Noise Impact Assessment

Tealing BESS

20/04/2023

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1. EXECUTIVE SUMMARY

1.1 This Noise Impact Assessment has been undertaken for a Proposed Development consisting of the installation and operation of a proposed BESS and ancillary infrastructure on lands northwest of Wellbank, Angus.

1.2 The objectives of the assessment were to identify and describe any likely significant noise effects on key receptors during the operational phase of the Proposed Development.

1.3 In order to assess the potential noise impacts of the Proposed Development, the current baseline characteristics of the Application Site and the surrounding area have been identified as well as the predicted impacts of the Proposed Development and the cumulative impacts with the solar farm to the south.

1.4 A total of six noise sensitive receptors were included in the assessment within a Study Area of 500m of the noise generating area of the Application Site. All of the identified receptors are residential dwellings.

1.5 An unattended noise was undertaken within the Application Site between the 15th and 19th October 2019 at two locations. These locations were chosen as they are representative of the nearest noise sensitive receptors and are far enough away from The Latch that passing vehicles at the property did not interfere with the baseline measurements.

1.6 The method set out in Figure 4 of BS4142 was adopted for this assessment which uses a histogram to determine the most commonly occurring background noise ($L_{A90,t}$) value within the data set. The most common background noise for the day-time period was the same as the average and therefore was used in this assessment as a worst case. The average for the night-time period was lower than the most common background noise and therefore it was used in this assessment as a worst case.

1.7 A simulation of noise associated with the Proposed Development was produced using SoundPlan modelling software to predict noise levels for the purpose of undertaking an ISO9613-2 assessment. Source noise levels were modelled based on a candidate noise source.

1.8 An assessment of the acoustic impact of the Proposed Development was undertaken in accordance with BS4142. The results for the day-time period showed only **Low impacts** at all receptors. The results for the night-time period showed **High impacts** at one receptor and **Low impacts** at all remaining receptors within the Study Area.

1.9 A 3m high acoustic grade fence has been proposed along the southern and eastern boundaries of the Battery Storage units. With this mitigation in place, the **High** noise levels reduce to **Low** and all impacts are **Low** or **Negligible**.

1.10 When the cumulative impact was included, the results showed **Low impacts** at all receptors for both the day-time and night-time periods.

1.11 In addition to this, the levels at each receptor are below the Night Noise Guideline value of 40dB set out in the WHO Night-time Guidelines. This is the level recommended for the primary prevention of subclinical adverse health effects related to night noise in the population.

1.12 An impact assessment was then conducted comparing the predicted effects of the operational stage of the development against Noise Rating curves for the internal noise. The noise levels at all receptors are below the target NR30 and NR20 Noise Rating Curves.

1.13 Internally, the predicted noise rating meets the required limits at all noise sensitive receptors.

2. INTRODUCTION

BACKGROUND

2.1 Neo Environmental Ltd has been appointed by AE Associates (the "Applicant") to undertake a Noise Impact Assessment (NIA) for a proposed Battery Energy Storage System (BESS) and associated infrastructure (the "Proposed Development") on lands northwest of Wellbank, Angus (the "Application Site").

2.2 Please refer to **Figure 1: Appendix A** for the layout of the Proposed Development.

DEVELOPMENT DESCRIPTION

2.3 The proposal is for a battery storage facility, main transformer, iDNO switch and meter room, client switch room, SSET control room, tower, fencing, access road, and associated infrastructure.

SCOPE OF THE ASSESSMENT

2.4 The objectives of this assessment are to identify and describe any likely significant noise effects on key receptors during the operational phase of the Proposed Development.

2.5 In order to assess the potential noise impacts of the Proposed Development, this report identifies the current baseline characteristics of the Application Site and the surrounding area, as well as the predicted impacts. This allows for the identification of potential noise impacts and recommendation of mitigation measures where appropriate.

2.6 This report is supported by the following Appendices:

- Appendix A: Figures
  - Figure 1: Development Layout
  - Figure 2: Noise Assessment Map
  - Figure 3: Noise Assessment Map with Mitigation
  - Figure 4: Cumulative Noise Assessment Map with Mitigation

STATEMENT OF AUTHORITY

2.7 This Noise Impact Assessment has been produced by Michael McGhee and David Thomson of Neo Environmental. Having completed a civil engineering degree in 2012, Michael became a technician member of the Institute of Acoustics in 2013 and has since worked on over 100 noise impact assessments, ranging from solar and wind farms to large scale residential developments across the UK and Ireland.

2.8 David has a BSc (Hons) in physics, a MSc in sensor design, a MSc in nanoscience and nanotechnology and a Diploma in Acoustics and Nosie Control. He has worked on numerous noise impact assessments for solar farms and battery storage facilities across the UK and Ireland.

3. LEGISLATION

3.1 This assessment has been collated and considered based on the following legislative, planning policy and guidance context:

- The Environmental Protection Act 1990[1]
- BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (BS4142)[2]
- ISO9613-2 Method for Rating Industrial noise affecting mixed residential and industrial areas[3];
- World Health Organisation (WHO) Guidelines for Community Noise[4]; and
- WHO Night-time Guidelines.[5]

The Environmental Protection Act 1990

3.2 The EPA 1990 specifies mandatory powers available to Local Authorities in respect of any noise that either constitutes or is likely to cause a statutory nuisance, which is also defined in the Act. A duty is imposed on Local Authorities to carry out inspections to identify statutory nuisances, and to serve abatement notices against these. Procedures are also specified with regards to complaints from persons affected by a statutory nuisance.

BS4142:2014+A1:2019

3.3 This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;

1 UK Government The Environmental Protection Act, 1990, Available at https://www.legislation.gov.uk/ukpga/1990/43/contents

2 BSI BS 4142+A1:2019 (2019) Methods for rating and assessing industrial and commercial sound.

3 International Standards Organisation (1996) Acoustics – Attenuation of sound during propagation outdoors, Dec 1996

4 World Health Organization (WHO), Guidelines for Community Noise, 1999

5 World Health Organization (WHO), Night Noise Guidelines for Europe, 2009

- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial Application Site.

3.4 The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

ISO9613 Part 2

3.5 This International Organisation for Standardisation (ISO) standard specifies an engineering method for calculating the attenuation of outdoor sound during propagation to predict the levels of environmental noise at a distance from a variety of sources.

WHO Guidelines for Community Noise

3.6 The WHO Guidelines for Community Noise sets out specific guideline values for community noise in specific environments. The values relevant to this assessment are:

- An L_{Aeq} of 30dB within bedrooms during night time hours (8 hour period);
- An L_{Aeq} of 35dB within living rooms during day time hours (16 hour period);
- An L_{Aeq} of 50-55dB in gardens during day time hours (16 hour period); and
- An L_{Aeq} of 45 dB outside bedrooms with an open window during night time hours (8-hour period).

WHO Night Time Guidelines

3.7 The WHO Night Time Guidelines recommend updated levels lower than those found in the community noise guidelines. In respect of sleep disturbance, the guidelines recommend:

- 40 dB $L_{night, outside}$ Night Noise Guideline (NNG); and
- 55 dB $L_{night, outside}$ Interim Target (IT).

3.8 It further states:

"For the primary prevention of subclinical adverse health effects related to night noise in the population, it is recommended that the population should not be exposed to night noise levels greater than 40 dB of $L_{night,outside}$ during the part of the night when most people are in bed. The

LOAEL of night noise, 40 dB $L_{night,outside}$, can be considered a health-based limit value of the night noise guidelines (NNG) necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise.

An interim target (IT) of 55 dB $L_{night,outside}$ is recommended in the situations where the achievement of NNG is not feasible in the short run for various reasons. It should be emphasized that IT is not a health-based limit value by itself. Vulnerable groups cannot be protected at this level. Therefore, IT should be considered only as a feasibility-based intermediate target which can be temporarily considered by policy-makers for exceptional local situations."

4. METHODOLOGY

BASELINE CONDITIONS

4.1 A desk-based assessment has been conducted to identify Noise Sensitive Receptors (NSRs) where it is considered that there is potential for increased noise effects due to the Proposed Development.

4.2 Residences closest to the Proposed Development were identified as the key NSRs for the purposes of this assessment. The Study Area included all receptors within 500m of the Application Site (**Figure 2: Appendix A**). Where there are several residential receptors within close proximity, a representative dwelling or dwellings is/are chosen for full assessment as the impacts will not vary to any significant degree.

4.3 The establishment of baseline conditions was then undertaken using the methodology found in BS4142. A sound level meter (SLM) was set-up at two locations to record the required acoustic information at the NSRs identified in the desk-based assessment.

4.4 This equipment is housed in weather-proof enclosures and is powered by battery. The SLM was set up to collect a number of noise metrics within a sampling period of 15 minutes. Only the $L_{A90,15min}$ is reported, as this defines the background levels which are required in the assessment.

4.5 The microphone was placed at a height of 1.4m above the ground level in free-field conditions, with wind shields, at all measurement locations, i.e. at least 3.5m from the nearest vertical, reflective surface.

4.6 The microphone was calibrated using a class 1 calibrator. Noise levels are monitored continuously, and summary statistics stored every 15 minutes in the internal memory of each meter.

4.7 Prior to establishing the baseline conditions the acoustic data was filtered as follows for each background noise measurement location:

- Periods of heavy rain, which can adversely affect the noise data, have been excluded from the analysis;
- Periods when the wind speed is above 5m/s; and
- Periods of measured background noise data thought to be affected by extraneous noise sources, i.e. non-typical, are removed from the acoustic data set. Whilst some 'extraneous' data may actually be real, in practice it tends to bias any trend lines upwards, so its removal is adopted as a conservative measure.

POTENTIAL EFFECTS

4.8 As the Proposed Development is not yet constructed, it is not possible to complete an onsite survey to measure the actual source noise levels on the Application Site. Therefore, the predicted impacts were calculated using source noise data from the manufacturer of the noise emitting equipment. The data is similar to the type anticipated to be used for the Proposed Development and therefore provided a valid method for calculating sound levels.

4.9 SoundPlan[6] noise modelling software was utilised to determine the noise impact from the Proposed Development. The software allows the user to create a three-dimensional replication of the topographic and structural detail of the assessment area. The user can characterise the ground type, and include further structural detail such as berms, walls and reflective surfaces. The user also assigns relevant Sound Power Levels (LWA) to individual items of plant taking account of percentage on time, etc. This software is industry standard.

4.10 ISO9613-2[7] is an international standard which specifies an engineering method for calculating the attenuation of sound during propagation outdoors, in order to predict the levels of environmental noise at a distance from a variety of sources.

4.11 The ISO9613-2 algorithms take the octave band sound power output of the source as their acoustic input data and calculates on an octave band basis attenuation due to geometric spreading, atmospheric absorption and ground effects. This is the model which was utilised within the software model.

4.12 Where appropriate, a rating penalty was established to correct the specific sound level if a tone, impulse or other characteristic was expected to occur.

4.13 The SoundPlan software model simulates the digital ground model ("DGM"), single point receivers and noise contour lines, to generate noise contour maps for each model simulation. Noise contour maps accurately illustrate noise propagation for the Study Area and can be viewed in **Figure 2: Appendix A**.

IMPACT ASSESSMENT

4.14 Once the specific sound levels due to the proposed new sound source were predicted, the rating sound level was calculated, and it is this which was compared to the existing background sound level to determine the level of impact. The rating level was obtained by

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[6] SoundPLAN International LLC, *Soundplan Noise software, debuting in 1986*. Further information found at http://www.soundplan.eu/english/soundplan-acoustics/

[7] International Standards Organisation (1996) *Acoustics – Attenuation of sound during propagation outdoors*

adding any penalties due to character that may be applicable to the predicted specific sound level.

4.15 **Table 4-1** below details how the difference between the rating sound level and background sound level was used to conclude the level of impact under BS 4142, although it should be noted that any assessment is context specific.

Table 4-1: Magnitude of Impact Criteria

MAGNITUDE OF IMPACT	DEFINITION
High	Rating level is more than 5dB above the background level
Low	Rating level is less than 5dB above the background level
Negligible	Rating level is 10dB or more below the background level

4.16 The impact assessment will include a review of the predicted noise levels at the noise sensitive receptors against the absolute levels from noise rating (NR) curves. The NR30 and NR20 rating curves criteria which have to be met can be found in **Table 4-2.**

Table 4-2: Noise Rating Values

NOISE RATING	OCTAVE BAND CENTRE FREQUENCY							
	63	125	250	500	1000	2000	4000	8000
NR30	59	48	40	34	30	27	25	23
NR20	51	59	51	24	20	17	14	13

4.17 To calculate the NR value of a space, the noise level in each 1:1 octave band is compared to the values in the NR table for each corresponding band.

4.18 The NR curve number which applies to each frequency band is the highest numerical value that is not exceeded in that band. The overall NR value is the highest of the individual NR values for the frequency bands.

5. BASELINE CONDITIONS

Noise Sensitive Receptors in the Study Area

5.1 The co-ordinates of the NSRs can be found in **Table 5-1** and these were identified from available mapping sources including Google Earth.

Table 5-1: Noise Sensitive Receptors in Study Area

Name	Easting	Northing
Receptor 1	344694	738061
Receptor 2	345617	737988
Receptor 3	345668	737990
Receptor 4	345365	737729
Receptor 5	345430	737719
Receptor 6	345459	737687

Baseline Monitoring

5.2 An unattended noise was undertaken near the Application Site (see **Figure 2: Appendix A**) between the 15th and 19th October 2021 at two locations. These locations were considered representative of the closest noise sensitive receptors. Measurement Location 1 was positioned 100m from Receptor 2 (The Latch), between the property and the Proposed Development, to reduce the influence of any passing vehicles close to the property. Measurement Location 2 was positioned 30m from Receptor 4 (Willowbank) on the corner of an arable field. It was thought that these locations could be used as a good proxy location for these reasons.

5.3 A Class 1 Sound Level Meter (SLM) (Rion NL-52) was used to measure noise at these locations. The sound level meters were calibrated at the start and end of the noise surveys. The meters were calibrated to 94.0dB at 1kHz with no recorded drift greater than 0.5dB at 1kHz. A weather monitoring location was installed at Location 1 to establish weather conditions during the unattended survey.

5.4 The monitoring locations are within fields. At Location 1 overhead aircraft, sheep and agricultural vehicles are the dominant noise sources. At Location 2 tractor movements, birds, agricultural noise, wind blowing through foliage and distant traffic from the A90 are the dominant noise sources.

Weather

- **Weather start:** light winds (<5m/s), intermittent precipitation.
- **Weather finish:** light winds <5m/s), intermittent precipitation.

Analysis of Baseline Data

5.5 The time series chart followed a typical diurnal pattern for noise, with higher sound levels during the day-time period. Some data was removed due to rainfall or high wind speeds which occurred during the measurement period.

5.6 The method set out in Figure 4 of BS4142 was adopted for this assessment which uses a histogram to determine the most commonly occurring background noise ($L_{A90,t}$) value within the data set. The most common background noise level was used for noise sensitive receptors closest to Location 1. As this was the same as the average it will be used in this assessment as a worst case. The average background noise level was used for noise sensitive receptors closest to Location 2. As this was lower than the most common noise level it will be used in this assessment as a worst case.

5.7 **Tables 5-2 and Table 5-3** show the background noise levels at both quiet day time and night-time periods at Locations 1 and 2, respectively.

Table 5-2: Quiet Day Time and Night-Time Noise Levels at Measurement Location1

Period	Most common Noise Level $L_{A90, 15min}$ (dB)	Average Noise Level, $L_{A90,15min}$ (dB)
Day Time	30.0	30.0
Night-Time	24.0	24.0

Table 5-3: Quiet Day Time and Night Time Noise Levels at Measurement Location 2

Period	Most common Noise Level $L_{A90, 15min}$ (dB)	Average Noise Level, $L_{A90,15min}$ (dB)
Day Time	33.0	31.0

Night-Time	26.0	26.0

5.8 An assessment and comparison against the WHO night-time levels will also be undertaken.

6. POTENTIAL EFFECTS

6.1 The main sources of sound within the Proposed Development are the cooling fans for the Power Conversion System (PCS) units, which will also include the HVAC system for the batteries, as well as the Main Transformer.

6.2 The 20 battery storage units are expected to be continuously charging and discharging. If there are any rest periods for the battery storage units these are likely to be infrequent and the HVAC will still be functioning. This will likely be similar with the fans on the PCS units.

6.3 Source noise levels are estimated based on research of similar projects and represent the equipment operating at maximum capacity. Predictions based on this data therefore represent a worst-case scenario and the sound levels would be expected to be less when the Proposed Development isn't operating at maximum capacity.

6.4 **Table 6-1** shows A-weighted sound power levels of the noise sources which have been included in the noise model.

Table 6-1: Summary of 1/1 Octave Band Centres

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Total
PCS Unit	39.8	59.9	64.4	72.8	68.0	78.5	50.0	44.1	**80.0**
HVAC System	46.8	64.4	73.4	72.8	71.0	72.2	69.5	65.9	**79.3**
Main Transformer	50.8	65.9	72.4	77.8	75.0	71.2	66.0	56.9	**81.1**

6.5 Should the chosen noise source increase noise levels from that specified in this report then this would be agreed with the Council prior to the construction stage.

RESULTS

6.6 Predicted specific sound levels at nearby properties are detailed in **Table 6-2** and an illustrative sound footprint for the Proposed Development is provided in **Figure 2 of Appendix A.**

6.7 The sound emitted by the PCS and HVAC units, as well as the site transformer, can depend on the capacity and usage of the ESF. It can therefore be intermittent. Under the intermittency method described in BS4142, a correction of 3dB would typically be applied as consistent with 'If the intermittency is readily distinctive against the residual acoustic environment'. Although it could be argued that the Proposed Development noise won't be distinctive at all NSR's, the correction has been supplied to all as a worst-case scenario.

6.8 Note that a 3dB façade correction is included within the SoundPlan model at each of the receptor locations.

Table 6-2: Predicted Noise Impacts at the NSRs

Receptor	Specific Sound Level ($L_{Ar,Tr}$) dB (Predicted)	Rating Penalty (dB)	Rating Level (dB)
Receptor 1	18.0	3.0	21.0
Receptor 2	28.8	3.0	31.8
Receptor 3	24.8	3.0	27.8
Receptor 4	22.9	3.0	25.9
Receptor 5	22.6	3.0	25.6
Receptor 6	21.7	3.0	24.7

7. IMPACT ASSESSMENT

7.1 **Table 7-1** and **7-2** compares the predicted rating level with the adopted background noise levels for both the day-time and night-time periods.

Table 7-1: Noise Impacts against the Quiet Day-Time Background Noise Level

Receptor	Rating Level (dB)	Baseline Noise Level (LA90) dB	Exceedance (dB)	Receptor
Receptor 1	21.0	30.0	-9.0	Low
Receptor 2	31.8	30.0	1.8	Low
Receptor 3	27.8	30.0	-2.2	Low
Receptor 4	25.9	31.0	-5.1	Low
Receptor 5	25.6	31.0	-5.4	Low
Receptor 6	24.7	31.0	-6.3	Low

Table 7-2: Noise Impacts against the Night-Time Background Noise Level

Receptor	Rating Level (dB)	Baseline Noise Level (LA90) dB	Exceedance (dB)	Receptor
Receptor 1	21.0	24.0	-3.0	Low
Receptor 2	31.8	24.0	7.8	High
Receptor 3	27.8	24.0	3.8	Low
Receptor 4	25.9	26.0	-0.1	Low
Receptor 5	25.6	26.0	-0.4	Low
Receptor 6	24.7	26.0	-1.3	Low

7.2 The Proposed Development is predicted to have only **Low impacts** at all receptors within the study area during the day-time period, and **High impacts** at one receptor and **Low impacts** at five receptors during the night-time period.

7.3 In addition to this, the levels at each receptor are found to be below the Night Noise Guideline value of 40dB set out in the World Health Organisation (WHO) Night-time Guidelines. This is the level recommended for the primary prevention of subclinical adverse health effects related to night noise in the population.

8. MITIGATION

8.1 The previous section has indicated that the noise levels at Receptor 2 exceed the criteria level and the most appropriate method for controlling noise in these areas is using an acoustic grade fence.

8.2 As a result, a 3m high acoustic grade fence has been proposed around the southern and eastern boundaries of the Battery Storage units (see **Figure 3: Appendix A**).

Results

8.3 The SoundPlan model results for the Proposed Development with the mitigation in place are presented in **Table 8-1** whilst the grid noise map can be seen in **Figure 3: Appendix A**.

Table 8-1: Predicted Noise Impacts at the NSRs with Mitigation

Receptor	Specific Sound Level ($L_{Ar,Tr}$) dB (Predicted)	Rating Penalty (dB)	Rating Level (dB)
Receptor 1	17.8	3.0	20.8
Receptor 2	17.5	3.0	20.5
Receptor 3	16.6	3.0	19.6
Receptor 4	14.4	3.0	17.4
Receptor 5	13.9	3.0	16.9
Receptor 6	13.6	3.0	16.6

8.4 With this mitigation in place, the noise levels remain **Low** at two receptors and reduce to **Negligible** at four receptors during the day-time period and remain **Low** at five receptors and reduce to **Low** at one receptor during the night-time period. However, the levels at each receptor are below the Night Noise Guideline value of 40dB set out in the WHO Night-time Guidelines. This is the level recommended for the primary prevention of subclinical adverse health effects related to night noise in the population.

9. CUMULATIVE ASSESSMENT

9.1 The Proposed Development is adjacent to the proposed Tealing Solar Farm (planning ref: 23/00017/EIASCR). The main source of noise within the solar farm will be the inverters. The solar panels have been included in the model as screens because they will act as noise barriers and will block some acoustic transmission paths between the noise sources and the receptors. Neo Environmental conducted the noise impact assessment (NIA) for the Tealing Solar farm, the noise data from which is used in the cumulative assessment.

9.2 **Table 9-1** shows A-weighted sound power levels of the noise sources which have been included in the noise model.

Table 9-1: Summary of 1/1 Octave Band Centres

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Total
Solar Inverter	56.2	68.2	77.1	71.7	80.3	75.8	83.5	70.1	**86.6**

9.3 Predicted specific sound levels at nearby properties are detailed in **Table 9-2** and an illustrative sound footprint for the Proposed Development is provided in **Figure 4 of Appendix A.**

Table 9-2: Predicted Cumulative Noise Impacts at the NSRs with Mitigation

Receptor	Specific Sound Level ($L_{Ar,Tr}$) dB (Predicted)	Rating Penalty (dB)	Rating Level (dB)
Receptor 1	22.0	3.0	25.0
Receptor 2	21.0	3.0	24.0
Receptor 3	20.1	3.0	23.1
Receptor 4	25.4	3.0	28.4
Receptor 5	23.5	3.0	26.5
Receptor 6	22.8	3.0	25.8

CUMULATIVE IMPACT ASSESSMENT

9.4 **Table 9-3 and Table 9-4** compares the predicted cumulative rating level with the adopted day-time and night-time background noise levels respectively. Whilst the grid noise map can be seen in **Figure 4: Appendix A**

Table 9-3: Cumulative Noise Impacts against the Quiet Day-Time Background Noise Level

Receptor	Rating Level (dB)	Baseline Noise Level (LA90) dB	Exceedance (dB)	Receptor
Receptor 1	25.0	30.0	-5.0	Low
Receptor 2	24.0	30.0	-6.0	Low
Receptor 3	23.1	30.0	-6.9	Low
Receptor 4	28.4	31.0	-2.6	Low
Receptor 5	26.5	31.0	-4.5	Low
Receptor 6	25.8	31.0	-5.2	Low

Table 9-4: Cumulative Noise Impacts against the Quiet Night-Time Background Noise Level

Receptor	Rating Level (dB)	Baseline Noise Level (LA90) dB	Exceedance (dB)	Receptor
Receptor 1	25.0	24.0	1.0	Low
Receptor 2	24.0	24.0	0.0	Low
Receptor 3	23.1	24.0	-0.9	Low
Receptor 4	28.4	26.0	2.4	Low
Receptor 5	26.5	26.0	0.5	Low
Receptor 6	25.8	26.0	-0.2	Low

9.5 The Proposed Development, including cumulative, is predicted to have a **Low impact** at all receptors within the study area during both the day-time and night-time periods.

9.6 In addition to this, the levels at each receptor are found to be below the Night Noise Guideline value of 40dB set out in the World Health Organisation (WHO) Night-time Guidelines. This is the level recommended for the primary prevention of subclinical adverse health effects related to night noise in the population.

9.7 **Table 9-5** shows the 1/1 octave spread which are required for the comparison against the Noise Rating curves for the internal noise assessment. There is a 3dB difference from the external levels due to the façade correction.

Table 9-5: Predicted Spectrum Output at Receptor Locations

Receptor	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)	Total dB(A)
1	4	9.3	9	7.3	18.3	17	12.3	-26.3	22.0
2	3.4	10.6	10.9	10.1	17.6	14.5	7.5	-34.4	21.0
3	2.7	9.7	10	9	16.8	13.6	4.6	-41.8	20.1
4	5.9	12	11.8	9	22.2	17.2	19.4	-9.9	25.4
5	4.9	10.7	10.7	8.3	20.7	15.2	16.2	-17.4	23.5
6	4.6	10.1	10.3	7.7	20	14.4	15.5	-17.7	22.8

9.8 **Table 9-6** displays the weighted difference level used for the attenuation through an open window. The levels were manipulated from a report by Napier University 'Sound Insulation through ventilated domestic windows'[8]. The average of three separate sized windows tests was analysed and an average of the test was then scaled to meet an 10dB noise reduction through an open window.

Table 9-6: Weighted difference level of an open window

	63Hz dB	125Hz dB	250Hz dB	500Hz dB	1kHz dB(A)	2kHz dB	4kHz dB	8kHz dB	Dw
Open Window	14	8	9	10	7	11	13	11.0	10.0

9.9 **Table 9-7** compares the noise rating levels with the target noise rating levels. These values are a noise rating level of 30dB.

Table 9-7: NR30 Noise Rating Curve Comparison

Receptor	Actual Noise Rating Curve (dB)	Target Noise Rating Curve (dB)	Pass / Fail
Receptor 1	11	30	Pass
Receptor 2	11	30	Pass
Receptor 3	10	30	Pass

[8] Napier University (2007) *Sound Insulation through ventilated domestic windows*. Accessed at http://www.napier.ac.uk/~/media/worktribe/output-246785/twfrepnanr116pdf.pdf

Receptor 4	15	30	Pass
Receptor 5	14	30	Pass
Receptor 6	13	30	Pass

9.10 The noise rating levels at all receptors are below the target NR30 noise rating levels. Therefore, the impacts are deemed to be **acceptable**.

9.11 **Table 9-7** compares the noise rating levels with the target noise rating levels. These values are a noise rating level of 20dB.

Table 9-7: NR20 Noise Rating Curve Comparison

Receptor	Actual Noise Rating Curve (dB)	Target Noise Rating Curve (dB)	Pass / Fail
Receptor 1	11	20	Pass
Receptor 2	11	20	Pass
Receptor 3	10	20	Pass
Receptor 4	15	20	Pass
Receptor 5	14	20	Pass
Receptor 6	13	20	Pass

9.12 The noise rating levels at all receptors are below the target NR20 noise rating levels. Therefore, the impacts are deemed to be **acceptable**.

10. SUMMARY

10.1 This Noise Impact Assessment has been undertaken for a Proposed Development consisting of the installation and operation of a proposed BESS and ancillary infrastructure on lands northwest of Wellbank, Angus.

10.2 The objectives of the assessment were to identify and describe any likely significant noise effects on key receptors during the operational phase of the Proposed Development.

10.3 In order to assess the potential noise impacts of the Proposed Development, the current baseline characteristics of the Application Site and the surrounding area have been identified as well as the predicted impacts of the Proposed Development and the cumulative impacts with the solar farm to the south.

10.4 A total of six noise sensitive receptors were included in the assessment within a Study Area of 500m of the noise generating area of the Application Site. All of the identified receptors are residential dwellings.

10.5 An unattended noise was undertaken within the Application Site between the 15th and 19th October 2019 at two locations. These locations were chosen as they are representative of the nearest noise sensitive receptors and are far enough away from The Latch that passing vehicles at the property did not interfere with the baseline measurements.

10.6 The method set out in Figure 4 of BS4142 was adopted for this assessment which uses a histogram to determine the most commonly occurring background noise ($L_{A90,t}$) value within the data set. The most common background noise for the day-time period was the same as the average and therefore was used in this assessment as a worst case. The average for the night-time period was lower than the most common background noise and therefore it was used in this assessment as a worst case.

10.7 A simulation of noise associated with the Proposed Development was produced using SoundPlan modelling software to predict noise levels for the purpose of undertaking an ISO9613-2 assessment. Source noise levels were modelled based on a candidate noise source.

10.8 An assessment of the acoustic impact of the Proposed Development was undertaken in accordance with BS4142. The results for the day-time period showed only **Low impacts** at all receptors. The results for the night-time period showed **High impacts** at one receptor and **Low impacts** at all remaining receptors within the Study Area.

10.9 A 3m high acoustic grade fence has been proposed along the southern and eastern boundaries of the Battery Storage units. With this mitigation in place, the **High** noise levels reduce to **Low** and all impacts are **Low** or **Negligible**.

10.10 When the cumulative impact was included, the results showed **Low impacts** at all receptors for both the day-time and night-time periods.

10.11 In addition to this, the levels at each receptor are below the Night Noise Guideline value of 40dB set out in the WHO Night-time Guidelines. This is the level recommended for the primary prevention of subclinical adverse health effects related to night noise in the population.

10.12 An impact assessment was then conducted comparing the predicted effects of the operational stage of the development against Noise Rating curves for the internal noise. The noise levels at all receptors are below the target NR30 and NR20 Noise Rating Curves.

10.13 Internally, the predicted noise rating meets the required limits at all noise sensitive receptors.

11. APPENDICES

APPENDIX A: FIGURES

- Figure 1: Development Layout
- Figure 2: Noise Assessment Map
- Figure 3: Noise Assessment Map with Mitigation
- Figure 4: Cumulative Noise Assessment Map with Mitigation