | 1k | 2k | 4k | dBA | NR |
|---|---|---|---|---|---|---|---|---|---|
| R1 | 44 | 36.9 | 33.9 | 32.7 | 33..1 | 28.9 | 24.6 | 36.9 | 33 |
| R2 | 40.2 | 33.7 | 30.6 | 31.7 | 32.2 | 27.8 | 20.6 | 35.5 | 32 |
| R3 | 39.5 | 34 | 29.2 | 29.2 | 30.8 | 25.9 | 14.1 | 33.7 | 31 |
| R4 | 45.9 | 35.5 | 32.2 | 31.5 | 30.7 | 27.2 | 23.6 | 35.2 | 31 |

## 5.6. Noise intrusion calculation and NR20.

5.6.1. The indoor noise levels assessment in habitable rooms of the nearest residential dwellings (R1, R2, R3 & R4) are based on the cumulative external noise levels included in table 7.

5.6.2. The table below includes the expected indoor noise levels in bedrooms exposed to the highest cumulative noise levels. The noise intrusion assumes the sound reduction offered by a partially open windows (-13 dBA) as recommended by *Acoustic ventilation and overheating Residential design guide January 2020 Version 1.0.*

*Table 10: Indoor noise assessment.*

| ID | Calculated indoor noise levels dBA | Calculated Indoor NR | Acoustic Criteria | Excess over the recommended criterion |
|---|---|---|---|---|
| R1 | 23.9 | 20 | ≤ NR 20 | 0 |
| R2 | 22.5 | 19 | | -1 |
| R3 | 20.7 | 18 | | -2 |
| R4 | 22.2 | 18 | | -3 |

5.6.3. Note. The indoor noise levels included in the above table are expected to be lower when the volume and sound absorption of the room are considered.

5.6.4. The assessment shows that the local authorities' noise rating limits can be met using suitable mitigations.

## 5.7. BS 4142 Assessment

5.7.1. The tables below show the BS 4142 assessment for each receptor, for both daytime and night-time periods.

*Table 11: Receptor 1 BS 4142 Assessment*

| Results | | Relevant Clause | Commentary |
|---|---|---|---|
| Background Sound Level (Daytime) | 30 dB $L_{A,90}$ | 8.1<br>8.2<br>8.6 | As per section 4 of this report, background noise surveys completed over two weekend and weekday periods. Representative background value derived from statistical analysis of the measured data. |
| Background Sound Level (Night-Time) | 20 dB $L_{A,90}$ | | |
| **Daytime** | | | |
| Assessment made during daytime, so reference time interval is1 h | | 7.2 | |
| Specific Sound Level | 37 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | 37 dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 30 dB $L_{A,90}$ | 8 | |
| Excess of Rating Level over Daytime Background | +7 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | 11 | See paragraphs 5.7.2 onwards |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |

| Night-Time | | | |
|---|---|---|---|
| Assessment made during night-time, so reference time interval is 15 min. | | 7.2 | |
| Specific Sound Level | 37 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 20 dB $L_{A,90}$ | 8 | |
| Excess of Rating Level over Night Time Background | +17 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | 11 | See paragraphs 5.7.2 onwards |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |

*Table 12: Receptor 2 BS 4142 Assessment*

| Results | | Relevant Clause | Commentary |
|---|---|---|---|
| Background Sound Level (Daytime) | 26 dB $L_{A,90}$ | 8.1<br>8.2<br>8.6 | As per section 4 of this report, background noise surveys completed over two weekend and weekday periods. Representative background value derived from statistical analysis of the measured data. |
| Background Sound Level (Night-Time) | 24 dB $L_{A,90}$ | | |
| **Daytime** | | | |
| Assessment made during daytime, so reference time interval is1 h | | 7.2 | |
| Specific Sound Level | 35 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | 35 dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 26 dB $L_{A,90}$ | 8 | |
| Excess of Rating Level over Daytime Background | +9 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | 11 | See paragraphs 5.7.2 onwards |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |
| **Night-Time** | | | |
| Assessment made during night-time, so reference time interval is 15 min. | | 7.2 | |

| | | | |
|---|---|---|---|
| Specific Sound Level | 35 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | 35 dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 24 dB $L_{A,90}$ | 8 | |
| Excess of Rating Level over Night Time Background | +11 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | 11 | See paragraphs 5.7.2 onwards |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |

*Table 13: Receptor 3 BS 4142 Assessment*

| Results | | Relevant Clause | Commentary |
|---|---|---|---|
| Background Sound Level (Daytime) | 26 dB $L_{A,90}$ | 8.1<br>8.2<br>8.6 | As per section 4 of this report, background noise surveys completed over two weekend and weekday periods. Representative background value derived from statistical analysis of the measured data. |
| Background Sound Level (Night-Time) | 24 dB $L_{A,90}$ | | |
| **Daytime** | | | |
| Assessment made during daytime, so reference time interval is1 h | | 7.2 | |
| Specific Sound Level | 34 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | 34 dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 26 dB $L_{A,90}$ | 8 | |
| Excess of Daytime Rating Level over Background | +8 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | 11 | See paragraphs 5.7.2 onwards |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |
| **Night-Time** | | | |

| | | | |
|---|---|---|---|
| Assessment made during daytime, so reference time interval is1 h | | 7.2 | |
| Specific Sound Level | 34 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | 34 dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 24 dB $L_{A,90}$ | 8 | |
| Excess of Night Time Rating Level over Background | +10 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | 11 | See paragraphs 5.7.2 onwards |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |

*Table 14: Receptor 4 BS 4142 Assessment*

| Results | | Relevant Clause | Commentary |
|---|---|---|---|
| Background Sound Level (Daytime) | 27 dB $L_{A,90}$ | 8.1<br>8.2<br>8.6 | As per section 4 of this report, background noise surveys completed over two weekend and weekday periods. Representative background value derived from statistical analysis of the measured data. |
| Background Sound Level (Night-Time) | 25 dB $L_{A,90}$ | | |
| **Daytime** | | | |
| Assessment made during daytime, so reference time interval is1 h | | 7.2 | |
| Specific Sound Level | 35 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | 35 dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 27 dB $L_{A,90}$ | 8 | |
| Excess of Rating Level over Daytime Background | +8 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | **11** | **See paragraphs 5.7.2 onwards** |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |
| **Night-Time** | | | |
| Assessment made during daytime, so reference time interval is1 h | | 7.2 | |

| | | | |
|---|---|---|---|
| Specific Sound Level | 35 dB $L_{Aeq,1\ hour}$ | 7.3<br>7.3.8<br>7.3.9 | The sources do not currently exist on site, specific sound level determined from manufacturer's data as per section 5.1 of this report |
| Acoustic Feature Correction | 0 | 9.2 | No acoustic features present, see section 5.1 of this report. |
| Calculated Rating Level | 35 dB $L_{Ar,T}$ | 9.2 | |
| Background Sound Level | 25 dB $L_{A,90}$ | 8 | |
| Excess of Rating Level over Night Time Background | +10 | 11 | |
| Assessment indicates likelihood of significant adverse impact | | 11 | See paragraphs 5.7.2 onwards |
| Uncertainty of the assessment | | 10 | Uncertainty in the background noise level is considered low as this has been measured over several long periods, with Class1 sound level meters.<br>Uncertainty in the calculation of the specific noise level is also considered low in most cases as this has been determined from manufacturers' noise data, measured in accordance with the relevant standards. |

5.7.2. Although all of the above quantitative assessments show 'likelihood of significant adverse impact', there are also significant qualitative considerations which mitigate this likelihood.

- Background noise levels are below 30 dBA. BS 4142 suggest that for very low background noise levels (such as those here) the 4142 methodology may not be the best way to assess noise impact. An assessment of absolute noise level may be more appropriate.
- The highest calculated noise level is 35 dB $L_{Aeq,T}$. This is considered to be a low absolute noise level, and is marginally lower than the typical external ambient $L_{Aeq,T}$ noise level during the day (see section 4.5).
- At the night time, when residents are likely to be inside the dwellings, the internal noise level is considered to be the more important parameter. The assessments in section 5.6 show that the local authority's criterion of NR20 inside dwellings from all new items of plant would be expected to be met.

5.7.3. It is also noted that the assessment is based on the manufacturers worst case noise data and that the typical day to day operation would be expected to be quieter.

5.7.4. On the basis of the above qualitative contextual factors, a lower level of adverse impact would therefore be expected.

## 5.8. Noise Impact During Construction

5.8.1. The noise impact during construction has been assessed according to the methodology recommended by BS5228-1:2009 Code of practice for noise and vibration control on construction and open sites. Part 1. Noise.

5.8.2. The total number of articulated lorries, crane, and concrete trucks attending the proposed site are extracted from the Construction Traffic Management Plan, dated 28/03/25.

5.8.3. The table below includes the expected activities and traffic forecast.

*Figure 9: Construction traffic forecast from CTMP*

**CONSTRUCTION TRAFFIC FORECAST**

3.7 In the absence of an appointed contractor at this stage, construction delivery traffic has been forecast using a scaled approach from another BESS site in Stairfoot. The Stairfoot site is smaller (40MWh instead of 1,000MWh planned for the proposed site) and therefore the deliveries have been uplifted proportionally as shown in Table 3.1.

*Table 3.1 Traffic Forecast*

| Activity | Vehicle type / size | Stairfoot site (40MWh) | Rothienorman site (1,000MWh) |
|---|---|---|---|
| Delivery of inverters | Articulated lorry | 4 deliveries | 100 deliveries |
| Delivery of transformers | Articulated lorry | 4 deliveries | 100 deliveries |
| Installation Inverters/Transformers | Crane | 3 movements | 75 movements |
| Delivery of Battery racks | Articulated lorry | 20 deliveries | 500 deliveries |
| Installation of Battery racks | Crane | 2 movements | 50 movements |
| Delivery of MV substation | Articulated lorry | 2 deliveries | 50 deliveries |
| Installation of MV substation | Crane | 2 movements | 50 movements |
| Delivery of concrete | Concrete truck | 6 deliveries | 150 deliveries |
| Concrete pumping | Concrete pump | 6 movements | 150 movements |
| Aggregate movements | Lorry | 5 movements | 125 movements |

3.8 On average it is expected that over the 18-months construction period this will create 3 - 4 HGV movements per day and the delivery of three abnormal loads for the supergrid transformers would also be expected. However this would need to be further validated by the appointed contractor.

5.8.4. According to the traffic impact assessment, up to 3-4 HGVs movements per day are expected on average during construction, and therefore the table below includes the

total number of lorries, noise levels, and expected operational time (%) based on 1 hour worst case scenario.

*Table 15: Expected traffic (stationary and haul route).*

| Traffic | Noise levels LWA (extracted from BS 5228-1:2009 | Total number 1 hour. | % activity on time 1 hr |
|---|---|---|---|
| Crane (stationary) | 105 | 2 | 40 |
| Concrete Pump (stationary) | 103 | 2 | 20 |
| Articulate Lorry (Haul Route) | 114 | 3 | N/A |
| Concrete Truck (Haul Route) | 113 | 1 | N/A |

5.8.5. It is understood that the traffic will enter the proposed site using a permanent road as shown in the image below.

*Figure 10: HGV vehicle route (grey line)*


5.8.6. The table below includes the calculated external noise levels at each residential dwelling based on the expected traffic and activities on site (1 hour worst case).

*Table 16: Construction noise calculated levels.*

| Receptor | External noise levels $L_{Aeq,1hr}$ dB |
|---|---|
| R1 | 50 |
| R2 | 52 |
| R3 | 53 |

| | |
|---|---|
| R4 | 51 |

5.8.7. The noise impact during construction is analysed according to the threshold levels (Categories A, B, and C) recommended by BS5228-1:2009.

5.8.8. Annex E of BS5228 refers to the ABC (Table E.1) which shows an example of the threshold of significant effect (SOAEL) at dwellings when the total noise level, rounded to the nearest decibel, exceeds the listed value.

5.8.9. The thresholds provide noise limits which can be simply monitored against, If the total noise during construction exceeds the appropriate category value, then a significant effect is deemed to occur.

*Table 17: BS5228-1 Annex E ABC Significance Method construction noise threshold limits*

| **BS5228-1 Table E.1 Example threshold of significant effect at dwellings** | | | |
|---|---|---|---|
| **Assessment category and threshold value period ($L_{Aeq}$)** | **Threshold value, in decibels (dB)** | | |
| | **Category A** A) | **Category B** B) | **Category C** C) |
| Night-time (23.00−07.00) | 45 | 50 | 55 |
| Evenings and weekends D) | 55 | 60 | 65 |
| Daytime (07.00−19.00) and Saturdays (07.00−13.00) | 65 | 70 | 75 |
| **NOTE 1:** | A significant effect has been deemed to occur if the total $L_{Aeq}$ noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. | | |
| **NOTE 2:** | If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total $L_{Aeq}$ noise level for the period increases by more than 3 dB due to construction activity. | | |
| **NOTE 3:** | Applied to residential receptors only. | | |
| **A)** | Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. | | |
| **B)** | Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values | | |
| **C)** | Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values | | |
| **D)** | 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays. | | |

5.8.10. Based on the measured noise levels at the nearest residential dwellings, the recommended threshold value is Category A (≤ $L_{Aeq}$ 65 dB Daytime 07.00−19.00) and Saturdays (07.00−13.00).

5.8.11. According to the above criteria, the impact of construction noise is fully compliant with category A. The full assessment is included in Appendix C.

# 6. Conclusions

6.1.1. Pace Consult has completed a baseline noise survey & noise impact assessment at the site of the proposed Rothienorman, Aberdeenshire 500MW BESS development.

6.1.2. Representative noise levels have been measured over typical weekday and weekend periods.

6.1.3. The site has been assessed following the guidance of the local authority.

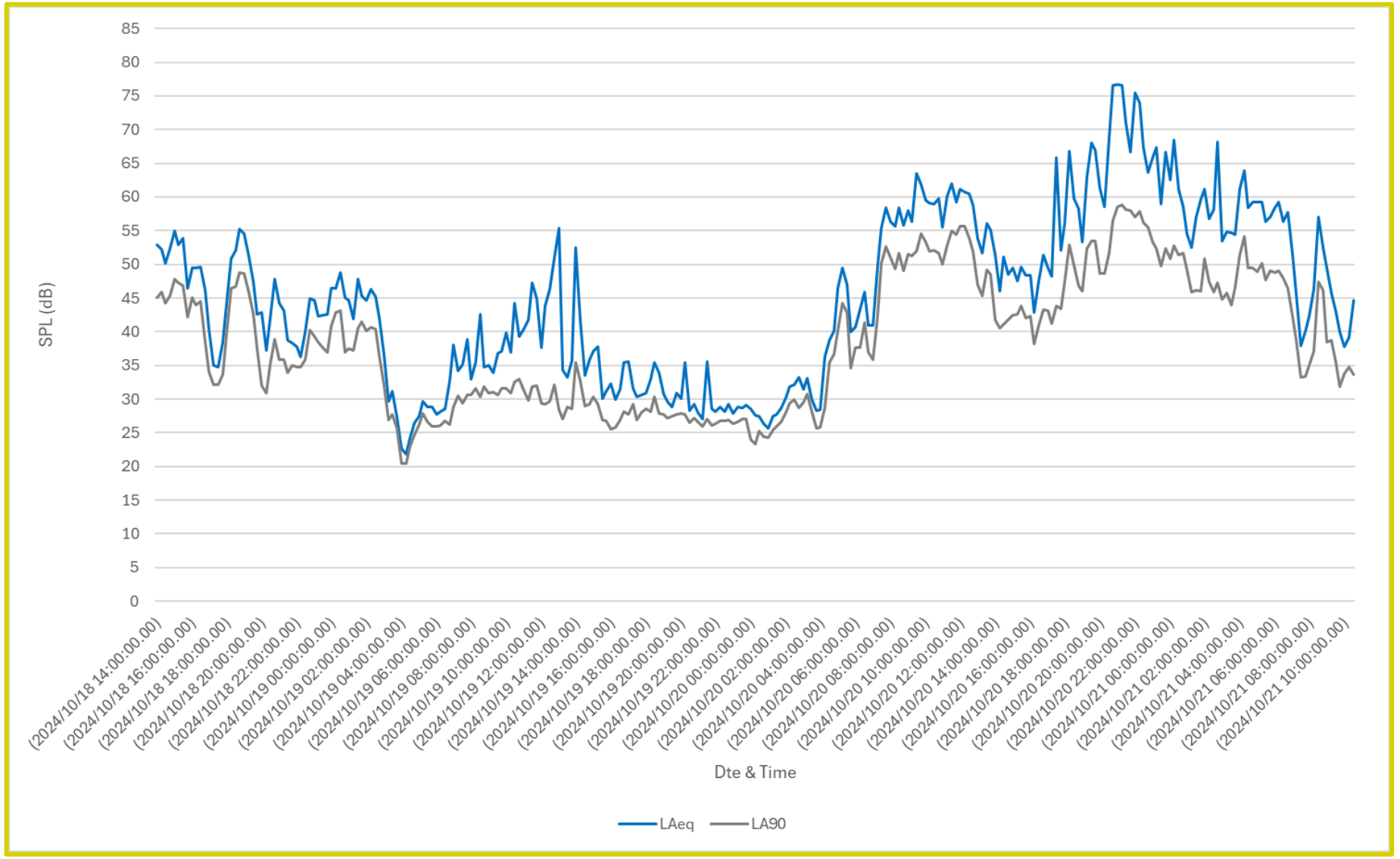
6.1.4. The various assessments show that:

- The local authority's criterion on NR 20 within dwellings can be met for all receptors, including the cumulative impact from the other 3 sites.
- The quantitative BS 4142 assessment shows a likelihood of adverse impact; however, the qualitative assessment shows that the absolute noise levels are considered low. This, as well as the NR 20 criteria, have been deemed more appropriate assessment metrics due to very low background noise levels and the fact that residents will likely be within dwellings overnight.
- The construction noise assessment shows that the CAT A noise traffic limits can be met for all receptors.

6.1.5. The expected cumulative impact from all nearby developments, including the Sweco Grid Stability Site, Rothienorman 50MW BESS, and Overhill Farm 50MW BESS have also been considered.

# 7. Appendix A - Baseline Noise Survey Data

*Figure 11: Baseline noise survey $L_{A90}$ time history*



# 8. Appendix B – $L_{A90}$ Statistical Analyses

*Figure 12: 18/11/24 14:00 to 23:00*

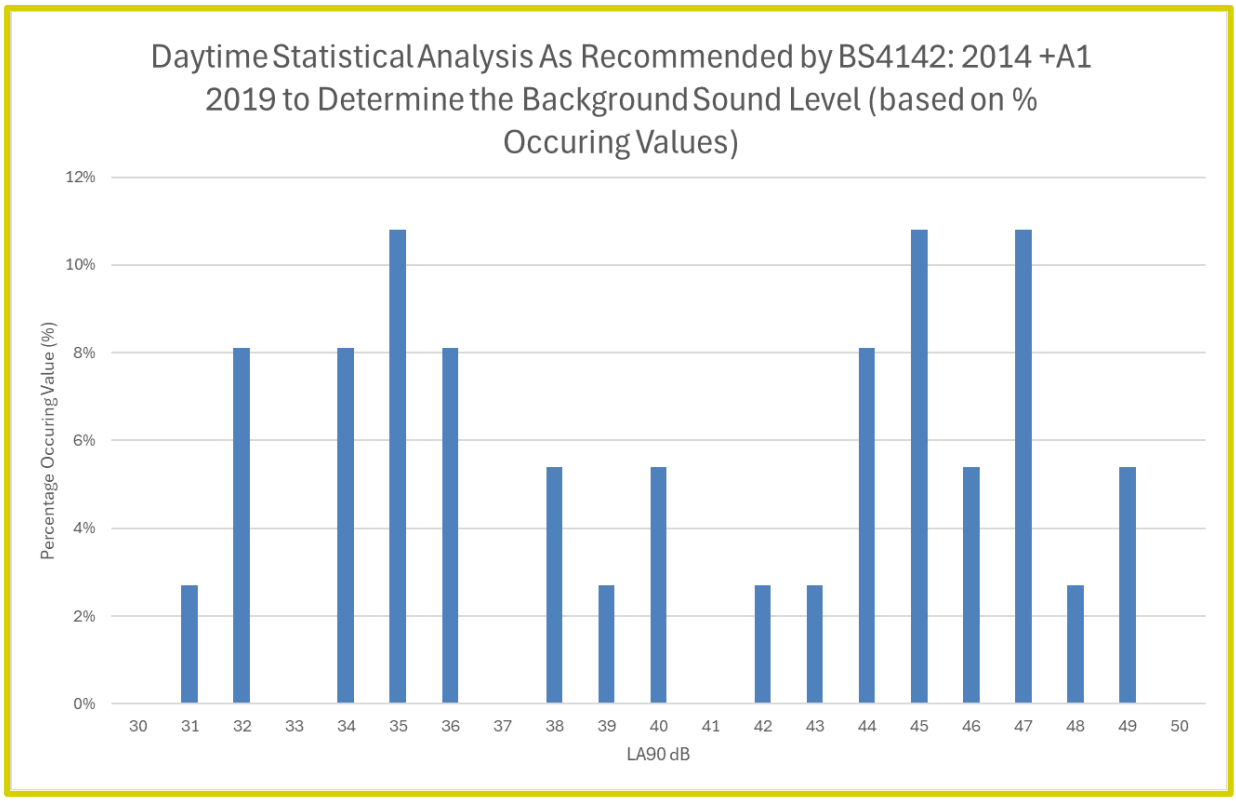



*Figure 13: 18/11/24 23:00 to 19/11/24 07:00*

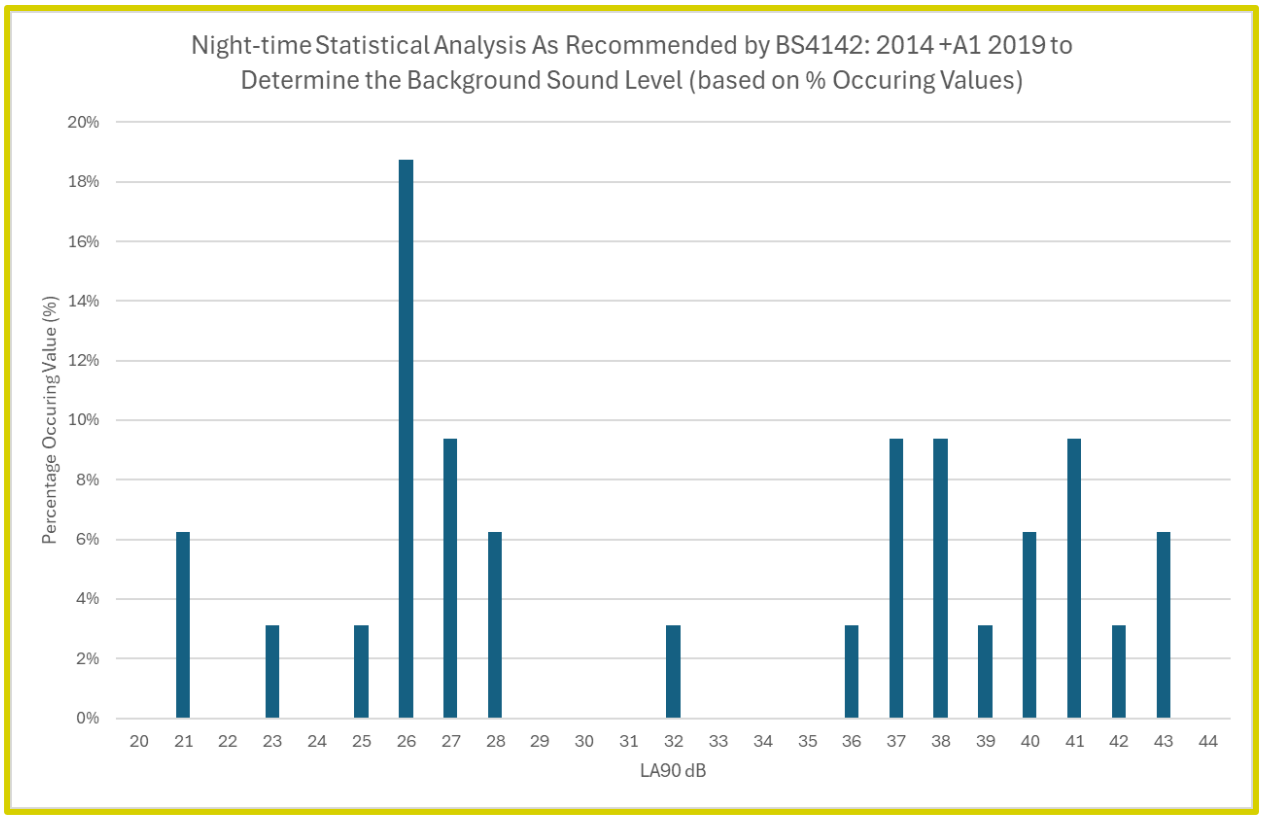


*Figure 14: 19/11/24 07:00 to 23:00*

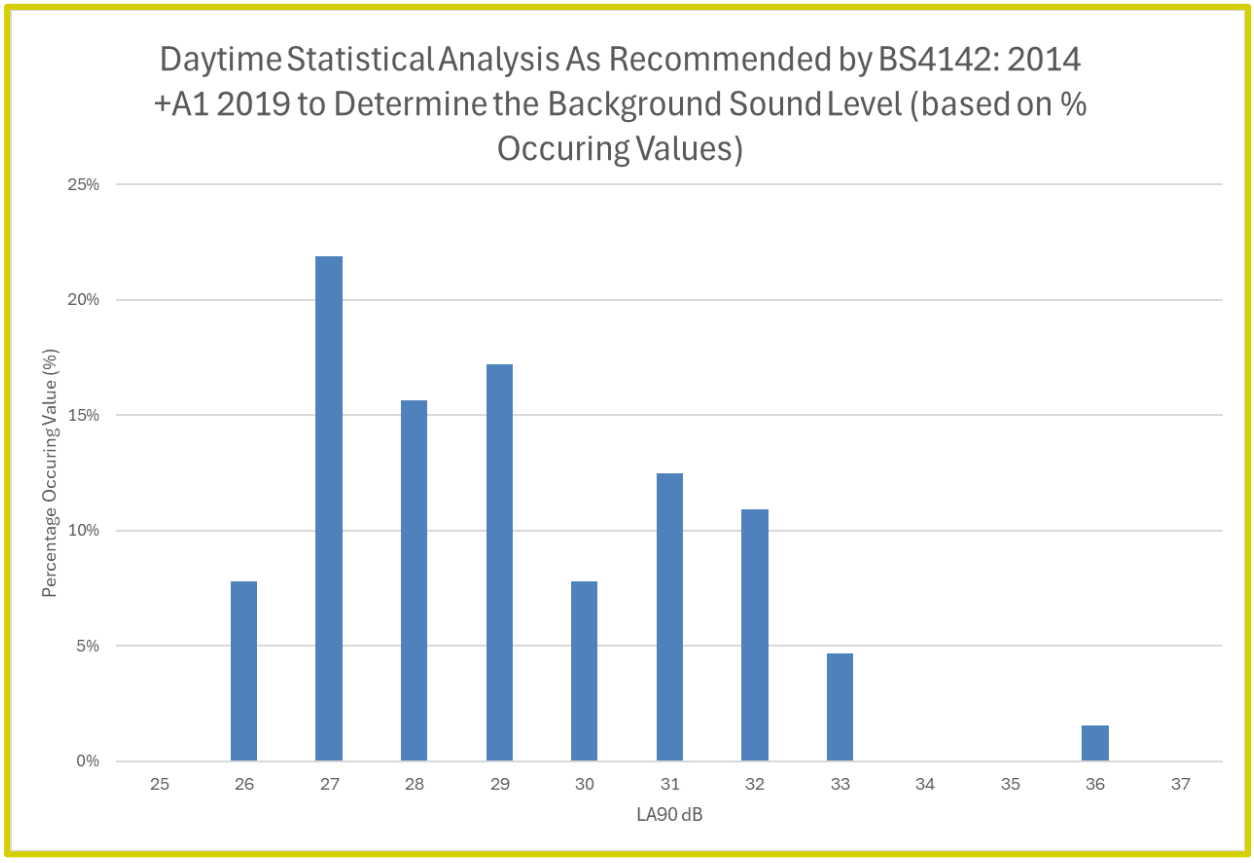



*Figure 15: 19/11/24 23:00 to 20/11/24 07:00*

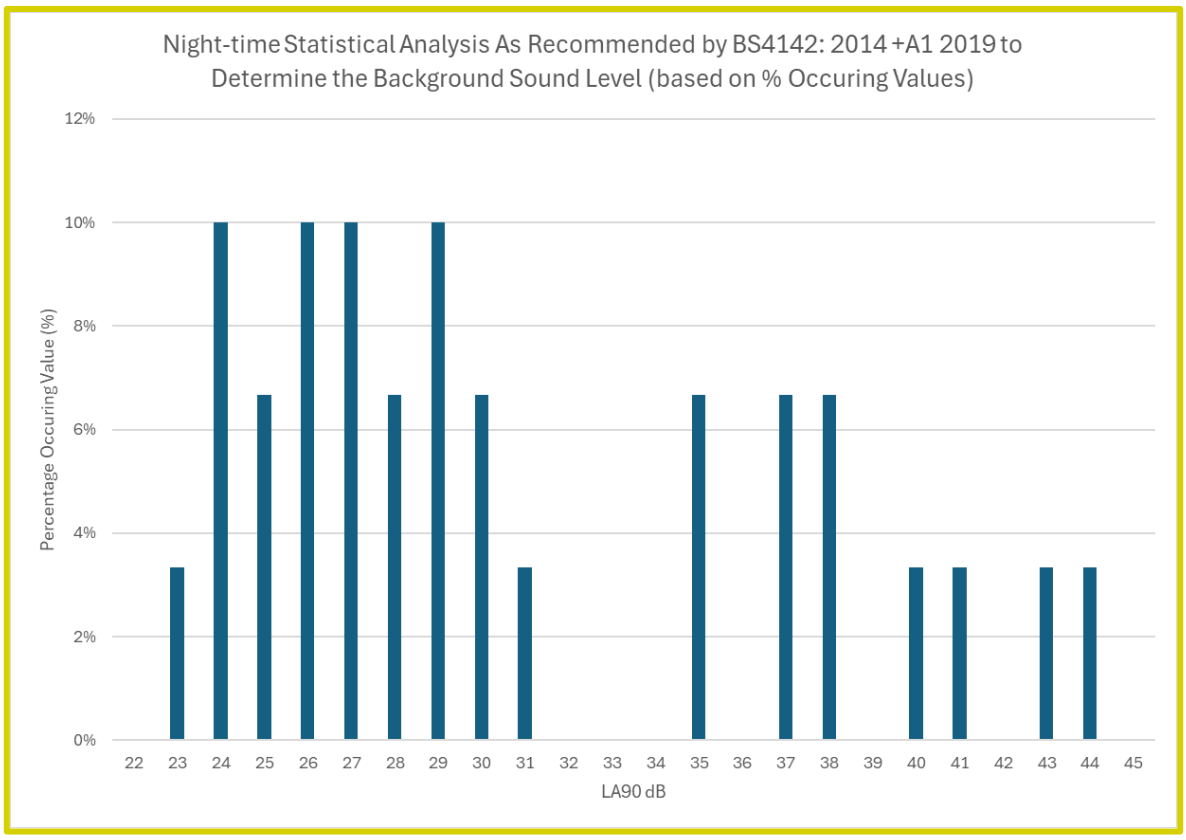


*Figure 16: 20/11/24 07:00 to 23:00*

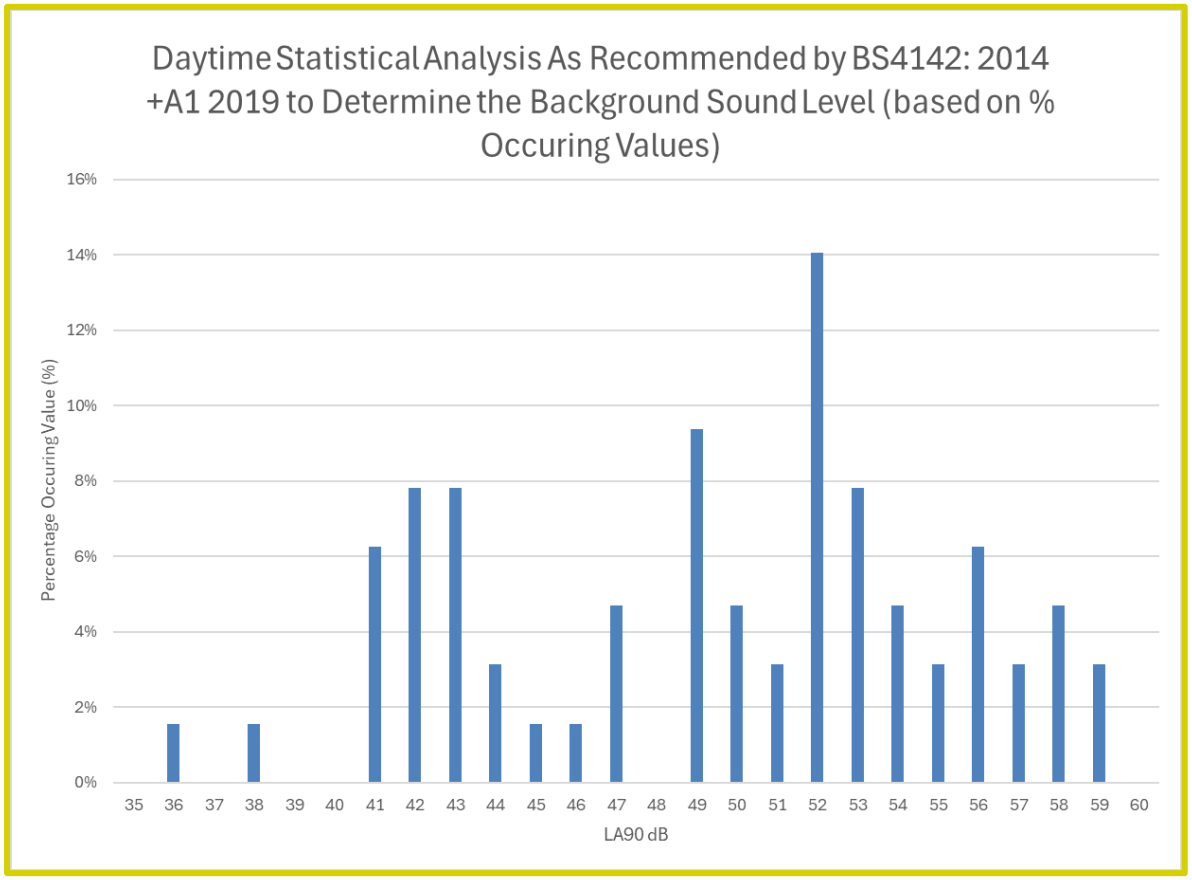



*Figure 17: 20/11/24 23:00 to 21/11/24 07:00*

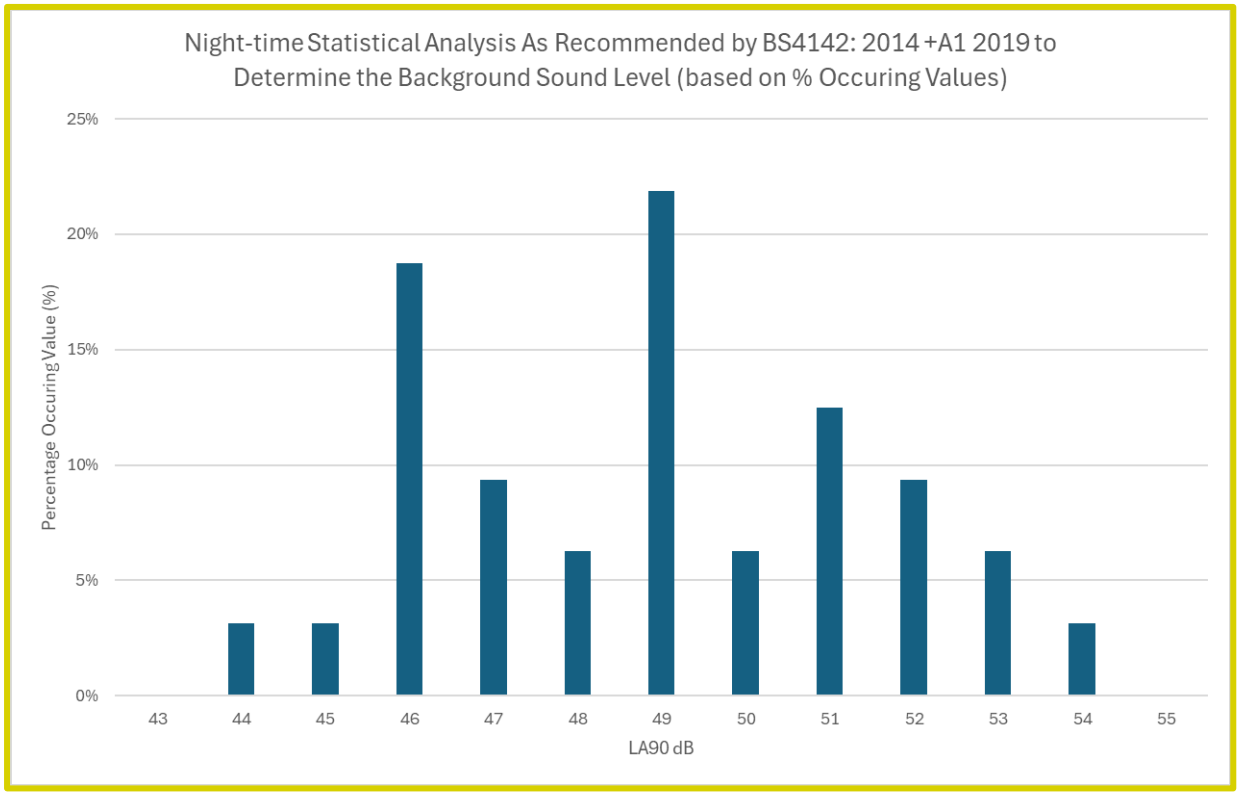
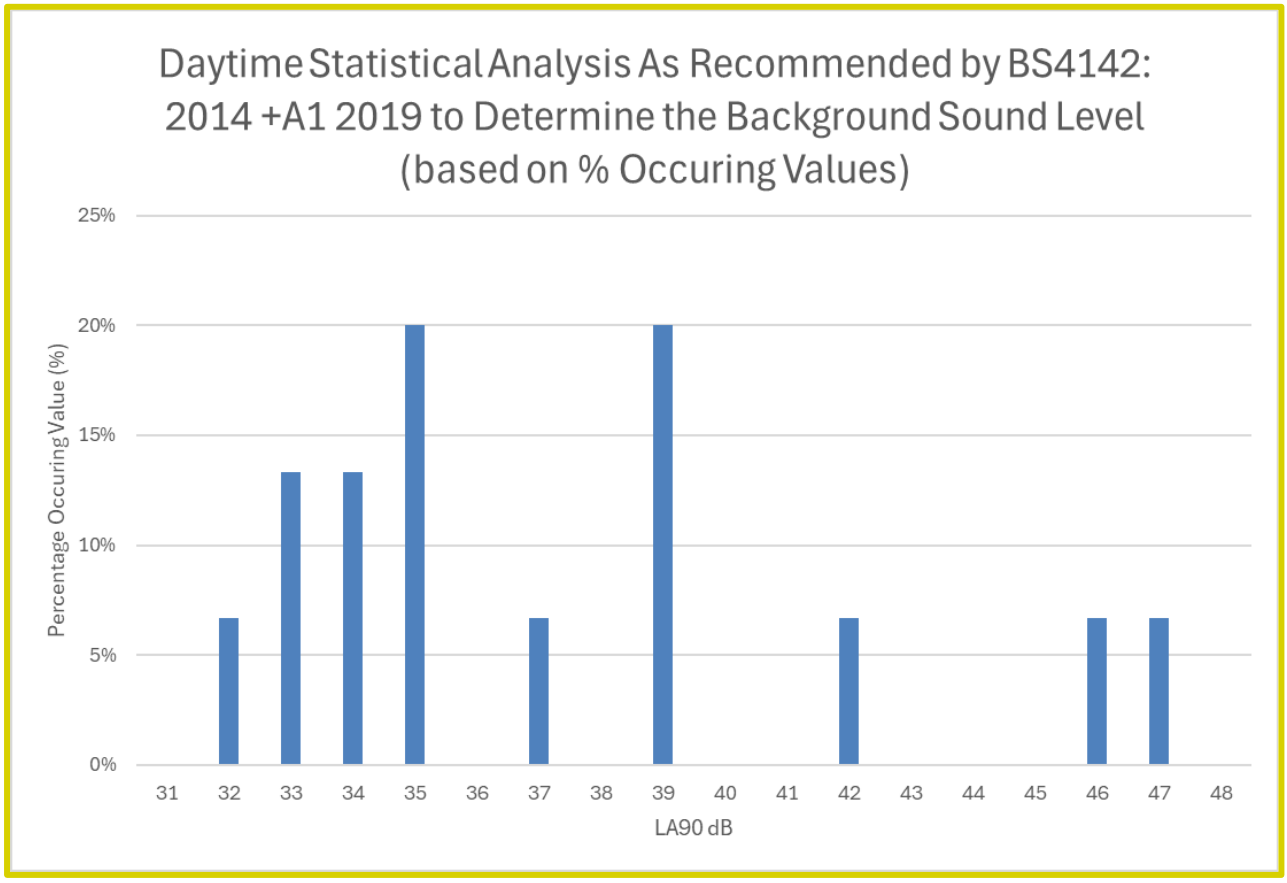


*Figure 18: 21/11/24 07:00 to 10:0*



# 9. Appendix C- BS 5228 Construction Noise Calculations

*Figure 19: Receptor 1*

**Prediction of Nosie from Stationary Plant**

| Plant Details | | Distance / m | % soft ground | Adjustments / dB(A) | | | $L_{Aeq}$ | Activity on-time | | Resultant |
|---|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | | distance | screening | reflection | | % | Correct. dB | $L_{Aeq}$ |
| Crane | 105 | 260 | 100 | 61 | | | 44 | 80 | -1.0 | 43 |
| Concrete pump | 103 | 260 | 100 | 61 | | | 42 | 40 | -4.0 | 38 |
| Crane | 105 | 260 | 100 | 61 | | | 44 | 80 | -1.0 | 43 |
| Concrete pump | 103 | 260 | 100 | 61 | | | 42 | 40 | -4.0 | 38 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | | | | Total SPL due to fixed plant = | | | 47 |

**Prediction of Noise from Haul Route**

| Plant Details | | Distance / m | No. vehicles | Av. Speed | Angle of view | $L_{Aeq}$ | Adjustments / dB(A) | | Resultant |
|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | per hour (Q) | km/h (Q) | | | screening | reflections | $L_{Aeq}$ |
| Articulate lorry | 114 | 310 | 3 | 30 | 180 | 46 | | | 46 |
| Concrete Truck | 113 | 310 | 1 | 30 | 180 | 40 | | | 40 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | Total SPL due to haul road = | | | 47 |

Total SPL due to fixed plant = 47
Total SPL due to haul road = 47
**Total SPL = 50**

*Figure 20: Receptor 2*

**Prediction of Nosie from Stationary Plant**

| Plant Details | | Distance / m | % soft ground | Adjustments / dB(A) | | | $L_{Aeq}$ | Activity on-time | | Resultant |
|---|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | | distance | screening | reflection | | % | Correct. dB | $L_{Aeq}$ |
| Crane | 105 | 430 | 100 | 67 | | | 38 | 80 | -1.0 | 37 |
| Concrete pump | 103 | 430 | 100 | 67 | | | 36 | 40 | -4.0 | 32 |
| Crane | 105 | 430 | 100 | 67 | | | 38 | 80 | -1.0 | 37 |
| Concrete pump | 103 | 430 | 100 | 67 | | | 36 | 40 | -4.0 | 32 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | | | | Total SPL due to fixed plant = | | | 41 |

**Prediction of Noise from Haul Route**

| Plant Details | | Distance / m | No. vehicles | Av. Speed | Angle of view | $L_{Aeq}$ | Adjustments / dB(A) | | Resultant |
|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | per hour (Q) | km/h (Q) | | | screening | reflections | $L_{Aeq}$ |
| Articulate lorry | 114 | 100 | 3 | 30 | 180 | 51 | | | 51 |
| Concrete Truck | 113 | 100 | 1 | 30 | 180 | 45 | | | 45 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | Total SPL due to haul road = | | | 52 |

Total SPL due to fixed plant = 41
Total SPL due to haul road = 52
**Total SPL = 52**

*Figure 21: Receptor 3*

**Prediction of Nosie from Stationary Plant**

| Plant Details | | Distance / m | % soft ground | Adjustments / dB(A) | | | $L_{Aeq}$ | Activity on-time | | Resultant |
|---|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | | distance | screening | reflection | | % | Correct. dB | $L_{Aeq}$ |
| Crane | 105 | 440 | 100 | 67 | | | 38 | 80 | -1.0 | 37 |
| Concrete pump | 103 | 440 | 100 | 67 | | | 36 | 40 | -4.0 | 32 |
| Crane | 105 | 440 | 100 | 67 | | | 38 | 80 | -1.0 | 37 |
| Concrete pump | 103 | 440 | 100 | 67 | | | 36 | 40 | -4.0 | 32 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | | | | Total SPL due to fixed plant = | | | 41 |

**Prediction of Noise from Haul Route**

| Plant Details | | Distance / m | No. vehicles | Av. Speed | Angle of view | $L_{Aeq}$ | Adjustments / dB(A) | | Resultant |
|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | per hour (Q) | km/h (Q) | | | screening | reflections | $L_{Aeq}$ |
| Articulate lorry | 114 | 90 | 3 | 30 | 180 | 51 | | | 51 |
| Concrete Truck | 113 | 90 | 1 | 30 | 180 | 46 | | | 46 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | Total SPL due to haul road = | | | 52 |

Total SPL due to fixed plant = 41
Total SPL due to haul road = 52
**Total SPL = 53**

## End of Report

*Figure 22: Receptor 4*

**Prediction of Nosie from Stationary Plant**

| Plant Details | | Distance / m | % soft ground | Adjustments / dB(A) | | | $L_{Aeq}$ | Activity on-time | | Resultant |
|---|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | | distance | screening | reflection | | % | Correct. dB | $L_{Aeq}$ |
| Crane | 105 | 200 | 100 | 59 | | | 46 | 80 | -1.0 | 46 |
| Concrete pump | 103 | 200 | 100 | 59 | | | 44 | 40 | -4.0 | 40 |
| Crane | 105 | 200 | 100 | 59 | | | 46 | 80 | -1.0 | 46 |
| Concrete pump | 103 | 200 | 100 | 59 | | | 44 | 40 | -4.0 | 40 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | 0 | | | 0 | | 0.0 | 0 |
| | | | | | | | Total SPL due to fixed plant = | | | 50 |

**Prediction of Noise from Haul Route**

| Plant Details | | Distance / m | No. vehicles | Av. Speed | Angle of view | $L_{Aeq}$ | Adjustments / dB(A) | | Resultant |
|---|---|---|---|---|---|---|---|---|---|
| Type & Number | $L_{WA}$ | | per hour (Q) | km/h (Q) | | | screening | reflections | $L_{Aeq}$ |
| Articulate lorry | 114 | 430 | 3 | 30 | 180 | 45 | | | 45 |
| Concrete Truck | 113 | 430 | 1 | 30 | 180 | 39 | | | 39 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | Total SPL due to haul road = | | | 46 |

| | | |
|---|---|---|
| Total SPL due to fixed plant | = | 50 |
| Total SPL due to haul road = | | 46 |
| **Total SPL** | **=** | **51** |

## End of Report