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Noise Impact Assessment For Solar Array and Battery Energy Storage System (BESS) Development

at

Land to the West of Main Road
Kelham
Newark

For

Sirius Planning

Report No.: R23.0603/DRK
Date: 10th October 2023

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[redacted]

Date: 10th October 2023

Summary

1. Assured Asset Solar 2 Ltd is proposing to construct and operate a Solar photovoltaic (PV) farm installation with a Battery Energy Storage System ("BESS") at on land north of Main Road, Kelham, Newark.

2. At the request of Sirius Planning, Noise & Vibration Consultants Ltd ("NVC") were commissioned to undertake a noise assessment to assess the impact and advise (where appropriate) on noise mitigation measures to meet planning guidance and noise standards.

3. Following a study of the local area the nearest sensitive receptors ("NSRs") were determined.

4. Baseline sound monitoring was carried out over a typical weekday and weekend period to determine the representative background and residual sound levels at NSRs.

5. Site operational noise has been calculated using empirical noise data for the battery storage, power conversion system ("PCS"), string inverters and transformers obtained from Technology Providers. The assessment has used ISO9613-2 prediction methodology and CadnaA noise modelling software for producing noise contours of the highest likely generated noise with all relevant plant operating.

6. An assessment of the resultant impacts has been undertaken by applying noise limits established from appropriate and relevant guidance and standards.

Conclusions

7. Following analysis of noise survey results our conclusions are as follows:

   (i) The results of baseline noise monitoring over a weekday and weekend monitoring period at three locations (in areas representing typical background sound levels) indicate that

modal (i.e. most common place value) or average background sound levels vary between 43dB to 50dB L_{A90} during the daytime, 31dB to 34dB L_{A90} during night-time and 38dB to 43dB L_{A90} during early morning sunrise periods between 0500 to 0700 hours.

(ii) Typical site operating noise levels have been established from empirical data obtained from Technology Providers taken from other sites in the UK to provide input data for the noise model.

(iii) The predicted rating noise level contribution from the application site using ISO9613-2 methodology and CadnaA noise modelling software shows noise levels at NSRs from the Site to range between 30dB and 37dB $L_{Aeq1hr/15mins}$ during maximum daytime or early morning sunrise site operations. During night-time periods prior to sunrise the predicted noise level would range between 26dB and 34dB $L_{Aeq15mins}$.

(iv) The results show that the noise contribution from maximum site rating noise levels would be below the representative background sound level during daytime and sunrise periods. According to BS4142: 2014+A1:2019 the resultant assessment would conclude that noise from the site would result in a **low impact**.

(v) The highest likely rating noise level during night-time periods (prior to sunrise) would result in a **low impact** according to BS4142:2014+A1:2019.

(vi) During night-time under maximum operational noise conditions, the noise level would be **well below** night-time recommended limits external to bedroom windows to meet sleep disturbance criteria of 40dB $L_{Aeq8hrs}$ and the internal design criteria according to BS8233: 2014 assuming an open bedroom window. Predicted levels within sensitive rooms with an open window would be between 11dB and 19dB $L_{Aeq,8hrs}$ (when allowing 15dB drop through open window in accordance with BS8233: 2014). This level is significantly lower than guidance limits provided within BS8233: 2014 for bedrooms of 30dB $L_{Aeq,8hrs}$.

(vii) The Local Authority are able to condition the site in terms of noise, to ensure noise levels and mitigation measures achieve a reasonable level of amenity in accordance with relevant guidance and standards.

(viii) Predictions of construction noise would indicate no significant impacts and `best practicable means' would be applied in accordance with BS5228-1:2009+A1:2014.

(ix) The temporary traffic movement would occur over the 6-month construction period. The number of HGVs delivering during the construction period would vary between 5 and 10 two-way movements per day, with the peak activities occurring during the first month. This would only amount on average to circa 1 HGV delivery per hour. As this is a temporary activity and there are no deliveries on Sundays, then any short-term impact would be limited, and the impact would be minor and **not significant**.

(x) Maximum levels of vibration during the construction phase (i.e. during the use of mini-piling rigs and vibratory plant) would be below perceptible levels of 0.3mm/sec at the closest approach and the impact would be **negligible** and a **neutral** level of effect and would therefore be **not significant**.

(xi) The impact on the closest ecological receptors would be **negligible and not significant**.

(xii) The cumulative effect of proposed development in the local area within the Local Authority planning portal would be **not significant** and negligible impacts at NSRs based on the noise impact assessments submitted for each application.

8. The assessment concludes that the site can be designed to operate such that it complies with all appropriate and relevant noise standards and guidance. There is, therefore, no reason to refuse the Proposed Development on the grounds of noise or vibration.

CONTENTS

1.0 INTRODUCTION

1.1 Assured Asset Solar 2 Ltd is proposing to construct and operate a Solar photovoltaic (PV) farm with a Battery Energy Storage System ("BESS") installation to the west of Main Street, Kelham, Newark.

1.2 At the request of Sirius Planning, Noise & Vibration Consultants Ltd (`NVC') were commissioned to undertake a noise assessment to assess the impact and advise (where appropriate) on noise mitigation measures to meet planning guidance and noise standards.

1.3 The study benefits from a baseline sound survey to determine typical background sound levels in the vicinity of nearest sensitive receptors to the proposed development. Monitoring was carried out over a weekday and weekend period (i.e. Friday to Monday) to determine representative background sound levels.

1.4 Following a study of the local area, the nearest sensitive receptors (NSRs) were determined.

1.5 Site operational noise has been calculated using empirical noise data for the transformers, Power conversion system (PCS), inverters and battery storage plant obtained from Technology Providers. The assessment has used ISO9613-2 prediction methodology and CadnaA noise modelling software for producing noise contours of the highest likely generated noise with all relevant plant operating.

Sources of Information

1.6 Information used in this assessment has been obtained from the following sources:

- Ordnance Survey maps of the local area;
- Information relating to the site layout was provided by Sirius;
- BS 7445: 2003 Description and measurement of environmental noise;
- BS4142: 2014+A1:2019 `Methods for rating and assessing industrial and commercial sound';
- Guidelines for Community Noise – World Health Organisation: April 1999;

- Night Noise Guidelines for Europe: 2009 – World Health Organisation
- BS8233: 2014 `Guidance on sound insulation and noise reduction for buildings';
- National Planning Policy Framework – September 2023;
- National Planning Practice Guidance – June 2021;
- Noise Policy Statement for England (NPSE) – March 2010: Department for Communities and Local Government;
- Design Manual for Roads and Bridges, LA 111 Noise and Vibration (Rev2) May 2020 (formerly HD 213/11);
- Newark & Sherwood District Council ("NSDC") `Amended Core Strategy DPD (adopted March 2019)' Policy DM5 `Design'; and
- Planning applications 22/00975/FULM, 22/00976/FULM, 22/01840/FULM & 23/00317/FULM.

Assessment Methodology

1.7 The aim of the survey was to provide information and advice on the following:

- provide information on typical operating noise levels from the transformers, PCS, inverters and battery storage plant;
- provide information on background and residual noise levels at the nearest sensitive receptors during the most sensitive periods of proposed operation; and
- advise on any operations that are shown to exceed appropriate and relevant noise criteria and where appropriate provide recommendations for further mitigation.

1.8 Appendix 1 provides details of technical terms within the report, for ease of reference. There is also a chart showing typical everyday noise levels to assist in understanding the subjective level of noise in terms of decibels.

1.9 The Solar Farm will produce renewable electricity obtained directly from the sun using photovoltaic technology.

1.10 The development would basically consist of the following components:

- Photovoltaic panels and associated supporting frames and ground mounting;
- Solar panel inverters and transformers;
- PCS (battery inverters and transformers);
- Battery Energy Storage System (`BESS') containers,
- Cabling linking battery containers and inverter and transformer stations;
- Perimeter fencing and CCTV (invisible infra-red illumination at night, only pointing into the site);
- DNO Sub-stations;
- Maintenance Cabin;
- Customer Cabin;
- Internal service roads;
- Scheme of landscaping; and
- Temporary Compound & set down area.

2.0 SITE DESCRIPTION

2.1 Location

2.1.1 The location of the Proposed Development is illustrated on Figure 1. The Site comprises an area of approximately 71 hectares of flat agricultural fields.

2.1.2 The site is set within a largely rural context, with the immediate surrounding area consisting of mainly agricultural land.

2.1.3 To the south of the site is Main Road (A617) which connects the village of Kelham with Newark-on-Trent. The village of Averham is to the south of Main Road where there are residential properties in proximity to the road and at a greater distance.

2.1.4 The village of Kelham is located east of the Proposed Development which includes Kelham House Hall.

2.1.5 Broadgate Lane is located northeast of the Site, which includes a number of residential properties, where the operational access to the development is located.

2.2 Site Operation Noise Sources

2.2.1 In terms of noise generated by this type of development, the assessment has considered the following noise sources:

- Noise from the operation of the solar transformers and inverters.
- Noise from the operation of the battery storage plant.

2.3 Site Operation Hours

2.3.1 Solar Farms are an inherently quiet installation due to the fact that there are no moving parts. The associated plant to convert the DC current to AC at the correct voltage involves the use of inverters and transformers.

2.3.2 Transformers are not particularly noisy plant and generate a low level `hum' at relatively close distances driven by the mains frequency. By its nature the Solar Farm is only operational during daylight hours, however during peak generation during the summer months (i.e. under conditions of high temperatures) there may be occasional periods when the operation of the inverters and transformers

occurs just after sun rise (i.e. around 0500 hours), but this would not be at full capacity and noise levels would be reduced compared with the daytime under sunny conditions.

2.3.3 The battery storage plant would be available for operation 24hrs/day and would provide energy when required.

2.4 Nearest Receptors

Residential Receptors

2.4.1 Based on distance relative to the Proposed Development, the existing NSRs at the closest approach are generally located around the Site towards the south of Main Road off Staythorpe Road (R1), east off Main Road (R2) and northeast off Broadgate Lane (R3).

2.4.2 There are other receptors located at greater distance than the above in similar directions and further to the west, which are shown on the noise map. As the impact would be lower (due to increased separation distance) these receptors are not specifically included in the assessment. The nearest sensitive receptor positions are indicated on Figure 1 together with the application site position.

2.4.3 We are not aware of any future receptors proposed within existing planning developments that are closer than those considered in this assessment.

2.4.4 Figure 1 attached shows the location of the NSRs and Figure 2 the layout of the Site.

2.4.5 The Ecological Appraisal identifies both statutory and non- statutory designated sites. There are no statutory designated sites within 5km of the application site, but there are 5 non statutory sites within 1km. The nearest is Kelham Hills Local Wildlife Site (LWS) which is designated for its woodland habitat and is located c. 160m from the application site. Kelham Hall Shingle Bank LWS is located 410m from the application and is designated for bird nesting opportunities. Other LWSs are over 600m from the site boundary.

3.0 NOISE POLICY, STANDARDS AND CRITERIA

3.1 Introduction

3.1 Noise has been defined as sound that is unwanted by the recipient. The effects of noise on the neighbourhood are varied and complicated, including such things as interference with speech communication, disturbance of work, leisure or sleep. A further complicating factor is that in any one neighbourhood some individuals will be more sensitive to noise than others.

3.2 General Planning Guidance

Local Policy

Newark & Sherwood District Council `Amended Core Strategy DPD (adopted March 2019)' Policy DM5 `Design'

3.2.1 As advised by NSDC "*Policy DM5 of the DPD states that development proposals should ensure no unacceptable reduction in amenity including overbearing impacts and loss of privacy upon neighbouring development"*.

National Planning Policy Framework – September 2023 (NPPF)

3.2.2 Chapter 15 of the National Planning Policy Framework (NPPF) relates to 'Conserving and enhancing the natural environment'.

3.2.3 Paragraph 174 e) refers directly to noise and states that: *"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;"*

3.2.4 Paragraph 185 also states: *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and*

the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and
c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

3.2.5 The Noise Policy Statement for England (NPSE) was published in March 2010. It specifies the following long-term vision in policy aims:

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

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life."*

3.2.6 The NPSE introduced three concepts to the assessment of noise, which includes:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable 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.

3.2.7 The above categories are however, undefined in terms of noise levels and for the SOAEL the NPSE indicates that the noise level will vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research is therefore required to establish what may represent an SOAEL. It is acknowledged in the NPSE that not stating specific SOAEL levels provides policy flexibility until there is further evidence and guidance.

3.2.8 The NPSE indicates how the LOAEL and SOAEL relate to the three aims listed above. The first aim of NPSE requires that:

"significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development."

3.2.9 The second aim of the NPSE (mitigating and minimising adverse impacts on health and quality of life) refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.

3.2.10 The third aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

Planning Practice Guidance – June 2021

3.2.11 In October 2014, the Ministry of Housing, Communities & Local Government updated the Planning Practice Guidance ("PPG") on noise associated with Minerals, which provides guidance on the planning process. The main section of PPG was also updated in July 2019 and consultation and pre-decision matters updated in June 2021.

3.2.12 The PPG refers to the NPSE documents and under the heading 'How can noise impacts be determined?' it states:
"Plan-making and decision taking need to take account of the acoustic environment and in doing so consider:

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

3.2.13 At paragraph 004 the PPG includes a table summarising the noise exposure hierarchy, based on the likely response. Under the heading of 'example of outcome' the '*present and not intrusive*' assessment of noise is defined as '*noise can be heard, but does not cause any change in behaviour, attitude or physiological response. Can slight affect the acoustic character of the area but not such that there is a change in the quality of life*'. The increasing effect level under these conditions is deemed to be '*no observed adverse effect*' and '*no specific measures are required'.*

3.2.14 The PPG explains this by stating:

"At the lowest extreme, when noise is not perceived to be present, there is by definition no effect. As the noise exposure increases, it will cross the 'no observed effect' level. However, the noise has no adverse effect so long as the exposure does not cause any change in behaviour, attitude or other physiological responses of those affected by it. The noise may slightly affect the acoustic character of an area but not to the extent there is a change in quality of life. If the noise exposure is at this level no specific measures are required to manage the acoustic environment.

As the exposure increases further, it crosses the 'lowest observed adverse effect' level boundary above which the noise starts to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard. The noise therefore starts to have an adverse effect and consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise).

Increasing noise exposure will at some point cause the 'significant observed adverse effect' level boundary to be crossed. Above this level the noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is predicted to be above this level the planning process should be used to avoid this effect occurring, for example through the choice of sites at the plan-

making stage, or by use of appropriate mitigation such as by altering the design and layout. While such decisions must be made taking account of the economic and social benefit of the activity causing or affected by the noise, it is undesirable for such exposure to be caused.

At the highest extreme, noise exposure would cause extensive and sustained adverse changes in behaviour and / or health without an ability to mitigate the effect of the noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be avoided."

3.2.15 The PPG includes a table summarising the noise exposure hierarchy, based on the likely average response. Table 3.1 below provides the perception, example of outcome, effect and action required relative to noise.

Table 3.1: Noise Exposure Hierarchy

Response	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect (NOEL)	No Specific Measures Required
Present and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect (NOAEL)	No Specific Measures Required
Lowest Observed Adverse Effect Level (LOAEL)			
Present and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Present and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid

Response	Examples of Outcomes	Increasing Effect Level	Action
Present and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/ awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Observed Adverse Effect	Prevent

BS4142: 2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

3.2.15 BS4142: 2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' is based on the measurement of background sound using L_{A90} noise measurements, compared to source noise levels measured in L_{Aeq} units. Once any corrections have been applied for source noise tonality, distinct impulses etc., the difference between these two measurements (i.e. known as the 'rating' level) determines the impact magnitude.

- Typically, the greater the difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact (although this can be dependent on the context).
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is, relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact (although this can be dependent on the context).

3.2.16 In order to establish the rating level, corrections for the noise character need to be taken into consideration. The Standard states that when considering the perceptibility:

"Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention."

3.2.17 The subjective method adopted includes the following character corrections:

Table 3.2: BS4142:2014+A1:2019 Character Corrections

Level of Perceptibility	Correction for Tonal Character dB	Correction for Impulsivity dB	Correction for Intermittency dB	Correction for other character dB
Not Perceptible	0	0	0	0
Just perceptible	+2	+3	0	0
Clearly perceptible	+4	+6	+3*	+3*
Highly perceptible	+6	+9	+3*	+3*

*Standard defines this should be readily distinctive against the residual acoustic environment, it is interpreted therefore to be either clearly or highly perceptible as a character. If characteristics likely to affect perception and response are present in the specific sound, within the same reference period, then the applicable corrections ought normally to be added arithmetically. However, if any single feature is dominant to the exclusion of the others, then it might be appropriate to apply a reduced or even zero correction for the minor characteristics.

3.2.18 The assessment of noise from the fixed plant at the NSR is considered and our expert opinion is provided below:

a) In terms of tonality, given the separation distance from fixed plant, predicted noise levels, residual sound levels and proposed mitigation measures any tonal noise from transformers and PCS systems are unlikely to be perceptible at the NSR. Empirical measurements of similar plant on other sites in the UK indicate no tonal character at a distance of circa 50m from the BESS compound or transformers and we would therefore not apply a correction. Refer to Appendix 6 for further frequency spectrum.

b) In terms of impulsivity this is unlikely to be a characteristic of solar farms, battery storage and transformers installations and is therefore not deemed to be applicable.

c) In terms of intermittency the solar plant would tend to work for reasonable long periods of time once demand requires use of its power and by its nature it does not tend to operate intermittently. The battery storage plant would operate for short periods but continuously. The intermittency is therefore highly unlikely to be distinctive.

3.2.19 In conclusion, in view of the noise contribution from the site, residual sound levels and design approach to provide suitable mitigation measures, we would advise that a noise character penalty is not appropriate to add to the calculated noise contribution from the fixed plant.

BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

3.2.20 The British Standard BS8233 provides additional guidance on noise levels within buildings. These are based on the WHO recommendations and the criteria given in BS8233 for unoccupied spaces within residential properties.

3.2.21 The guidance provided in section 7.7 of BS8233 provides recommended internal ambient noise levels for resting, dining and sleeping within residential dwellings. Table 3.3 provides detail of the levels given in the standard.

Table 3.3: BS8233: 2014 Indoor ambient noise levels for dwellings

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

3.2.22 For a partially open window the standard refers to a reduction of approximately 15dB (Ref. Annex G: G.1). This would therefore indicate a noise level outside the window of approximately 50dB $L_{Aeq,16hours}$ for living rooms during daytime and 45dB $L_{Aeq,8\ hours}$ during night-time outside bedrooms.

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

3.2.23 This document provides further updated information on noise and its effects on the community. The document for noise `*In Dwellings'* states "*The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events. Lower noise levels may be disturbing depending upon the nature of the noise source."*

3.2.24 The WHO document also states "*To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq}. To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of*

people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development."

3.2.25 In 2009, the WHO published: 'Night Noise Guidelines for Europe', which it describes as an extension to the WHO 'Guidelines for Community Noise' (1999). It concludes that: *"Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive (2002/48/EC), an $L_{night,outside}$ of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. $L_{night,outside}$ value of 55dB is recommended as an interim target for those countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach."*

3.3 Survey Techniques

3.3.1 The background sound survey monitoring has been carried out in accordance with appropriate measurement conditions as defined in BS4142: 2014+A1:2019.

3.4 Guidance on Construction Noise

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

3.4.1 BS 5228 refers to *"the need for the protection against noise and vibration of persons living and working in the vicinity of, and those working on, construction and open sites. It recommends procedures for noise and vibration control in respect of construction operations and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners."*

3.4.2 Part 1 deals with noise in terms of background legislation and gives recommendations for basic methods of noise control relating to construction and open sites where significant noise levels may be generated. The guidance is aimed at giving advice on achieving `best practice' in controlling noise and

vibration from construction and open sites. There is an example of noise limits given in Annex E, which sets out cut-off limits between 65dB(A) and 75dB(A) or 5dB(A) above the ambient noise, whichever is the greater. Part 2 of BS 5228 deals specifically with vibration control and provides the legislative background to the control of vibration and recommendations for controlling vibration at source and management controls (e.g. liaison with communities, supervision, preparation and choice of plant etc.)

Construction Phase Road Traffic Impacts

3.4.3 Section 5.0 of this report includes an assessment of road traffic impacts relating to the construction phase of the Proposed Development on existing receptors.

3.4.4 According the DMRB LA 111 guidelines, the magnitude of impact at noise sensitive receptors of construction traffic shall be determined in accordance with Table 3.4.

Table 3.4: Magnitude of impact at receptors

Magnitude of impact	Increase in basic noise level of closest public road used for construction traffic (dB)
Negligible	Less than 1.0
Minor (Slight)	Greater than or equal to 1.0 and less than 3.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Major	Greater than or equal to 5.0

Note: Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

1) 10 or more days or nights in any 15 consecutive days or nights;
2) a total number of days exceeding 40 in any 6 consecutive months.

Construction Phase – Vibration Impacts

3.4.5 For construction phase vibration, the LOAEL and SOAEL for construction vibration is set out in DMRB LA 111 and is provided in Table 3.5 below. (Appendix 4 provides an explanation of technical terms associated with the vibration assessment).

Table 3.5: Construction vibration LOAELs and SOAELs for all receptors

Time Period	LOAEL	SOAEL
All time periods	0.3mm/sec PPV	1.0mm PPV

3.4.6 The magnitude of impact for construction vibration, shall be determined in accordance with Table 3.6 (as defined in DMRB LA 111).

Table 3.6: Magnitude of impact at receptors

Magnitude of impact	Vibration Level
Negligible	Below LOAEL
Minor (Slight)	Above or equal to LOAEL and below SOAEL
Moderate	Above or equal to SOAEL and below 10mm/s PPV
Major	Above or equal to 10mm/s PPV

Note: Construction vibration shall constitute a likely significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:
1) 10 or more days or nights in any 15 consecutive days or nights; or
2) a total number of days exceeding 40 in any 6 consecutive months.

3.5 Relevant Noise Criteria

3.5.1 The relevant guidance would be BS4142:2014+A1:2019. This is appropriate to apply in general terms to any plant operational noise generated by the Site. To achieve a **low** impact the site rating level would not exceed the established representative background sound level. Where rating levels exceed background sound levels by around 5dB(A) then this would indicate an **adverse impact**. In the situation where the background sound levels and rating levels are low (i.e. around 30dB(A)) then the Standard states:

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

3.5.2 Sleep disturbance criteria is set out in WHO `Night Noise Guidelines for Europe' 2009, which it describes as an extension to the WHO 'Guidelines for Community Noise' (1999) and a level of 40dB $L_{Aeq,8hrs}$ and BS8233:2014 for guidance inside a bedroom of 30dB $L_{Aeq,8hrs}$, which accords with an external level of circa 45dB with an open window (i.e. 15dB reduction through open window according to BS8233:2014).

3.5.3 Following formal consultation with Newark & Sherwood District Council via a Pre-application enquiry, the advice includes the following comments:

"Policy DM5 of the DPD states that development proposals should ensure no unacceptable reduction in amenity including overbearing impacts and loss of privacy upon neighbouring development. The NPPF seeks to secure high quality design and a good standard of amenity for all existing and future occupants of land and buildings.

The nearest residential properties are Kelham House and those forming 'The Rutlands' to the east and those located along Broadgate Lane to the northeast.

Full consideration needs to be given to all surrounding residential dwellings regarding potential noise disturbance through the construction and operation of this proposal and any other impacts on residential amenity. However, I consider it possible that a scheme which results in no adverse impact upon residential amenity could be developed on the site."

4.0 BASELINE SURVEY METHODOLOGY & RESULTS

4.1 Baseline Sound Monitoring (See Appendix 2 & Figure 1)

Instrumentation and Fieldwork Details

4.1.1 A detailed environmental baseline sound survey was carried out in the vicinity of the NSRs to determine details of the noise climate.

4.1.2 The three monitoring positions for establishing typical background sound levels are provided in Figure 1. The noise monitoring positions are representative of NSRs adjacent to the Proposed Development and provide broadband data of the existing sound climate at these receptors. Details of the instrumentation used for the survey are detailed below.

4.1.3 The existing baseline sound survey was undertaken over a weekday and weekend period, which was set up on Friday 3rd until Monday 6th February 2023 at three fixed locations in proximity to NSRs to the Site and is therefore considered to provide representative baseline sound levels.

4.1.4 The existing background sound survey was carried out in accordance with the advice given in BS4142: 2014+A1:2019.

4.1.5 The monitoring positions were as follows:

Position A (South of Site) Rectory Farm off Main Road

4.1.6 Monitoring position A is representative of the nearest receptors located south of the Site circa 50m from Main Road. Noise levels at this location are generally affected by intermittent local road traffic noise. The monitoring position was chosen in the field northwest of Rectory Farm. Refer to Figure 1 for location.

Position B (Southeast of Site) – Kelham House Hall

4.1.7 Position B was chosen as a suitable monitoring position to represent typical baseline levels in the vicinity of Kelham House Country Manor. Noise levels at this location are formed in general by distant road traffic noise and birdsong. The monitoring position was in the field adjacent to the Manor. Figure 1 shows the location.

Position C (Northeast of Site) – Broadgate Lane

4.1.8 This monitoring position is representative of the closest existing receptors northeast of the overall Site in proximity to Broadgate Lane in the garden of one of the properties closest to the Site boundary. Noise levels at this location are generally formed by intermittent local road traffic noise and birdsong. Figure 1 shows the location.

4.1.9 In consideration of the cross section of monitoring positions and locations in proximity to NSRs and the baseline survey includes a weekend monitoring period, it is considered that the results represent a robust indication of existing background sound levels.

4.1.11 The main source of existing sound affecting nearest receptor properties relates to local and distant road traffic noise and bird sound.

4.1.12 For noise measurements at the nearest sensitive receptor positions the following noise meters were used:

Table 4.1: Instrumentation

Manufacturer	***Description***	***Type***	***Calibration Due Date***	***Serial No.***
Cirrus	Real Time Sound Analyser	171A	June 2023	G061253
Cirrus	Real Time Sound Analyser	1710	April 2023	G063350
Cirrus	Real Time Sound Analyser	171B	April 2023	G056142
Cirrus	Electronic Calibrator	CR: 513A	April 2023	031523

4.1.13 The following set-up parameters were used on the sound level meters during measurements:

Static Sound Monitoring:
Time Weighting: Fast
Frequency Weighting: `A'
Measurement Period: 15 minutes

Monitoring Period and Test Details

4.1.14 Measurements were recorded over a period of approximately 96 hours. Data logging of L_{Aeq}, L_{A10}, L_{A90} and L_{Amax} were recorded at 15-minute contiguous intervals for information on the variation of sound levels (see Appendix 2 for details).

4.1.15 The noise meters were mounted on a tripod at a height of between 1.2 to 1.5 metres above ground level and fitted with a wind and rain shield.

Calibration

Calibration setting: 94dB

4.1.16 The noise meters were calibrated with the electronic calibrator prior to commencement and on completion of the survey. No significant drift in calibration was observed.

Survey Dates and Personnel

4.1.17 Static sound measurement positions (shown on Figure 1) were chosen to establish typical and representative background and ambient sound data in vicinity of NSRs (see Appendix 2 for detailed information). Consultants of NVC set up the sound monitoring on the Friday 3rd February and removed the equipment on Monday 6th February 2023.

Meteorological Conditions

4.1.18 Weather details have been established from the use of a portable Davis Vantage Vue weather station, which was set up by the NVC consultant for the duration of the survey and the recorded data is detailed in Appendix 2.

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4.1.19 The above climatic conditions were suitable for monitoring environmental noise levels in accordance with advice given in BS4142:2014+A1:2019.

4.2 Results

Background Sound

4.2.1 Background sound measurements taken adjacent to the nearest residential sensitive receptors.

4.2.2 The results of measurements taken at the fixed monitoring positions at site are presented in Tables 4.2 and 4.3 with detailed measurements in Appendix 2.

Table 4.2: Average Sound Levels during Daytime Periods

Position	Time Period	Grid Ref. X Y	LAeq dB	LA10 dB	LA90 dB	Representative LA90 Db	LAmax dB
A. Rectory Farm (south of Site)	0700-2300	476741 354759	57	59	51	50	58-85
B. Kelham House Hall (south-east of Site)	0700-2300	476905 355480	54	56	50	48	53-78
C. Broadgate Lane (north-east of Site)	0700-2300	477107 355770	51	52	45	43	46-78

[1]Representative taken as most commonplace or average. whichever is the lower.

Table 4.3: Average Sound Levels during Night-time Periods

Position	Time Period	Grid Ref. X Y	LAeq dB	LA10 dB	LA90 dB	Representative LA90 dB	LAmax dB
A. Rectory Farm (south of Site)	2300-0700 0430-0700	476741 354759	51 54	44 58	42 47	34 43	56-69 60-69
B. Kelham House Hall (south-east of Site)	2300-0700 0430-0700	476905 355480	49 53	52 56	42 47	31 39	46-65 53-64
C. Broadgate Lane (north-east of Site)	2300-0700 0430-0700	477107 355770	45 48	49 51	38 43	31 38	39-67 44-67

[1]Representative taken as most commonplace or average, whichever is the lower.

4.2.3 The methodology detailed in the latest version of BS4142: 2014+A1:2019 provides an example of statistical analysis to determine the background sound level (i.e. most common place). Further detail of the measured background sound levels and analysis of representative background sound levels is provided in Appendix 2.

4.2.4 The above table shows the most common place or average value (whichever is lowest) for determining background sound levels. The results show that between 0700-2300 hours at the monitoring positions, the representative LA90 level is 43dB to 50dB. During night-time periods the representative background level was shown to be between 31dB to 34dB LA90 and during sunrise periods (between 0500 to 0700 hours) a level of 38dB to 43dB LA90.

4.3 Source Noise Levels

4.3.1 Refer to section 6.0 for details of noise levels for the transformers, inverters and battery storage units assumed for the noise prediction calculations.

5.0 CONSTRUCTION NOISE

5.1 Introduction

5.1.1 Typical planning consent conditions relating to construction noise will be based on the application of `best practicable means' in accordance with BS5228-1:2009+A1:2014 and restriction on operating hours.

5.2 Construction Activities

5.2.1 Initial site preparation works is likely to involve the movement of soil, mini piling works, construction of infrastructure and installation of plant and PV equipment. It is considered that excavators, mini-piling rigs, JCB's, vehicles, dumpers, generators, compressors, concrete mixers and power tools etc. would be required to construct the site.

5.2.2 The above noise sources and their associated activities will vary from day to day and may be in use at different stages of the development for relatively short durations.

5.3 Construction Noise Prediction

5.3.1 Below the assessment indicates the expected highest noise levels at the nearest receptors based on vehicle movements, mini-rig piling works, general site activities and PV installation at the closest approach to existing residential areas.

5.3.2 The calculations use the methodology given in BS 5228: Part 1, 2009. For this method the sound power level of the noise source is defined, and the attenuation is calculated between its location and the selected receiver, taking account of distance, ground attenuation and the time that a noise source will be operating.

5.3.3 The results of calculations for vehicle movement, infrastructure, PV installation and general site activities are shown below in Table 5.1.

Table 5.1: Noise Predictions for Worst Case Construction Noise

Position (Refer to Figure 1)	Distance to receptor (m)	Works	Residual Noise Levels LAeq dB	Noise Level Range at receptor, $LAeq_{1hr}$ dB	BS5228 Threshold Value LAeq dB Daytime
R1. Staythorpe Road (south of Site)	145-450	Piling (mini rig)	57	38-50	65
	130-450	Site Preparation	57	38-53	65
	200-450	General site activities	57	44-51	65
	130-450	Infrastructure	57	35-57	65
	145-450	PV Installation	57	44-55	65
R2. Off Main Road (east of Site)	90-500	Piling (mini rig)	54	37-55	65
	70-500	Site Preparation	54	37-60	65
	200-500	General site activities	54	43-51	65
	70-500	Infrastructure	54	34-63	65
	90-500	PV installation	54	43-61	65
R3. Off Broadgate Lane (northeast of Site)	65-650	Piling (mini rig)	51	35-59	65
	50-650	Site Preparation	51	35-64	65
	120-650	General site activities	51	40-57	65
	250-650	Infrastructure	51	32-50	65
	65-650	PV Installation	51	41-64	65

5.3.4 The noise of activities during the construction of the site would vary throughout the day and would depend on the particular work being undertaken. The highest noise levels are likely to be created during site preparation, infrastructure activities and the PV installation. This would be within the level of noise normally found to be acceptable for an activity of this type and duration. Noise mitigation measures are proposed applying best practical means.

5.3.5 In accordance with BS5228, best practical means would be employed to control the noise generation.

5.3.6 The basis of the above predictions the level of noise, as a result of construction, is not predicted to be significant although some short-term periods could exceed the guidance threshold level.

5.3.7 The application of applying best practicable means in accordance with BS5228-1:2009+A1:2014 will assist in minimising impact from construction noise. A Construction Environmental Management Plan (CEMP) would be provided to the LPA prior to commencement of works for agreement.

5.3.8 Construction hours for noise generating activity proposed are as follows:
Monday to Friday: 0800 to 1800 hours.
Saturday: 0800 to 1600 hours
Sundays: No deliveries

Under exceptional circumstances both working and deliveries outside of these hours may be required.

Mitigation Measures

5.3.9 In accordance with BS5228-1:2009+A1:2014, best practical means (BPM) would be employed to control the noise generation (e.g. using equipment that is regularly maintained, where practicable use equipment fitted with silencers or acoustic hoods).

5.3.10 In consideration of the likely highest levels of construction noise, the following approach would be considered as part of any CEMP:

- Restriction of construction hours to non-sensitive times of day would normally form part of the planning consent conditions.
- Careful choice of piling rigs to minimise noise and vibration (e.g. non-percussive mini piling rigs).
- Avoid un-necessary plant operation and revving of plant or vehicles.
- Where practicable locate plant away from nearest sensitive receptors or in locations which provide good screening in the direction of sensitive receptors.
- Use of broadband noise reverse alarms (where practicable) on mobile plant (i.e. avoid tonal `beeper' type reversing alarms).
- During periods when the plant is operating within circa 50m of a residential property boundary the introduction of site boundary hoarding screens could be introduced (where practicable) to reduce noise levels in the direction of NSRs. This could be formed by solid screen hoarding at site boundary or close to the noise source to an appropriate height.
- Plant will be serviced regularly to minimise adverse noise impacts.
- All vehicles and mechanical plant used for the purpose of the works will be fitted with effective exhaust silencers and where practicable acoustic enclosures/hoodsand maintained in good efficient working order.
- Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum.
- Materials will be handled with care and be placed (e.g. not dropped into skips or lorries or dropped onto metal surfaces).

- Any ancillary plant if required, such as generators, compressors and pumps will be positioned so as to cause minimum noise disturbance, i.e. furthest from receptors or behind close boarded noise barriers. If necessary, acoustic enclosures and /or shielding will be provided.
- Implementation of site rules related to considerate construction practices.
- Consider using a one-way system/turning circle and/or use of a banksman to avoid/reduce the need for reverse alarms.
- Battery operated tools would be used rather than compressed air tools, wherever practicable.

Community Liaison

Community Relations – this is one of the most important aspects of mitigation as providing the local residents with clear information of the activities that would be taking place and the length of time that any peak noise levels may occur will assist in allaying people's fears. BS5228 states *"It is suggested that good relations can be developed by keeping people informed of progress and by treating complaints fairly and expeditiously. The person, company or organisation carrying out the work on site should appoint a responsible person to liaise with the public.*

5.3.11 The implementation of appropriate mitigation measures based on `Best Practical Means' (BPM) would enable peak construction noise to be controlled to reasonable levels in accordance with BS5228.

Construction Road Traffic Noise onto Local Road

5.3.12 The construction of the proposed solar farm and BESS is expected to last around 6 to 12 months, however, the majority of vehicle movements will be carried within the first six months. The remaining 6 months will be commissioning, and 'snagging' works which typically do not generate HVG movements. During this period, there will be journeys associated with the arrival and departure of site staff and the delivery of equipment and construction materials.

5.3.13 Assuming first 6-month construction period and a 6-day working week (156 days total) on average this equates to approximately 5 deliveries a day. The majority of deliveries will be made during the beginning of construction works as site

preparation works are carried out, and towards the end when the electrical infrastructure and equipment is delivered. During the peak periods, the number of HGVs would increase to circa 9-10 two-way movements per day (i.e. approximately 1 two-way movement per hour).

5.3.14 The site is currently accessed from Main Road (A617) to the southeast, via an existing agricultural access. The proposal site will utilise this existing access point, opposite the access road to Rectory Farm. The proposed access off A617 will be used during the construction phase of the solar farm and BESS.

5.3.15 An estimated 50 staff will be on site during the first 6 month construction period, depending on the phases of the construction schedule. It is envisaged that staff trips will be made by mini-buses and/or transit vans with a 'crew cab' with an expected minimum capacity of 6 persons. All vehicle parking will be provided within the temporary construction compound, there will be no parking on the public highway.

5.3.16 Once the site is operational, there will be no staff based on the site. However, monthly routine checks will be required, this will be carried out via LGVs or pick-ups.

5.3.17 The effect of construction traffic onto the A617 Main Road has been assessed and Table 5.2 provides the results of noise predictions in accordance with the DMRB LA 111 guidance.

Table 5.2: Predicted Road Traffic Noise Increase at Existing Residential Properties During Peak Traffic Flow Period for the Construction Phase

Receptor Road	Time Period	Baseline noise (`do nothing') $LA10_{,T}$ (dB)	Baseline + Construction noise (`do something') $LA10_{,T}$ (dB)	Change[1] compared to baseline $LA10_{,T}$ (dB)
Main Road (A617)	0800-1800hrs (weekday)	67.7	67.8	+0.1
	0800-1600 (Saturday)	66.7	66.9	+0.2

Note: Distance from kerbside to dwelling is assumed to be 10m.

5.3.18 The impact due to the Proposed Development during peak vehicle movement during the construction phase along Main Road (A617) has been calculated using Calculation of Road Traffic Noise (CRTN) methodology and impact methodology using DMRB LA 111.

5.3.19 According to Table 3.4 the DMRB LA 111, impact assessment for existing residential receptors is shown to be a **negligible** impact and **neutral** effect and therefore **not significant**.

Construction Vibration Levels

5.3.20 The separation distance between the nearest site solar array panels and NSRs is circa 65m to 145m and the levels of vibration from mini-piling rigs or compaction works would be <0.3mm/sec at the closest approach of 65m, which is below the level of perceptibility. According to Table 3.5 and 3.6, the highest impact would be **negligible** and a **neutral** level of effect and is therefore **not significant**.

6.0 PLANT NOISE LEVEL PREDICTIONS

6.1 Introduction

6.1.1 Noise has been defined as sound, which is undesired by the recipient. The effects of noise on the neighbourhood are varied and complicated, including such things as interference with speech communication, disturbance of work, leisure or sleep. A further complicating factor is that in any one neighbourhood some individuals will be more sensitive to noise than others.

6.1.2 A measure that is in general use and is recommended internationally for the description of environmental noise is the equivalent continuous noise level or L_{Aeq} parameter.

6.1.3 In general, the level of noise in the local environs that arises from a development site will depend on a number of factors. The more significant of which are:-

(a) The sound power levels (SWL's) of the plant or equipment used on site.
(b) The periods of operation of the plant on site.
(c) The distance between the source noise and the receiving position.
(d) The presence or absence of screening effects due to barriers, or ground absorption.
(e) Any reflection effects due to the facades of buildings etc.

6.1.4 The empirical noise levels have been used for the plant equipment to assist in determining the likely noise contribution at nearest sensitive receptors for comparison with the requirements of BS4142: 2014+A1:2019 and BS8233:2014.

6.2 Prediction Methodology

Operational Noise

6.2.1 For site operational noise the assessment used ISO9613-2 prediction modelling and CadnaA software for producing a noise map of the highest likely generated noise during peak noise operations. The Input settings for the noise model include:

Ground factor (G) = 0.5 (mixed ground absorption)
Temperature = 10degC

Relative humidity = 70%

Receptor height = Assumed to be 1.5m above ground for daytime and 4m for night-time and sunrise periods.

6.2.2 The methodology takes into account source position and distance to the nearest sensitive receptors. The noise modelling assumes that during daytime and early morning periods all inverters, battery storage units, PCS and solar/auxiliary transformers are in operation and therefore the noise predictions provide an indication of the highest likely noise level. During night-time periods a worst-case scenario of battery storage units, PCS, battery and auxiliary transformers would be operating.

Source Noise Levels & Mitigation

6.2.3 The following example of mitigation measures is based on typical plant noise from similar sites in the UK. It is important to note that there is more than one method to control noise levels (e.g. plant selection, design or screening) that can achieve similar levels at NSRs.

a) Battery Transformer noise level of 72dB $L_{Aeq15mins}$ @ 1m sound pressure level.
b) PV Transformer designed to a noise level of 72dB $L_{Aeq15mins}$ @ 1m sound pressure level.
c) PV String Inverter designed to a noise level of <65dB $L_{Aeq15mins}$ @ 1m sound pressure level.
d) Battery Storage Containers 65dB $L_{Aeq15mins}$ @ 1m sound pressure level.
e) BESS PCS (inverters for batteries) 75dB $L_{Aeq15mins}$ @ 1m sound pressure level.
f) Substation transformer 55dB $L_{Aeq15mins}$ @ 10m sound pressure level.
g) The battery storage compound would incorporate a 3m high concrete fire wall around the plant compound and between plant units. Refer to Figure 3.
h) The sub-station compound would incorporate a 4m high acoustic screen around the east, south and west side of the compound as indicated in Figure 3. The minimum mass of the solid screen to be 15kg/m2.

6.2.4 The results of the CadnaA software prediction modelling noise contours for site operations are provided in Appendix 3.

6.3 Results of Noise Predictions

Site Plant Noise Assessment:

6.3.1 Noise levels from fixed plant operating at the development site during daytime and early morning sunrise periods would be assessed against BS4142: 2014+A1:2019. Refer to Appendix 3 noise map 1 and 2.

Noise Contribution Levels from the Proposed Solar Farm & BESS

Table 6.1: Predicted Noise from Proposed Solar Farm during Daytime (0700-2300 hrs) and Sunrise (0500-0700 hrs)

Receptor Position (Refer to Figure 1)	Period	Representative Background Sound Level L_{A90} dB [L_{Aeq}]	Predicted highest rating[1] noise level $L_{Aeq,T}$ (dB)	Level Difference dB(A)*	Impact Magnitude BS4142
Daytime					
R1. Staythorpe Road (south of Site)	Daytime	50 [57]	34-35	-16 to 15	**Low**
R2. Off Main Road (east of Site)	Daytime	48 [54]	31-35	-17 to -13	**Low**
R3. Off Broadgate Lane (northeast of Site)	Daytime	43 [51]	30-32	-13 to -11	**Low**
Early Morning Sunrise					
R1. Staythorpe Road (south of Site)	Sunrise	43 [54]	35-37	-8 to -6	**Low**
R2. Off Main Road (east of Site)	Sunrise	39 [53]	33-37	-6 to -2	**Low**
R3. Off Broadgate Lane (northeast of Site)	Sunrise	38 [48]	33-34	-5 to -4	**Low**

*Note: Column 5 is the subtraction of column 4 from column 3.
[1] Noise characteristics at receptor locations do not include a penalty as this would be controlled by mitigation and design. The noise predictions assume the worst case i.e. the solar plant and battery storage plant are operating at same time (in theory the earliest operation of both sets of plant would be from or about 0500-0700 hours when the sun rises sufficiently)

6.3.2 Table 6.1 shows the range of predicted noise levels from the plant associated with the Solar Farm & BESS based on peak production during high ambient temperature conditions. Note: we have assumed maximum noise conditions after the sunrise periods, (which in reality would generally only occur during sunny periods after around 0700 hours).

6.3.3 The fifth column in Table 6.1 shows the difference between the predicted rating noise level and the baseline sound level at the NSR. The rating level in column 4 is therefore in accordance with the methodology found within BS 4142: 2014+A1:2019 for daytime impacts.

6.3.4 The results show that the noise contribution from maximum site operations with chosen mitigation measures would be below the representative background sound level during the daytime and sunrise hours. According to BS4142: 2014+A1:2019, the resultant assessment would conclude that noise from the Site would result in a **low impact** (see Table 6.2 below for more detailed assessment at receptor having highest impact in accordance with BS4142: 2014+A1:2019).

Table 6.2: BS4142 Assessment of mitigated noise at Receptor R2 (all plant running i.e. highest impact) at sunrise

Results		**Relevant**	**Commentary**
Calculated Specific sound level	$L_{Aeq(15mins)}$ = 37dB	7.3.6	Specific sound source calculated using ISO9613-2
Representative Background sound level	L_{A90} = 39dB	8.1.3 8.2	Measured over sunrise period (0500 to 0700) measured over weekday & weekend & representative of the background sound level.
Assessment during sunrise, reference time interval is 15mins		7.2	
Acoustic feature correction	0dB	9.2	No acoustic feature expected due to mitigation strategy and site noise contribution and residual sound levels.
Rating level	(37 + 0) dB = 37dB	9.2	No significant perceptible noise character predicted
Background sound level	L_{A90} = 39dB	8	Most common place or average (whichever is lowest) value determined using measured background level (0430-0700) providing a robust assessment of baseline.
Excess of rating over background sound level	(37− 39) dB = -2dB	11	
Assessment indicates Low Impact and the specific level would comply with sleep disturbance criteria.		11	
Uncertainty	Not significant	10	The residual levels are higher (53dB $LAeq_{15mins}$) and the uncertainty of the measurement does not have any significance to the outcome of the assessment. Appropriate standards used for the calculation. All instruments used Type 1, calibrated and in calibration limits for baseline.

Night-time Operations

6.3.5 For night-time periods, in order to ensure protection of residential amenity and sleep disturbance, the `rating' noise level from the operation of the Site should not exceed representative background. An external absolute limit of 40dB or lower would comply with internal bedroom guidance levels according to BS8233:2014 and WHO Guidelines (i.e. assuming a conservative reduction of 10dB for an open window).

6.3.6 Table 6.3 shows the results of the highest likely noise generation during the night-time period prior to sunrise. Refer to Appendix 3 noise map 3.

Table 6.3: Predicted Noise from BESS Operations During Night-time (2300-0500 hrs)

Receptor Position (Refer to Figure 1)	Period	Representative Background Sound Level LA90 dB [LAeq]	Predicted highest rating[1] noise level LAeq(dB)	Level Difference dB(A)*	Impact Magnitude BS4142
Daytime					
R1. Staythorpe Road (south of Site)	Night-time	34 [51]	34	0	**Low**
R2. Off Main Road (east of Site)	Night-time	31 [49]	26-29	-5 to -2	**Low**
R3. Off Broadgate Lane (northeast of Site)	Night-time	31 [45]	26	-5	**Low**

*****Note: Column 5 is the subtraction of column 4 from column 3.
[1] Noise characteristics at receptor locations do not include a penalty as this would be controlled by mitigation and design.

6.3.7 The results show that the noise contribution from maximum site operations with chosen mitigation measures would be at or below representative background during night-time hours. According to BS4142: 2014+A1:2019, the resultant assessment would conclude that noise from the Site would result in a **low impact**, which is not significant. (see Table 6.3 below for more detailed assessment at receptor having highest impact in accordance with BS4142: 2014+A1:2019).

Table 6.3: BS4142 Assessment of mitigated noise at Receptor R1 (BESS plant running i.e. highest impact) at night-time

Results		Relevant	Commentary
Calculated Specific sound level	$L_{Aeq(15mins)}$ = 34dB	7.3.6	Specific sound source calculated using ISO9613-2
Representative Background sound level	L_{A90} = 34dB	8.1.3 8.2	Measured over sunrise period (2300 to 0700) measured over weekday & weekend & representative of the background sound level.

Results		**Relevant**	**Commentary**
Assessment during sunrise, reference time interval is 15mins		7.2	
Acoustic feature correction	0dB	9.2	No acoustic feature expected due to mitigation strategy and site noise contribution and residual sound levels.
Rating level	(34 + 0) dB = 34dB	9.2	No significant perceptible noise character predicted
Background sound level	L_{A90} = 34dB	8	Most common place or average (whichever is lowest) value determined using measured background level (2300-0700) providing a robust assessment of baseline.
Excess of rating over background sound level	(34− 34) dB = 0dB	11	
Assessment indicate Low Impact and the specific level would comply with sleep disturbance criteria.		11	
Uncertainty	Not significant	10	The residual levels are higher (51dB LAeq) and the uncertainty of the measurement does not have any significance to the outcome of the assessment. Appropriate standards used for the calculation. All instruments used Type 1, calibrated and in calibration limits for baseline.

6.3.8 In relation to absolute levels during night-time periods, the maximum noise levels generated by the BESS are well below sleep disturbance limits and predicted levels within sensitive rooms with an open window would be between 11dB and 19dB L_{Aeq} (when allowing 15dB drop through open window in accordance with BS8233: 2014). This level is significantly lower than guidance limits provided within BS8233: 2014 for bedrooms of 30dB L_{Aeq}.

Operational Road Traffic Noise

6.3.9 This type of development will attract negligible operational traffic demand and therefore **no significant impacts** would occur.

Operational Vibration Levels

6.3.10 There is no likely significant vibration expected from this type of plant and therefore magnitude impacts would be **not insignificant**.

Cumulative Impacts

6.3.11 The cumulative effects of any proposed or permitted development (not built) in the area surrounding the Proposed Development is considered below:

Table 6.4: Proposed Development Considered for Cumulative Effects

Planning Ref.	Proposal	Operational, consented or awaiting decision	Address	Distance from Site
22/00975/FULM	Proposed solar development	Awaiting decision	Land at Knapthorpe Lodge, Hockerton Rd, Caunton	2.8km (north)
22/00976/FULM	Proposed solar development	Awaiting decision	Field Reference 2227 Hockerton Rd, Caunton	2.7km (north)
23/00317/FULM	Construction & Operation of a BESS facility	Awaiting decision	Land off Staythorpe Road, Averham	400m (west)

6.3.12 The associated planning submission for the above applications include noise impact assessment reports which we have examined and the predicted noise contribution at the NSR relative to these sites and conclusions are summarised below.

Planning Ref: 22/00975/FULM

6.3.13 The ENS Noise Impact Assessment report for the Solar Farm development (Ref. NIA/10053/22/10270/v2 dated May 2022) provides proposed noise limits at the NSR relative to the solar development site. Based on the separation distance from the nearest NSR to the Kelham Solar & BESS facility NSR and noise limits we predict a noise contribution of circa 12dB $L_{Aeq,T}$, which is **not significant** and would not have any increase or effect on the overall levels at NSRs.

Planning Ref: 22/00976/FULM

6.3.14 The ENS Noise Impact Assessment report for the Solar Farm development (Ref. NIA/10054/22/10271/v2 dated May 2022) provides proposed noise limits at the NSR relative to the solar development site. Based on the separation distance from the nearest NSR to the Kelham Solar & BESS facility NSR and noise limits we predict a noise contribution of circa 15dB $L_{Aeq,T}$, which is **not significant** and would not have any increase or effect on the overall levels at NSRs.

Planning Ref: 23/00317/FULM

6.3.15 The ENS Noise Impact Assessment report for the BESS development at Staythorpe Road (Ref. NIA/10611/22/10790/v2 dated February 2023) provides proposed noise limits and predicted noise levels at the NSRs relative to the BESS development site. Based on the separation distance from the nearest NSR to the Kelham Solar & BESS facility NSRs and noise predictions, Table 6.5 provides the following predicted noise contributions.

Table 6.5: Noise contribution predictions from the Staythorpe Road BESS & Kelham Solar Farm & BESS

NSR	ENS Noise Level Prediction Staythorpe Rd BESS $L_{Aeq,T}$ dB	NVC Noise Level Prediction From Kelham Solar & BESS $L_{Aeq,T}$ dB	Cumulative Noise Level $L_{Aeq,T}$ dB	Level Increase
A – Hopwass Close	40 (daytime) 40 (night-time)	28.1 28.6	40.2 40.2	+0.3 +0.3
B – The Close	42 (daytime) 42 (night-time)	35.4 36.0	42.3 42.2	+0.8 +0.9
C – Pinfold Lane	44 (daytime) 44 (night-time)	34.7 35.6	44.5 44.5	+0.4 +0.5

6.3.16 The above table shows that the cumulative impact of the Proposed Development at Kelham would have negligible impact on the noise levels predicted at NSRs from the Staythorpe Road BESS development and is therefore **not significant**.

Impact on Ecological Receptors

6.3.17 The Ecological Appraisal identifies both statutory and non- statutory designated sites. There are no statutory designated sites within 5km of the application site, but there are 5 non statutory sites within 1km. The nearest is Kelham Hills Local Wildlife Site (LWS) which is designated for its woodland habitat and is located c. 160m from the application site. Kelham Hall Shingle Bank LWS is located 410m

from the application and is designated for bird nesting opportunities. Other LWSs are over 600m from the site boundary.

6.3.18 The predicted noise levels at designated sites varies between 27dB to 33dB L_{Aeq} at the closest approach to the site boundary. The impact on the ecological receptors within the woodland habitat would therefore be negligible and not significant when considering the nature of the designation (protected species), the absolute levels (which are very low) and the residual ambient baseline levels, which are much higher.

7.0 CONCLUSIONS

7.1 The proposed Solar Farm & BESS, has been assessed in terms of noise impact during maximum operational conditions. This report has been undertaken to provide technical support to the planning application for the development.

7.2 The results of baseline noise monitoring over a weekday and weekend monitoring period at three locations (in areas representing typical background sound levels) indicate that modal (i.e. most common place value) or average background sound levels vary between 43dB to 50dB L_{A90} during the daytime, 31dB to 34dB L_{A90} during night-time and 38dB to 43dB L_{A90} during early morning sunrise periods between 0500 to 0700 hours (refer to Appendix 1 for explanation of L_{A90} measurement index).

7.3 Typical site operating noise levels have been established from empirical data obtained from Technology Providers taken from other sites in the UK to provide input data for the noise model.

7.4 The predicted rating noise level contribution from the application site using ISO9613-2 methodology and CadnaA noise modelling software shows noise levels at NSRs from the Site to range between 30dB and 37dB $L_{Aeq1hr/15mins}$ during maximum daytime or early morning sunrise site operations. During night-time periods prior to sunrise the predicted noise level would range between 26dB and 34dB $L_{Aeq15mins}$.

7.5 The results show that the noise contribution from maximum site rating noise levels would be below the representative background sound level during daytime and sunrise periods. According to BS4142: 2014+A1:2019 the resultant assessment would conclude that noise from the site would result in a **low impact**.

7.6 The highest likely rating noise level during night-time periods (prior to sunrise) would result in a **low impact** according to BS4142:2014+A1:2019.

7.7 During night-time under maximum operational noise conditions, the noise level would be **well below** night-time recommended limits external to bedroom windows to meet sleep disturbance criteria of 40dB $L_{Aeq8hrs}$ and the internal design criteria according to BS8233: 2014 assuming an open bedroom window. Predicted levels within sensitive rooms with an open window would be between 11dB and 19dB

$L_{Aeq,8hrs}$ (when allowing 15dB drop through open window in accordance with BS8233: 2014). This level is significantly lower than guidance limits provided within BS8233: 2014 for bedrooms of 30dB $L_{Aeq,8hrs}$.

7.8 The Local Authority are able to condition the site in terms of noise, to ensure noise levels and mitigation measures achieve a reasonable level of amenity in accordance with relevant guidance and standards.

7.9 Predictions of construction noise would indicate no significant impacts and `best practicable means' would be applied in accordance with BS5228-1:2009+A1:2014.

7.10 The temporary traffic movement would occur over the 6-month construction period. The number of HGVs delivering during the construction period would vary between 5 and 10 two-way movements per day, with the peak activities occurring during the first month. This would only amount on average to circa 1 HGV delivery per hour. As this is a temporary activity and there are no deliveries on Sundays, then any short-term impact would be limited, and the impact would be minor and **not significant**.

7.11 Maximum levels of vibration during the construction phase (i.e. during the use of mini-piling rigs and vibratory plant) would be below perceptible levels of 0.3mm/sec at the closest approach and the impact would be **negligible** and a **neutral** level of effect and would therefore be **not significant**.

7.12 The impact on the closest ecological receptors would be **negligible and not significant.**

7.13 The cumulative effect of proposed development in the local area within the Local Authority planning portal would be **not significant** and negligible impacts at NSRs based on the noise impact assessments submitted for each application.

7.14 The assessment concludes that the site can be designed to operate such that it complies with all appropriate and relevant noise standards and guidance. There is, therefore, no reason to refuse the Proposed Development on the grounds of noise.

REFERENCES

BS7445:2003 Description and measurement of environmental noise.

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

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

Guidelines for Community Noise – World Health Organisation: April 1999

Night Noise Guidelines for Europe: 2009 – World Health Organisation

Noise Policy Statement for England (NPSE) – March 2010

Department for Communities and Local Government: National Planning Policy Framework: September 2023

National Planning Practice Guidance: June 2021

Design Manual for Roads and Bridges, LA 111 Noise and Vibration: Version 2 (May 2020)

ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors

Newark & Sherwood District Council ("NSDC") `Amended Core Strategy DPD (adopted March 2019)' Policy DM5 `Design'

FIGURE

Figure 1: Noise Measurement Locations, Receptors & Site Position

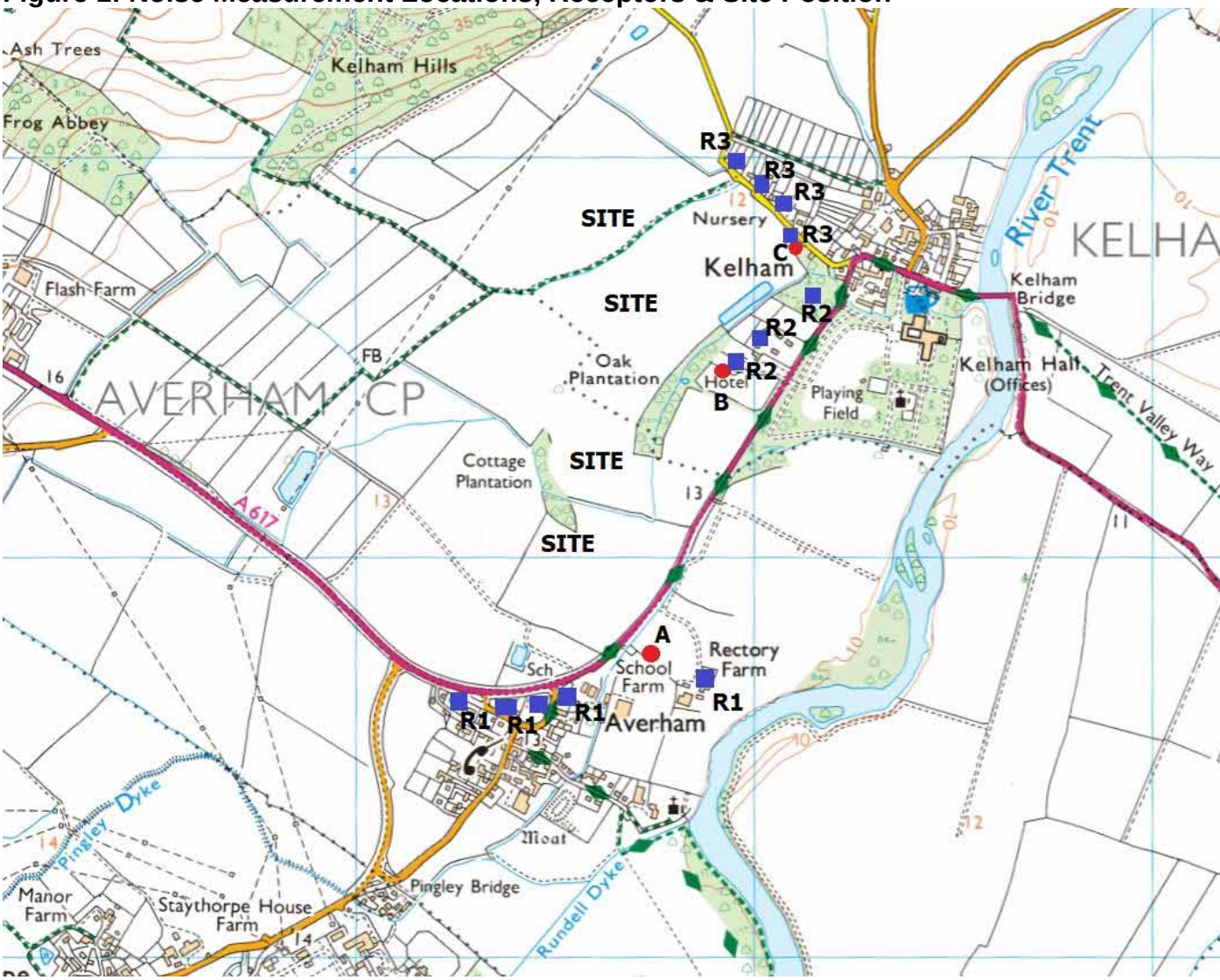


Figure 2: Draft Site Layout

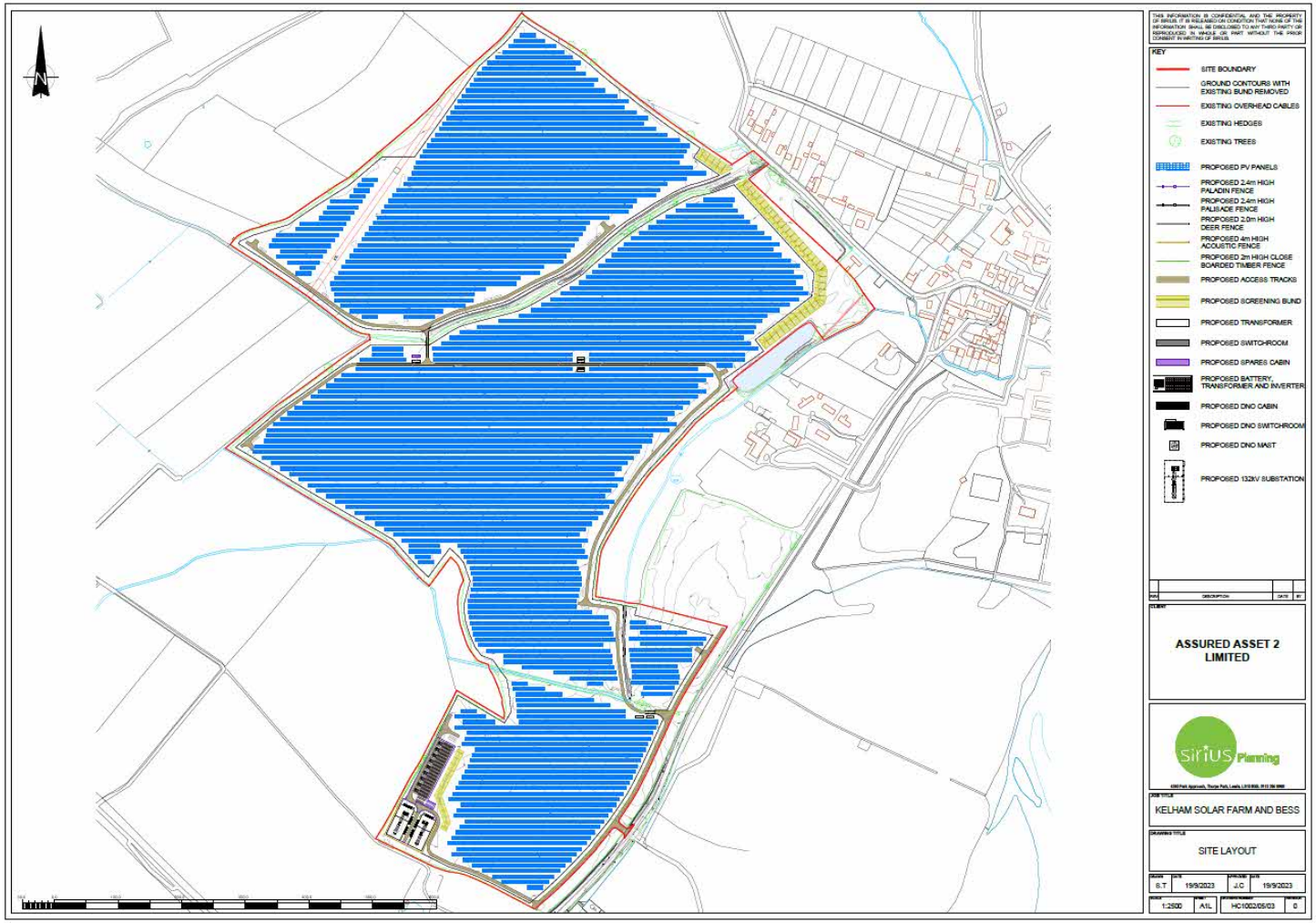
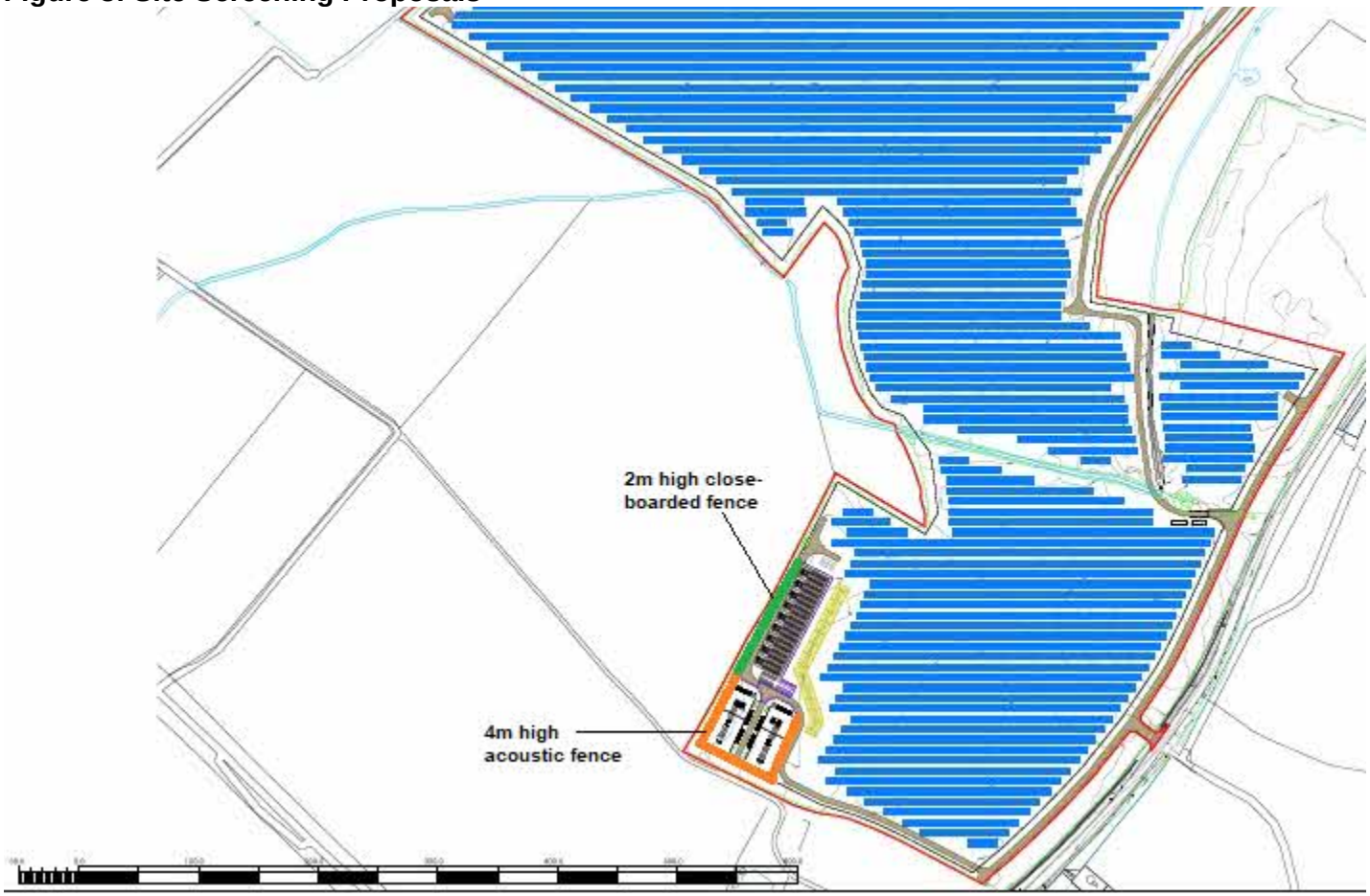


Figure 3: Site Screening Proposals



Appendix 1

BASIC ACOUSTIC TERMINOLOGY

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

Sound Pressure Level is a measurement of the size of these pressure fluctuations. It is expressed in decibels (dB) on a logarithmic scale. Each 3 dB increase in sound pressure level represents a doubling of the sound energy. The threshold of hearing is approximately 0 dB.

The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hz to 20,000 Hz. Although sound can be of one discrete frequency - a 'pure tone' - most noises are made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same 'subjective' way. This is the basis of the A-weighted sound level dB(A), normally used to assess the effect of noise on people. The dB(A) weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Measurement

The measurement of sound pressure level is only really meaningful where the level of noise is constant. In the typical industrial environment noise levels can vary widely and sometimes short duration high levels of noise are interspersed with periods of relative quiet. The most widely used means of 'averaging' the noise over a period of time is the Equivalent Continuous Sound Level. Normally written as L_{Aeq} this value takes into account both the level of noise and the length of time over which it occurs. There are many meters available which are capable of measuring L_{Aeq} by electronic integration over the measurement period.

The L_{Aeq} or A-weighted equivalent continuous noise level is a measure of the total noise energy over a stated time period and includes all the varying noise levels and re-expresses as an 'average', allowing for the length of time for which each noise level was presented.

The L_{An} parameters are defined as the noise levels which are exceeded for n% of the monitoring period, thus, for example, the L_{A90} parameter is the noise level exceeded for 90% of the 15 minute period, i.e. 13.5 minutes. The L_{A50} parameter is the noise level exceeded for 50% of the hourly period, i.e. 30 minutes, etc. The L_{max} parameter is the maximum RMS A-weighted noise level occurring during the measurement period.

The definition in layman's terms is given below for terminology used in the measurement and results obtained during the survey work.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to `A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner which correlates well with human perceptions of loudness.

$L_{A10,T}$: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

$L_{A90,T}$: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest `A' weighted noise level recorded during a noise measurement period.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

Examples of typical noise levels

Source/Activity	**Indicative noise level [dB(A)]**
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

Appendix 2

Baseline Sound Survey Results

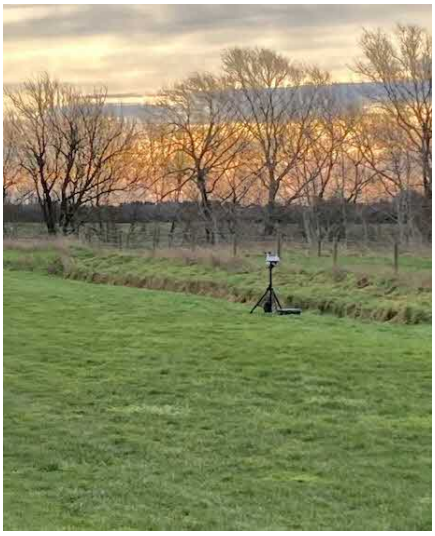
Photographs of Monitoring Locations

Position A: Rectory Farm (circa 50m from Main Street)

Position B: Kelham Manor

Position C: Broadgate Lane

Portable Weather Station (Rectory Farm)



Baseline Sound Survey Results

Noise Survey Results

Date: Friday 3rd February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 1**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
09:00	15:00	57.8	60.1	53.7	67.3	Local Road Traffic Noise off Main Road
09:15	15:00	57.9	60.0	53.3	64.1	
09:30	15:00	59.1	61.6	54.7	67.9	
09:45	15:00	60.1	62.8	54.7	74.1	
10:00	15:00	60.7	63.0	54.9	81.2	
10:15	15:00	61.0	64.1	55.1	70.5	
10:30	15:00	59.4	62.1	53.4	70.1	
10:45	15:00	59.6	62.4	53.1	70.5	
11:00	15:00	59.8	62.8	53.4	68.5	
11:15	15:00	60.0	62.9	54.8	70.0	
11:30	15:00	60.0	62.8	54.9	68.0	
11:45	15:00	60.1	62.6	55.7	69.8	
12:00	15:00	60.1	62.4	55.9	69.7	
12:15	15:00	59.9	62.9	52.3	70.7	
12:30	15:00	61.3	64.1	56.4	70.9	
12:45	15:00	61.0	64.2	55.0	71.3	
13:00	15:00	61.5	64.7	54.9	72.9	
13:15	15:00	61.0	63.9	54.5	69.8	
13:30	15:00	61.1	63.7	55.0	70.9	
13:45	15:00	61.1	64.1	53.9	70.3	
14:00	15:00	59.8	62.6	54.3	69.6	
14:15	15:00	59.8	62.6	54.1	68.3	
14:30	15:00	60.1	62.8	55.9	69.2	
14:45	15:00	59.9	62.7	54.8	68.1	
Average 0900-1500		60.1	62.9	54.6	64-81	

Noise Survey Results

Date: Friday 3rd February 2023 **TABLE 2**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	59.5	61.8	55.6	68.3	
15:15	15:00	60.1	62.6	54.4	68.8	
15:30	15:00	59.4	62.0	54.5	67.9	
15:45	15:00	59.6	62.0	54.2	68.5	
16:00	15:00	60.4	63.0	55.8	70.3	
16:15	15:00	59.9	62.3	55.2	67.6	
16:30	15:00	59.0	61.7	54.2	69.3	
16:45	15:00	59.5	62.1	54.5	67.8	
17:00	15:00	58.9	61.2	54.3	66.9	
17:15	15:00	59.0	61.0	55.2	67.5	
17:30	15:00	58.5	61.0	54.2	65.3	
17:45	15:00	58.0	60.7	52.4	67.0	
18:00	15:00	56.1	58.2	52.2	63.5	
18:15	15:00	55.8	57.9	52.3	64.4	
18:30	15:00	57.1	59.9	52.1	64.4	
18:45	15:00	55.3	57.6	50.8	63.0	
19:00	15:00	55.5	58.1	50.6	63.0	
19:15	15:00	55.5	58.3	48.9	63.8	
19:30	15:00	56.9	59.8	50.7	65.5	
19:45	15:00	55.9	59.3	45.4	66.8	
20:00	15:00	55.1	59.2	43.8	66.5	
20:15	15:00	54.8	58.7	42.0	65.1	
20:30	15:00	53.4	56.9	40.2	65.6	
20:45	15:00	53.0	55.9	45.6	62.4	
21:00	15:00	52.8	56.4	43.7	61.9	
21:15	15:00	52.3	55.3	42.7	62.1	
21:30	15:00	52.9	55.9	45.5	60.2	
21:45	15:00	51.8	55.1	43.6	60.7	
22:00	15:00	51.5	54.1	46.5	61.5	
22:15	15:00	49.3	52.6	39.0	58.8	
22:30	15:00	49.4	53.3	37.4	58.8	
22:45	15:00	50.1	53.6	36.5	59.7	
Average 1500-2300		56.9	59.5	51.6	59-70	

Noise Survey Results

Date: Friday 3rd - Saturday 4th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 3**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	49.8	53.7	37.2	62.5	
23:15	15:00	49.9	53.8	37.9	62.3	
23:30	15:00	49.4	53.5	34.0	60.8	
23:45	15:00	49.9	54.1	36.2	62.3	
00:00	15:00	48.9	53.1	34.8	61.0	
00:15	15:00	46.7	51.8	29.4	58.7	
00:30	15:00	46.9	51.6	30.5	58.0	
00:45	15:00	45.8	50.7	27.7	59.8	
01:00	15:00	45.5	50.5	28.6	57.6	
01:15	15:00	44.5	49.4	26.4	58.7	
01:30	15:00	45.0	49.7	26.8	61.8	
01:45	15:00	43.8	48.4	28.2	60.1	
02:00	15:00	44.8	49.6	30.2	61.7	
02:15	15:00	44.1	48.7	30.4	59.4	
02:30	15:00	41.9	45.6	31.4	58.0	
02:45	15:00	46.1	50.1	34.0	59.4	
03:00	15:00	44.5	49.0	34.3	59.0	
03:15	15:00	45.1	49.5	32.8	59.5	
03:30	15:00	46.5	51.0	33.6	61.2	
03:45	15:00	44.2	49.0	33.8	58.7	
04:00	15:00	45.6	50.5	33.6	61.6	
04:15	15:00	49.3	53.7	33.5	61.7	
04:30	15:00	46.7	51.6	33.7	60.6	
04:45	15:00	47.9	52.9	33.4	59.8	
05:00	15:00	47.7	52.2	34.4	61.5	
05:15	15:00	49.5	53.8	36.1	60.7	
05:30	15:00	52.0	55.5	43.1	59.5	
05:45	15:00	51.7	55.4	39.3	61.7	
06:00	15:00	51.3	55.2	39.1	61.7	
06:15	15:00	52.3	55.7	44.1	61.2	
06:30	15:00	52.8	56.3	43.4	62.4	
06:45	15:00	52.7	56.1	44.8	61.6	
Average 2300-0700		48.5	52.6	37.3	58-63	
Average 0900-2300		58.6	61.3	53.1	59-81	

Noise Survey Results

Date: Saturday 4th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 4**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	53.0	56.3	45.9	64.2	
07:15	15:00	53.8	56.7	46.7	61.9	
07:30	15:00	54.9	57.9	46.7	64.8	
07:45	15:00	55.1	57.9	49.5	63.0	
08:00	15:00	54.7	57.7	47.9	62.0	
08:15	15:00	54.8	57.5	49.5	66.9	
08:30	15:00	56.1	58.6	51.8	62.9	
08:45	15:00	56.4	59.0	51.8	63.7	
09:00	15:00	57.0	59.5	52.0	64.2	
09:15	15:00	57.3	59.5	53.2	69.4	
09:30	15:00	56.4	59.1	52.0	62.8	
09:45	15:00	56.9	59.5	51.6	63.0	
10:00	15:00	57.3	59.2	53.9	64.1	
10:15	15:00	57.6	59.9	52.5	64.7	
10:30	15:00	60.6	60.2	53.9	84.6	
10:45	15:00	57.2	60.0	52.2	64.5	
11:00	15:00	57.9	60.3	53.9	65.3	
11:15	15:00	57.6	59.8	52.9	68.0	
11:30	15:00	57.8	60.2	53.5	65.7	
11:45	15:00	58.4	60.0	53.9	74.6	
12:00	15:00	57.3	60.0	51.9	64.1	
12:15	15:00	57.7	59.8	53.8	69.2	
12:30	15:00	57.4	59.6	53.1	65.5	
12:45	15:00	57.3	59.4	53.4	65.9	
13:00	15:00	56.8	59.1	52.3	63.7	
13:15	15:00	56.8	59.1	52.6	64.1	
13:30	15:00	55.9	58.0	52.4	65.5	
13:45	15:00	56.7	59.2	52.6	63.5	
14:00	15:00	56.8	58.8	53.0	69.0	
14:15	15:00	56.3	58.4	52.0	63.0	
14:30	15:00	55.9	58.1	52.2	64.8	
14:45	15:00	55.5	57.7	50.7	62.5	
Average 0700-1500		56.8	59.0	52.1	62-85	

Noise Survey Results

Date: Saturday 4th February 2023 **TABLE 5**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	55.5	57.9	50.9	63.5	
15:15	15:00	55.9	58.3	51.6	65.6	
15:30	15:00	55.6	57.6	52.1	64.7	
15:45	15:00	56.9	59.0	53.0	66.2	
16:00	15:00	56.1	58.5	51.5	64.3	
16:15	15:00	56.5	58.7	51.6	66.7	
16:30	15:00	56.2	58.4	51.7	64.3	
16:45	15:00	56.1	58.2	52.0	62.6	
17:00	15:00	55.7	57.9	51.9	61.6	
17:15	15:00	55.0	57.6	50.4	62.3	
17:30	15:00	55.8	58.3	50.2	67.3	
17:45	15:00	54.8	57.4	50.2	61.8	
18:00	15:00	54.6	57.5	48.2	61.7	
18:15	15:00	54.6	57.1	49.2	67.5	
18:30	15:00	54.5	57.2	49.5	62.8	
18:45	15:00	54.2	56.7	49.4	60.9	
19:00	15:00	54.1	56.7	48.6	61.7	
19:15	15:00	52.6	55.9	43.9	60.5	
19:30	15:00	52.1	54.8	45.7	59.5	
19:45	15:00	51.8	55.6	40.5	60.4	
20:00	15:00	52.2	55.3	45.7	66.8	
20:15	15:00	51.1	54.1	43.2	60.1	
20:30	15:00	51.5	54.7	40.4	60.6	
20:45	15:00	51.1	54.2	43.0	62.9	
21:00	15:00	50.6	53.6	44.1	58.3	
21:15	15:00	49.8	53.6	41.1	59.7	
21:30	15:00	52.8	55.8	45.1	62.3	
21:45	15:00	50.7	55.0	37.4	62.6	
22:00	15:00	53.0	56.2	40.3	66.3	
22:15	15:00	56.7	60.3	44.0	66.9	
22:30	15:00	54.1	57.6	42.7	73.1	
22:45	15:00	54.7	59.0	41.2	68.1	
Average 1500-2300		54.4	57.1	48.7	58-73	

Noise Survey Results

Date: Saturday 4th - Sunday 5th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 6**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	53.1	57.1	36.0	68.3	
23:15	15:00	54.2	58.5	40.4	65.3	
23:30	15:00	51.8	56.5	34.9	65.2	
23:45	15:00	53.2	57.2	36.4	64.0	
00:00	15:00	49.6	54.2	33.0	61.2	
00:15	15:00	49.5	54.5	30.3	62.2	
00:30	15:00	49.2	53.7	28.8	62.6	
00:45	15:00	51.1	56.2	31.5	64.9	
01:00	15:00	48.5	52.2	29.5	63.3	
01:15	15:00	50.2	55.5	28.0	63.3	
01:30	15:00	44.7	50.0	26.3	59.3	
01:45	15:00	47.1	52.4	28.3	61.6	
02:00	15:00	47.5	52.1	28.1	63.8	
02:15	15:00	45.0	50.2	27.6	59.6	
02:30	15:00	49.8	54.6	30.8	63.6	
02:45	15:00	48.5	53.1	30.4	64.8	
03:00	15:00	47.9	52.9	29.2	67.6	
03:15	15:00	49.3	52.4	26.9	67.9	
03:30	15:00	49.4	54.3	31.1	62.8	
03:45	15:00	48.8	53.2	29.5	64.2	
04:00	15:00	48.4	53.0	32.7	62.9	
04:15	15:00	48.6	53.5	32.0	64.0	
04:30	15:00	46.7	51.1	33.9	64.5	
04:45	15:00	46.3	51.2	34.4	60.0	
05:00	15:00	52.2	56.6	36.0	67.1	
05:15	15:00	51.1	56.2	36.5	63.1	
05:30	15:00	52.7	57.1	37.5	65.5	
05:45	15:00	51.8	56.1	36.1	67.7	
06:00	15:00	52.6	56.9	37.8	65.4	
06:15	15:00	54.8	59.0	41.2	69.0	
06:30	15:00	54.6	58.9	42.5	67.0	
06:45	15:00	55.8	59.8	44.7	69.2	
Average 2300-0700		51.0	55.4	36.1	59-69	
Average 0700-2300		55.7	58.2	50.7	58-85	

Noise Survey Results

Date: Sunday 5th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 7**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	54.9	58.7	45.0	69.8	
07:15	15:00	54.1	58.1	43.8	66.6	
07:30	15:00	55.6	58.7	46.7	69.7	
07:45	15:00	57.2	61.1	46.6	68.0	
08:00	15:00	54.9	58.7	44.5	67.2	
08:15	15:00	55.9	59.2	45.5	66.6	
08:30	15:00	57.3	60.5	50.1	69.4	
08:45	15:00	56.4	59.7	49.2	65.6	
09:00	15:00	56.5	59.5	50.3	65.9	
09:15	15:00	55.5	57.0	48.8	71.4	
09:30	15:00	55.8	58.9	49.5	64.6	
09:45	15:00	54.9	57.3	50.4	61.9	
10:00	15:00	55.3	58.0	49.5	63.0	
10:15	15:00	55.4	57.7	49.9	68.0	
10:30	15:00	55.7	58.3	51.0	63.4	
10:45	15:00	56.0	58.7	50.0	69.2	
11:00	15:00	53.3	56.1	43.7	60.6	
11:15	15:00	52.9	55.5	46.0	61.4	
11:30	15:00	55.2	57.8	50.3	63.8	
11:45	15:00	54.9	57.3	49.1	66.7	
12:00	15:00	54.0	56.7	48.4	61.1	
12:15	15:00	53.9	56.3	48.8	61.1	
12:30	15:00	55.8	57.3	48.4	71.1	
12:45	15:00	53.5	56.4	46.9	59.5	
13:00	15:00	53.3	55.8	47.6	60.4	
13:15	15:00	53.7	56.0	47.5	68.0	
13:30	15:00	58.1	57.9	49.8	75.1	
13:45	15:00	52.4	55.1	45.7	59.4	
14:00	15:00	53.0	55.6	45.6	63.6	
14:15	15:00	53.2	55.6	47.7	65.0	
14:30	15:00	52.7	55.6	45.6	61.7	
14:45	15:00	52.9	55.7	46.4	61.9	
Average 0700-1500		55.0	57.8	48.2	59-75	

Noise Survey Results

Date: Sunday 5th February 2023 **TABLE 8**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	53.3	56.2	46.7	61.0	
15:15	15:00	53.5	56.1	47.0	62.9	
15:30	15:00	53.3	55.7	48.4	62.4	
15:45	15:00	52.0	54.5	46.1	62.5	
16:00	15:00	53.3	55.5	46.9	73.5	
16:15	15:00	53.9	56.1	49.3	60.8	
16:30	15:00	55.7	58.1	50.8	68.5	
16:45	15:00	57.2	59.0	53.2	72.4	
17:00	15:00	55.0	57.3	51.0	59.8	
17:15	15:00	54.3	56.7	47.1	60.2	
17:30	15:00	56.0	58.6	50.4	65.3	
17:45	15:00	58.2	60.8	52.4	65.6	
18:00	15:00	59.0	61.5	52.7	70.7	
18:15	15:00	58.2	60.9	52.3	67.6	
18:30	15:00	60.5	59.7	53.2	79.4	
18:45	15:00	56.6	59.1	51.1	64.1	
19:00	15:00	56.9	59.4	50.9	64.2	
19:15	15:00	55.5	58.1	50.6	63.1	
19:30	15:00	55.4	58.0	50.5	61.9	
19:45	15:00	55.4	58.5	47.8	65.7	
20:00	15:00	55.4	58.8	45.1	63.9	
20:15	15:00	54.0	57.3	44.1	63.5	
20:30	15:00	53.5	57.7	42.6	62.0	
20:45	15:00	54.1	57.4	42.9	62.7	
21:00	15:00	52.5	56.2	44.5	63.7	
21:15	15:00	53.2	56.6	44.3	62.6	
21:30	15:00	53.5	57.0	44.7	62.3	
21:45	15:00	51.3	55.2	42.4	62.2	
22:00	15:00	51.9	56.6	41.0	64.4	
22:15	15:00	50.4	54.2	41.2	60.5	
22:30	15:00	50.0	53.7	41.1	60.1	
22:45	15:00	50.3	54.7	39.4	62.6	
Average 1500-2300		55.2	57.7	48.8	60-79	

Noise Survey Results

Date: Sunday 5th - Monday 6th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 9**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	48.9	53.0	39.2	62.7	
23:15	15:00	48.0	52.7	40.8	58.7	
23:30	15:00	46.2	50.4	37.9	59.4	
23:45	15:00	49.3	53.6	38.0	61.6	
00:00	15:00	47.3	51.3	38.2	61.2	
00:15	15:00	45.1	49.1	38.6	55.9	
00:30	15:00	46.4	50.5	38.4	60.0	
00:45	15:00	47.9	51.6	40.7	60.3	
01:00	15:00	46.0	50.6	38.1	58.7	
01:15	15:00	47.9	52.8	37.9	60.5	
01:30	15:00	46.0	50.1	35.4	61.0	
01:45	15:00	42.9	45.5	36.2	57.6	
02:00	15:00	44.5	48.6	34.3	58.0	
02:15	15:00	41.4	40.6	35.0	59.0	
02:30	15:00	41.4	41.6	34.1	58.0	
02:45	15:00	46.1	51.0	33.9	59.9	
03:00	15:00	46.9	51.7	35.5	61.2	
03:15	15:00	47.2	51.5	35.7	60.4	
03:30	15:00	47.4	51.8	36.7	57.6	
03:45	15:00	48.7	52.6	39.8	59.3	
04:00	15:00	48.7	52.8	38.5	60.4	
04:15	15:00	49.4	53.3	40.4	61.4	
04:30	15:00	50.4	54.4	41.8	61.8	
04:45	15:00	52.4	56.0	43.9	61.0	
05:00	15:00	52.8	56.6	43.6	61.7	
05:15	15:00	53.6	57.4	44.3	63.5	
05:30	15:00	53.7	56.8	46.7	63.4	
05:45	15:00	56.0	58.9	50.0	61.8	
06:00	15:00	56.0	59.1	50.2	63.4	
06:15	15:00	57.2	60.0	51.5	64.6	
06:30	15:00	57.5	60.2	51.6	64.9	
06:45	15:00	58.6	60.5	55.7	63.5	
Average 2300-0700		51.6	54.8	45.4	56-65	
Average 0700-2300		55.1	57.8	48.5	59-79	

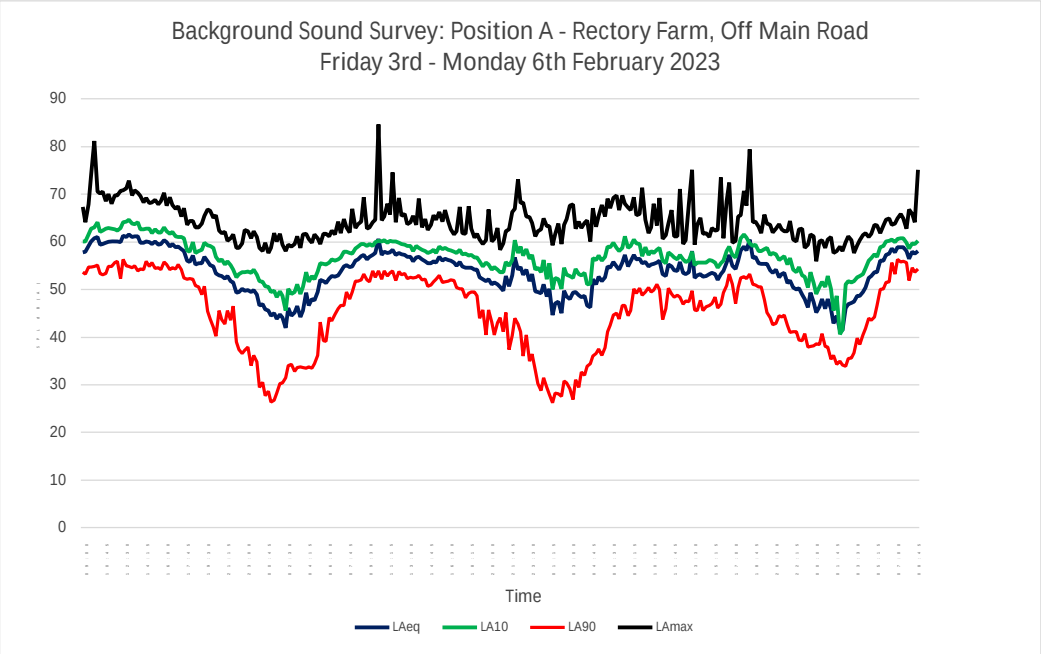
Noise Survey Results

Date: Sunday 5th - Monday 6th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 10**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position A - Rectory Farm, off Main Road**
Instrumentation: Cirrus 171A Real Time Analyser (G061253)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	57.8	59.9	53.2	63.8	
07:15	15:00	58.9	60.6	56.3	64.9	
07:30	15:00	58.9	60.7	55.8	65.9	
07:45	15:00	58.9	60.8	55.9	64.9	
08:00	15:00	58.1	59.8	55.6	62.8	
08:15	15:00	56.5	58.6	51.9	66.8	
08:30	15:00	57.9	59.7	54.5	65.9	
08:45	15:00	57.5	59.6	53.6	64.1	
09:00	15:00	58.0	60.2	54.3	75.1	
Average 0700-0915		58.1	60.0	54.7	63-75	

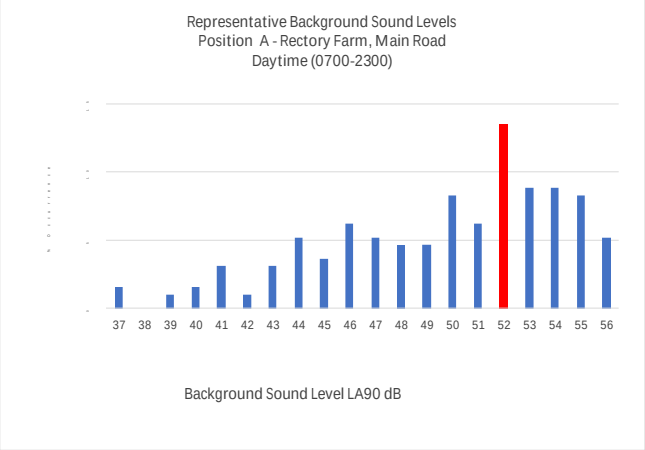
Overall Av. 2300-0700	**50.6**	**54.4**	**41.7**	**56-69**	
Overall Av. 0700-2300	**56.7**	**59.3**	**51.3**	**58-85**	

Average 0500-0700	**54.1**	**57.5**	**46.8**	**60-69**
			43	

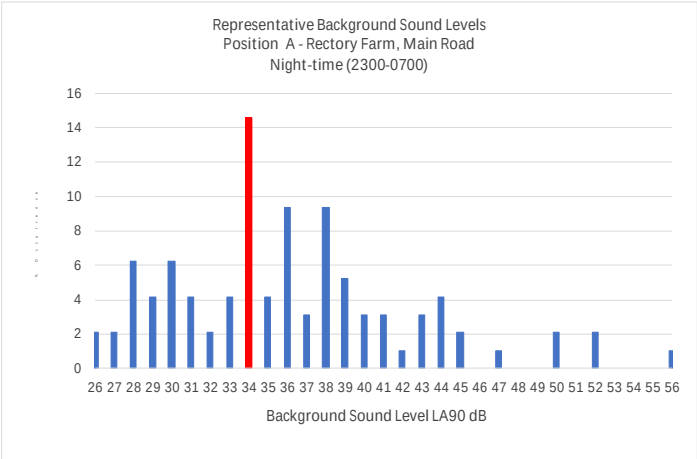


LA90 Representative Levels

LA90	% Occurrence
37	1.6
38	0.0
39	1.0
40	1.6
41	3.1
42	1.0
43	3.1
44	5.2
45	3.6
46	6.2
47	5.2
48	4.7
49	4.7
50	8.3
51	6.2
52	**13.5**
53	8.8
54	8.8
55	8.3
56	5.2



LA90	% Occurrence
26	2.1
27	2.1
28	6.3
29	4.2
30	6.3
31	4.2
32	2.1
33	4.2
34	**14.6**
35	4.2
36	9.4
37	3.1
38	9.4
39	5.2
40	3.1
41	3.1
42	1.0
43	3.1
44	4.2
45	2.1
46	0.0
47	1.0
48	0.0
49	0.0
50	2.1
51	0.0
52	2.1
53	0.0
54	0.0
55	0.0
56	1.0



Noise Survey Results

Date: Friday 3rd February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 11**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
09:15	15:00	56.3	58.0	53.3	64.2	Distant road traffic noise
09:30	15:00	56.1	58.1	53.2	62.5	
09:45	15:00	54.3	56.0	51.7	65.0	
10:00	15:00	53.6	54.8	51.1	66.6	
10:15	15:00	54.8	56.4	51.7	65.6	
10:30	15:00	52.9	54.6	50.1	59.8	
10:45	15:00	53.7	55.4	51.1	61.4	
11:00	15:00	53.1	54.6	50.8	58.4	
11:15	15:00	52.8	54.6	50.5	60.5	
11:30	15:00	52.0	53.7	49.4	58.1	
11:45	15:00	51.0	52.5	48.0	60.3	
12:00	15:00	50.5	52.2	47.8	60.3	
12:15	15:00	52.8	54.6	50.0	61.0	
12:30	15:00	54.0	55.6	51.4	60.6	
12:45	15:00	55.0	56.5	52.6	67.3	
13:00	15:00	54.5	56.0	52.1	62.8	
13:15	15:00	53.7	55.2	51.4	64.0	
13:30	15:00	53.5	54.5	51.6	65.1	
13:45	15:00	52.7	54.3	49.8	60.4	
14:00	15:00	52.2	53.6	50.1	60.9	
14:15	15:00	53.0	54.8	50.6	59.3	
14:30	15:00	54.1	55.6	51.7	58.2	
14:45	15:00	53.7	55.3	51.5	60.2	
Average 0915-1500		53.7	55.3	51.1	58-67	

Noise Survey Results

Date: Friday 3rd February 2023 **TABLE 12**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	53.5	54.9	51.5	58.8	
15:15	15:00	53.8	55.4	51.6	60.3	
15:30	15:00	53.5	55.1	51.2	60.0	
15:45	15:00	53.5	55.1	50.5	57.8	
16:00	15:00	54.6	55.3	51.3	81.6	
16:15	15:00	53.7	55.0	51.8	64.5	
16:30	15:00	53.7	55.4	50.7	60.2	
16:45	15:00	53.6	55.1	51.1	58.2	
17:00	15:00	52.9	54.5	50.6	57.5	
17:15	15:00	52.8	54.3	49.3	61.1	
17:30	15:00	53.5	55.2	50.6	59.7	
17:45	15:00	53.9	55.7	51.0	58.8	
18:00	15:00	53.4	55.2	49.8	63.5	
18:15	15:00	54.2	56.3	50.8	60.8	
18:30	15:00	54.7	56.8	51.1	61.3	
18:45	15:00	54.4	56.4	50.8	61.1	
19:00	15:00	54.3	56.6	49.1	65.2	
19:15	15:00	52.1	54.4	45.8	65.4	
19:30	15:00	53.9	56.8	47.7	62.8	
19:45	15:00	52.7	56.1	43.6	62.8	
20:00	15:00	52.8	56.0	38.6	61.6	
20:15	15:00	51.7	54.5	40.8	60.5	
20:30	15:00	50.7	53.7	41.2	60.5	
20:45	15:00	51.2	54.4	42.7	61.2	
21:00	15:00	51.8	55.1	45.5	59.0	
21:15	15:00	51.9	55.1	42.4	60.2	
21:30	15:00	51.5	54.7	42.4	60.4	
21:45	15:00	50.8	54.4	42.3	59.4	
22:00	15:00	51.0	54.0	43.3	61.9	
22:15	15:00	50.5	54.0	40.6	60.5	
22:30	15:00	48.6	52.1	39.5	57.3	
22:45	15:00	50.2	54.1	37.9	60.5	
Average 1500-2300		52.8	55.1	48.6	57-82	

Noise Survey Results

Date: Friday 3rd - Saturday 4th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 13**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	51.0	54.2	37.6	65.1	
23:15	15:00	48.7	52.3	36.7	59.8	
23:30	15:00	48.3	52.2	37.3	59.0	
23:45	15:00	48.3	52.1	35.2	60.1	
00:00	15:00	47.9	51.2	36.6	64.3	
00:15	15:00	44.0	48.3	28.7	55.2	
00:30	15:00	44.0	48.6	32.8	55.2	
00:45	15:00	44.1	49.2	26.8	60.9	
01:00	15:00	43.0	46.8	30.4	56.9	
01:15	15:00	41.5	46.3	27.7	54.9	
01:30	15:00	41.6	45.4	28.3	58.5	
01:45	15:00	41.1	45.8	27.5	58.3	
02:00	15:00	42.6	47.9	27.2	55.9	
02:15	15:00	42.9	47.4	28.8	57.8	
02:30	15:00	40.7	44.2	28.8	56.5	
02:45	15:00	44.7	49.6	31.9	56.8	
03:00	15:00	43.0	48.1	29.9	57.5	
03:15	15:00	42.8	47.8	29.4	57.2	
03:30	15:00	44.9	48.8	31.4	60.9	
03:45	15:00	42.2	47.6	30.6	56.1	
04:00	15:00	43.7	48.0	29.8	60.7	
04:15	15:00	47.2	50.9	33.4	58.9	
04:30	15:00	44.9	49.6	29.4	57.2	
04:45	15:00	46.0	50.2	31.1	59.3	
05:00	15:00	45.9	50.4	31.3	57.7	
05:15	15:00	47.9	51.9	34.6	59.2	
05:30	15:00	50.2	53.1	44.4	63.3	
05:45	15:00	49.4	52.8	39.0	58.5	
06:00	15:00	49.0	52.8	37.2	58.6	
06:15	15:00	50.2	53.6	39.0	59.3	
06:30	15:00	51.0	54.8	41.5	60.2	
06:45	15:00	50.4	53.7	40.6	60.4	
Average 2300-0700		46.8	50.7	35.7	55-65	
Average 0915-2300		53.2	55.2	49.8	57-82	

Noise Survey Results

Date: Saturday 4th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 14**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	50.4	52.9	44.2	58.6	
07:15	15:00	52.0	54.7	44.2	66.2	
07:30	15:00	53.0	55.3	48.8	59.8	
07:45	15:00	53.5	56.4	47.5	60.2	
08:00	15:00	53.4	56.0	48.0	60.5	
08:15	15:00	53.0	55.5	49.0	61.4	
08:30	15:00	54.1	56.3	50.8	63.4	
08:45	15:00	54.9	56.6	51.0	66.8	
09:00	15:00	54.3	56.3	51.0	61.3	
09:15	15:00	55.0	57.0	51.4	61.0	
09:30	15:00	54.7	57.0	50.5	64.8	
09:45	15:00	54.3	56.4	50.6	67.7	
10:00	15:00	54.5	56.2	51.8	68.5	
10:15	15:00	54.9	56.9	52.0	61.9	
10:30	15:00	55.3	57.0	52.6	66.4	
10:45	15:00	54.3	56.1	50.7	65.0	
11:00	15:00	55.2	57.1	52.4	60.1	
11:15	15:00	55.0	56.5	52.7	60.3	
11:30	15:00	54.9	56.5	51.7	63.3	
11:45	15:00	54.2	56.0	51.6	61.2	
12:00	15:00	53.6	55.5	50.9	63.0	
12:15	15:00	54.3	56.2	51.0	59.0	
12:30	15:00	55.1	56.7	52.8	62.2	
12:45	15:00	54.5	56.1	51.1	60.3	
13:00	15:00	54.6	56.4	51.5	62.8	
13:15	15:00	54.7	56.4	52.2	60.1	
13:30	15:00	54.5	56.3	51.0	59.4	
13:45	15:00	54.5	56.5	51.6	59.1	
14:00	15:00	54.6	56.4	51.1	60.5	
14:15	15:00	54.8	56.3	51.7	61.5	
14:30	15:00	54.7	56.5	51.5	60.0	
14:45	15:00	54.3	56.0	51.7	59.9	
Average 0700-1500		54.3	56.2	51.0	59-69	

Noise Survey Results

Date: Saturday 4th February 2023 **TABLE 15**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	54.4	56.4	50.3	60.2	
15:15	15:00	54.7	56.2	51.7	63.5	
15:30	15:00	54.1	56.2	50.6	60.1	
15:45	15:00	55.2	56.6	52.4	67.2	
16:00	15:00	54.5	56.1	51.6	62.4	
16:15	15:00	54.4	56.4	51.1	60.1	
16:30	15:00	54.3	56.2	51.5	58.5	
16:45	15:00	54.6	56.4	52.1	60.0	
17:00	15:00	54.6	56.2	51.8	66.7	
17:15	15:00	54.0	56.1	49.6	64.1	
17:30	15:00	55.4	56.4	49.3	72.0	
17:45	15:00	54.0	56.1	49.9	65.7	
18:00	15:00	53.1	55.6	47.6	58.4	
18:15	15:00	53.1	55.8	46.5	65.0	
18:30	15:00	53.1	55.1	49.6	59.7	
18:45	15:00	52.7	54.5	49.7	58.7	
19:00	15:00	52.4	54.6	48.4	59.2	
19:15	15:00	51.6	54.1	46.4	59.8	
19:30	15:00	50.9	53.5	45.6	58.7	
19:45	15:00	51.2	54.6	39.7	60.0	
20:00	15:00	51.7	54.8	44.2	61.5	
20:15	15:00	50.7	53.5	42.1	61.4	
20:30	15:00	51.7	54.7	44.8	59.1	
20:45	15:00	51.3	54.8	42.6	62.6	
21:00	15:00	52.2	55.1	47.0	58.7	
21:15	15:00	50.1	53.4	40.8	60.9	
21:30	15:00	50.4	53.4	43.1	59.1	
21:45	15:00	47.3	50.6	39.9	56.5	
22:00	15:00	46.2	49.8	39.4	56.1	
22:15	15:00	45.7	48.8	38.9	55.2	
22:30	15:00	44.0	47.2	37.6	54.3	
22:45	15:00	45.5	49.2	38.2	56.8	
Average 1500-2300		52.6	54.8	48.3	54-72	

Noise Survey Results

Date: Saturday 4th - Sunday 5th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 16**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	43.6	47.8	34.8	53.6	
23:15	15:00	44.0	48.6	34.8	53.2	
23:30	15:00	42.5	47.3	32.7	52.2	
23:45	15:00	45.5	49.6	32.2	57.8	
00:00	15:00	41.1	45.6	32.1	52.5	
00:15	15:00	41.8	46.9	30.7	53.9	
00:30	15:00	41.3	45.8	31.7	52.3	
00:45	15:00	41.3	46.5	31.4	51.0	
01:00	15:00	39.5	42.8	31.1	54.8	
01:15	15:00	40.9	45.0	31.4	54.6	
01:30	15:00	37.1	39.7	29.2	52.2	
01:45	15:00	39.0	41.3	30.4	53.9	
02:00	15:00	38.3	41.1	29.6	55.5	
02:15	15:00	36.1	38.7	31.1	49.6	
02:30	15:00	41.1	45.8	32.7	55.4	
02:45	15:00	39.0	41.9	32.4	52.4	
03:00	15:00	34.4	35.4	32.0	46.0	
03:15	15:00	38.7	39.2	29.9	56.2	
03:30	15:00	40.3	44.4	31.1	55.2	
03:45	15:00	40.3	44.4	32.2	54.7	
04:00	15:00	39.6	41.1	33.4	55.3	
04:15	15:00	39.9	43.9	33.0	55.6	
04:30	15:00	39.6	41.8	33.5	53.9	
04:45	15:00	39.5	41.7	35.7	50.5	
05:00	15:00	42.9	46.7	36.2	55.4	
05:15	15:00	42.5	46.7	35.6	54.0	
05:30	15:00	42.9	47.4	35.9	53.3	
05:45	15:00	42.7	46.7	36.0	53.2	
06:00	15:00	43.0	47.2	36.3	53.8	
06:15	15:00	45.7	49.2	39.6	55.6	
06:30	15:00	45.0	49.0	39.0	53.6	
06:45	15:00	45.6	48.9	39.0	57.7	
Average 2300-0700		41.8	45.7	34.3	46-58	
Average 0700-2300		53.5	55.6	49.8	54-72	

Noise Survey Results

Date: Sunday 5th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 17**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	47.0	50.0	41.7	60.5	
07:15	15:00	45.8	49.2	39.9	59.3	
07:30	15:00	47.2	50.4	42.1	59.8	
07:45	15:00	48.1	51.0	42.6	59.4	
08:00	15:00	46.9	49.9	41.7	55.7	
08:15	15:00	48.0	51.1	41.7	61.8	
08:30	15:00	49.2	52.3	42.6	58.2	
08:45	15:00	48.6	51.2	42.4	56.4	
09:00	15:00	49.7	52.8	43.5	62.5	
09:15	15:00	51.8	52.8	45.4	68.7	
09:30	15:00	50.0	52.6	44.5	59.1	
09:45	15:00	49.6	52.0	44.3	61.3	
10:00	15:00	49.2	51.7	44.0	59.9	
10:15	15:00	50.0	52.1	44.7	65.5	
10:30	15:00	49.7	51.8	45.5	57.1	
10:45	15:00	50.0	51.7	43.1	70.3	
11:00	15:00	49.3	51.9	43.3	55.7	
11:15	15:00	49.4	51.9	43.7	56.1	
11:30	15:00	49.2	51.7	43.9	56.9	
11:45	15:00	53.4	52.3	45.0	74.6	
12:00	15:00	48.0	50.7	42.1	53.0	
12:15	15:00	48.6	51.1	43.1	54.2	
12:30	15:00	51.2	53.4	45.9	64.2	
12:45	15:00	49.5	52.1	43.8	54.8	
13:00	15:00	50.1	52.3	45.5	59.6	
13:15	15:00	50.9	53.2	44.1	63.7	
13:30	15:00	57.8	55.0	46.0	78.3	
13:45	15:00	49.5	51.9	43.4	58.1	
14:00	15:00	49.7	51.9	43.0	59.6	
14:15	15:00	49.4	51.9	42.6	60.3	
14:30	15:00	49.3	52.1	41.9	57.1	
14:45	15:00	49.5	51.8	44.5	55.2	
Average 0700-1500		50.2	51.9	43.7	53-78	

Noise Survey Results

Date: Sunday 5th February 2023 **TABLE 18**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	49.2	52.1	42.9	56.3	
15:15	15:00	50.2	52.4	44.7	63.0	
15:30	15:00	50.0	52.5	42.8	56.5	
15:45	15:00	51.2	53.7	45.2	57.7	
16:00	15:00	51.6	53.6	45.0	69.1	
16:15	15:00	51.6	53.8	47.3	57.9	
16:30	15:00	53.2	55.6	48.6	60.1	
16:45	15:00	57.4	57.9	52.5	77.8	
17:00	15:00	55.6	57.8	52.0	61.9	
17:15	15:00	55.1	57.8	48.5	61.5	
17:30	15:00	55.1	57.5	50.9	62.8	
17:45	15:00	55.3	57.6	50.4	62.6	
18:00	15:00	55.5	57.9	49.7	66.0	
18:15	15:00	55.8	58.4	50.3	63.0	
18:30	15:00	55.4	57.8	49.6	62.4	
18:45	15:00	55.1	58.0	48.9	62.0	
19:00	15:00	54.7	57.9	48.0	62.1	
19:15	15:00	54.8	57.5	47.0	61.2	
19:30	15:00	55.1	57.7	49.7	61.9	
19:45	15:00	54.1	57.1	45.5	63.2	
20:00	15:00	52.9	56.2	45.0	60.3	
20:15	15:00	52.5	55.8	44.6	60.2	
20:30	15:00	52.5	55.9	44.5	60.3	
20:45	15:00	52.4	56.1	41.8	60.5	
21:00	15:00	53.1	56.7	42.4	68.0	
21:15	15:00	52.1	55.6	43.7	60.6	
21:30	15:00	51.5	54.5	44.0	62.9	
21:45	15:00	49.7	53.3	40.7	62.7	
22:00	15:00	49.2	53.8	40.0	59.6	
22:15	15:00	49.8	53.6	41.0	63.6	
22:30	15:00	49.5	53.3	39.3	61.2	
22:45	15:00	49.2	53.8	37.3	61.4	
Average 1500-2300		53.4	56.1	47.3	56-78	

Noise Survey Results

Date: Sunday 5th - Monday 6th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 19**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	47.8	52.0	35.8	59.2	
23:15	15:00	46.8	51.1	36.0	59.4	
23:30	15:00	45.8	50.6	34.5	59.0	
23:45	15:00	48.6	53.2	34.4	60.1	
00:00	15:00	46.3	50.4	37.2	61.8	
00:15	15:00	45.1	49.7	34.3	57.4	
00:30	15:00	46.0	50.4	35.8	60.4	
00:45	15:00	48.1	52.4	38.4	60.1	
01:00	15:00	45.3	50.1	34.2	56.3	
01:15	15:00	46.0	50.8	35.4	55.8	
01:30	15:00	45.2	49.5	34.5	58.6	
01:45	15:00	41.4	44.9	34.2	59.2	
02:00	15:00	43.3	47.9	34.2	54.8	
02:15	15:00	40.4	41.2	30.9	59.8	
02:30	15:00	40.9	41.1	31.9	57.8	
02:45	15:00	46.3	50.5	30.7	63.4	
03:00	15:00	47.0	50.9	32.6	63.1	
03:15	15:00	47.1	51.4	34.4	60.6	
03:30	15:00	47.6	50.9	37.6	62.1	
03:45	15:00	48.7	52.6	38.8	60.5	
04:00	15:00	50.1	53.3	41.3	61.7	
04:15	15:00	50.8	54.7	40.2	63.7	
04:30	15:00	51.3	55.2	40.9	64.6	
04:45	15:00	53.5	56.5	47.2	64.7	
05:00	15:00	53.1	56.7	43.1	62.8	
05:15	15:00	54.5	58.1	42.1	63.4	
05:30	15:00	55.2	58.6	48.7	62.4	
05:45	15:00	56.7	59.4	50.8	62.6	
06:00	15:00	55.7	58.8	49.6	63.6	
06:15	15:00	57.5	59.6	53.3	64.3	
06:30	15:00	58.7	60.9	54.9	64.0	
06:45	15:00	59.0	61.1	54.9	64.2	
Average 2300-0700		52.0	55.1	46.1	55-65	
Average 0700-2300		52.1	54.5	45.8	53-78	

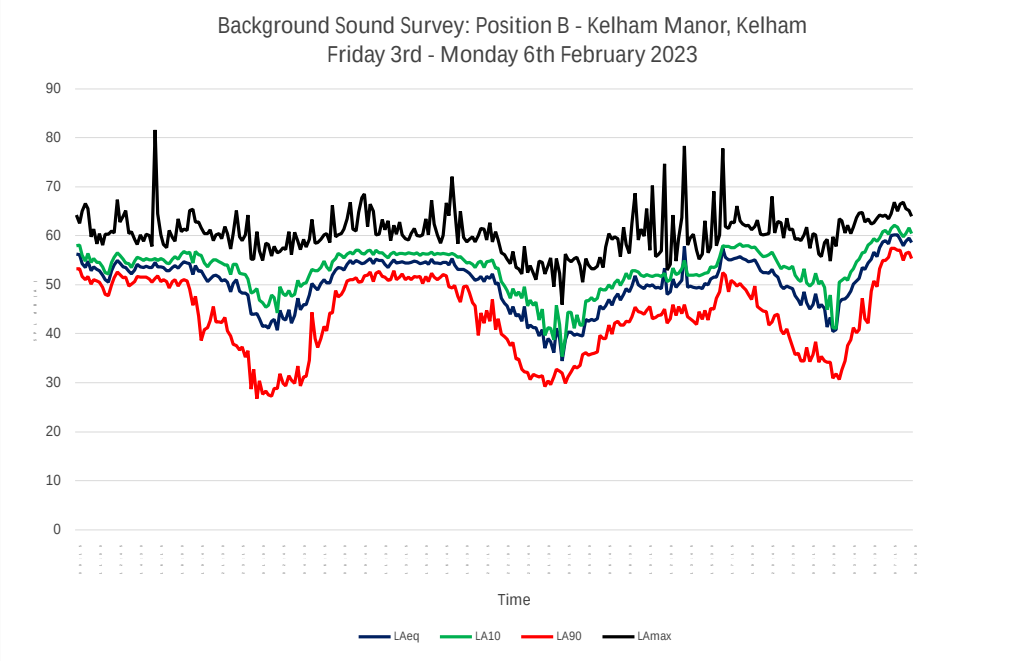
Noise Survey Results

Date: Sunday 5th - Monday 6th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 20**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position B - Kelham Manor**
Instrumentation: Cirrus 1710 Real Time Analyser (G066350)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	58.4	60.3	55.6	63.4	
07:15	15:00	60.0	61.5	57.4	64.5	
07:30	15:00	60.2	62.1	57.4	66.8	
07:45	15:00	60.1	61.8	57.1	65.0	
08:00	15:00	59.2	60.7	57.0	66.4	
08:15	15:00	57.9	59.8	55.0	66.9	
08:30	15:00	58.8	60.5	56.4	65.6	
08:45	15:00	59.6	61.6	56.7	65.2	
09:00	15:00	58.6	60.5	55.3	63.9	
Average 0700-0915		59.2	61.0	56.5	63-67	

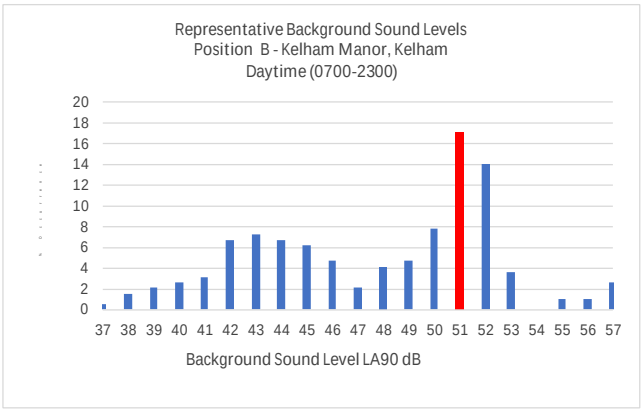
Overall Av. 2300-0700	**48.7**	**52**	**41.9**	**46-65**	
Overall Av. 0700-2300	**53.6**	**55.6**	**49.7**	**53-78**	

Average 0500-0700	**52.8**	**55.7**	**47.2**	**53-64**
			39	

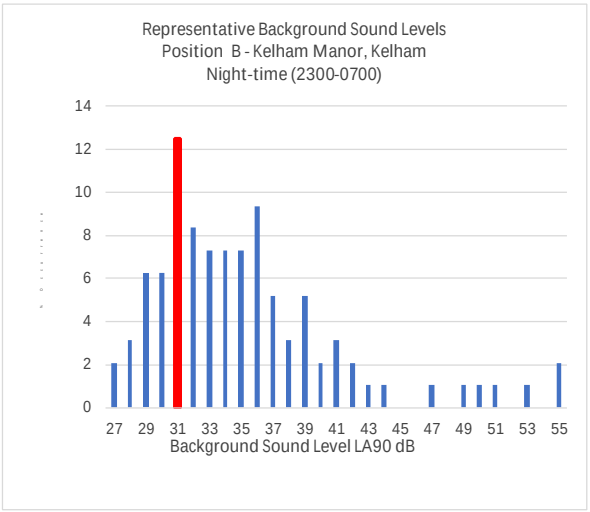


LA90 Representative Levels

LA90	% Occurrence
37	0.5
38	1.6
39	2.1
40	2.6
41	3.1
42	6.8
43	7.3
44	6.8
45	6.3
46	4.7
47	2.1
48	4.2
49	4.7
50	7.8
51	**17.2**
52	14.1
53	3.6
54	0.0
55	1.0
56	1.0
57	2.6



LA90	% Occurrence
27	2.1
28	3.1
29	6.3
30	6.3
31	**12.5**
32	8.3
33	7.3
34	7.3
35	7.3
36	9.4
37	5.2
38	3.1
39	5.2
40	2.1
41	3.1
42	2.1
43	1.0
44	1.0
45	0.0
46	0.0
47	1.0
48	0.0
49	1.0
50	1.0
51	1.0
52	0.0
53	1.0
54	0.0
55	2.1



Noise Survey Results

Date: Friday 3rd February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 21**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
10:45	15:00	52.4	53.0	48.6	65.4	Distant road traffic noise
11:00	15:00	49.9	51.5	47.3	59.0	
11:15	15:00	50.1	52.0	46.7	60.3	
11:30	15:00	47.7	49.8	44.4	62.9	
11:45	15:00	45.8	47.4	43.4	58.7	
12:00	15:00	46.8	49.1	43.3	54.6	
12:15	15:00	52.2	55.2	48.5	60.3	
12:30	15:00	53.5	56.0	49.8	63.8	
12:45	15:00	54.8	56.7	51.6	61.8	
13:00	15:00	55.6	58.2	51.8	66.4	
13:15	15:00	53.0	55.4	50.0	62.5	
13:30	15:00	54.7	57.1	51.0	61.3	
13:45	15:00	51.3	53.8	48.1	60.2	
14:00	15:00	49.2	51.3	46.0	59.4	
14:15	15:00	49.0	50.5	46.9	60.5	
14:30	15:00	50.0	51.3	48.1	66.4	
14:45	15:00	49.7	51.1	47.4	61.3	
Average 1045-1500		51.7	53.9	48.5	55-66	

Noise Survey Results

Date: Friday 3rd February 2023 **TABLE 22**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	49.7	51.4	47.1	63.2	
15:15	15:00	50.4	52.3	47.5	62.1	
15:30	15:00	49.3	51.0	46.8	58.7	
15:45	15:00	48.4	49.7	46.1	58.2	
16:00	15:00	48.5	49.8	46.6	56.2	
16:15	15:00	48.8	50.1	46.4	69.8	
16:30	15:00	47.9	49.4	45.6	64.3	
16:45	15:00	48.1	49.2	46.2	58.4	
17:00	15:00	48.8	51.4	45.4	61.4	
17:15	15:00	48.3	49.9	44.4	65.3	
17:30	15:00	47.2	48.6	45.3	52.4	
17:45	15:00	47.5	49.2	44.8	54.3	
18:00	15:00	47.3	48.9	44.5	56.8	
18:15	15:00	47.3	49.1	44.6	56.6	
18:30	15:00	47.7	49.9	44.3	55.4	
18:45	15:00	46.9	48.7	44.0	52.1	
19:00	15:00	46.6	48.5	43.5	52.3	
19:15	15:00	44.4	46.4	41.4	51.6	
19:30	15:00	45.8	48.0	42.1	55.9	
19:45	15:00	46.2	49.1	41.0	55.5	
20:00	15:00	45.6	48.2	39.0	55.4	
20:15	15:00	45.8	48.2	39.1	62.3	
20:30	15:00	44.4	47.2	37.6	53.1	
20:45	15:00	44.4	46.9	39.9	55.2	
21:00	15:00	45.0	47.7	39.3	56.8	
21:15	15:00	44.6	47.5	38.4	52.8	
21:30	15:00	44.5	47.6	38.6	55.3	
21:45	15:00	43.7	47.0	37.8	51.6	
22:00	15:00	43.4	46.2	39.0	53.0	
22:15	15:00	43.0	45.9	36.8	53.0	
22:30	15:00	42.4	45.4	36.9	52.7	
22:45	15:00	42.8	46.1	35.2	52.4	
Average 1500-2300		46.9	48.9	43.6	52-70	

Noise Survey Results

Date: Friday 3rd - Saturday 4th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 23**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	42.7	45.6	35.9	55.0	
23:15	15:00	41.9	44.9	35.7	50.9	
23:30	15:00	41.6	45.1	34.1	50.8	
23:45	15:00	41.9	44.9	34.0	53.8	
00:00	15:00	40.4	43.2	34.7	53.4	
00:15	15:00	37.8	41.2	27.5	47.9	
00:30	15:00	38.0	41.6	31.1	48.0	
00:45	15:00	36.8	40.7	28.9	48.7	
01:00	15:00	37.1	40.5	30.7	49.4	
01:15	15:00	36.2	40.1	27.3	48.2	
01:30	15:00	39.6	41.5	27.3	58.9	
01:45	15:00	35.9	39.4	26.0	50.3	
02:00	15:00	36.1	40.6	26.8	47.5	
02:15	15:00	36.5	40.0	27.2	52.0	
02:30	15:00	34.8	38.1	27.8	47.6	
02:45	15:00	42.5	43.4	31.1	67.4	
03:00	15:00	37.0	40.6	30.6	51.5	
03:15	15:00	37.0	41.3	30.5	49.2	
03:30	15:00	38.4	42.1	30.0	50.9	
03:45	15:00	36.9	41.3	28.0	48.5	
04:00	15:00	37.6	40.9	29.5	53.1	
04:15	15:00	41.5	45.0	32.8	53.3	
04:30	15:00	38.4	42.2	30.5	52.0	
04:45	15:00	39.8	43.8	30.8	51.3	
05:00	15:00	40.4	44.2	30.7	54.5	
05:15	15:00	41.7	45.3	33.4	51.7	
05:30	15:00	43.8	46.2	39.1	52.5	
05:45	15:00	42.9	45.8	36.4	52.5	
06:00	15:00	43.0	46.3	35.6	53.6	
06:15	15:00	44.2	47.3	38.3	54.8	
06:30	15:00	44.9	47.9	39.8	53.2	
06:45	15:00	45.8	47.9	39.7	63.4	
Average 2300-0700		40.8	43.8	33.8	48-67	
Average 1045-2300		49.4	51.5	46.1	52-70	

Noise Survey Results

Date: Saturday 4th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 24**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	53.3	57.9	43.1	66.3	
07:15	15:00	52.5	56.7	43.5	63.9	
07:30	15:00	59.5	56.5	47.3	67.4	
07:45	15:00	52.5	55.6	45.9	70.4	
08:00	15:00	52.7	55.9	47.4	64.0	
08:15	15:00	51.9	55.4	45.4	66.5	
08:30	15:00	52.4	55.6	47.2	67.3	
08:45	15:00	51.6	54.5	46.5	63.1	
09:00	15:00	49.4	51.3	46.4	56.5	
09:15	15:00	50.5	52.5	47.6	61.0	
09:30	15:00	52.3	55.7	46.4	64.9	
09:45	15:00	50.5	52.9	46.2	62.2	
10:00	15:00	51.4	54.6	47.2	62.2	
10:15	15:00	50.9	52.7	47.2	67.9	
10:30	15:00	51.1	53.1	47.6	64.9	
10:45	15:00	51.9	55.2	46.8	64.2	
11:00	15:00	50.7	52.8	47.4	60.4	
11:15	15:00	50.7	52.5	48.0	66.4	
11:30	15:00	49.8	51.6	47.3	58.0	
11:45	15:00	50.2	51.8	47.1	64.2	
12:00	15:00	48.8	50.4	46.4	60.2	
12:15	15:00	49.3	51.0	46.5	62.0	
12:30	15:00	50.0	51.8	47.5	60.0	
12:45	15:00	49.2	51.0	46.4	57.4	
13:00	15:00	50.0	52.0	46.9	61.2	
13:15	15:00	50.8	53.5	47.0	66.3	
13:30	15:00	50.7	53.4	46.9	61.8	
13:45	15:00	50.2	52.1	47.2	60.5	
14:00	15:00	49.7	51.7	46.5	60.6	
14:15	15:00	50.1	52.1	47.1	71.2	
14:30	15:00	50.1	52.0	47.1	67.8	
14:45	15:00	49.8	51.4	47.1	61.1	
Average 0700-1500		51.7	53.8	46.7	57-71	

Noise Survey Results

Date: Saturday 4th February 2023 **TABLE 25**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	50.3	52.4	46.3	60.3	
15:15	15:00	49.5	51.1	46.8	60.7	
15:30	15:00	49.8	51.7	46.5	59.6	
15:45	15:00	50.6	52.5	47.7	65.1	
16:00	15:00	49.8	51.6	47.3	57.7	
16:15	15:00	49.4	51.3	46.2	59.3	
16:30	15:00	49.8	51.5	46.7	64.0	
16:45	15:00	50.0	51.9	46.9	60.7	
17:00	15:00	49.7	51.4	47.0	62.2	
17:15	15:00	50.4	52.3	45.7	66.2	
17:30	15:00	50.2	51.7	45.5	65.2	
17:45	15:00	49.0	51.0	45.2	59.4	
18:00	15:00	48.0	50.3	43.8	56.1	
18:15	15:00	47.6	49.9	43.3	61.7	
18:30	15:00	47.2	49.2	43.9	56.1	
18:45	15:00	46.5	48.2	44.0	54.2	
19:00	15:00	46.8	48.9	43.5	55.0	
19:15	15:00	45.7	47.8	41.7	56.9	
19:30	15:00	45.4	48.0	40.5	57.2	
19:45	15:00	44.6	47.6	38.6	54.8	
20:00	15:00	45.4	48.2	40.3	55.5	
20:15	15:00	45.2	48.3	39.3	55.3	
20:30	15:00	45.5	48.3	40.3	56.1	
20:45	15:00	44.9	48.0	39.6	53.5	
21:00	15:00	45.5	48.3	41.0	55.0	
21:15	15:00	44.0	46.9	38.9	57.9	
21:30	15:00	43.7	46.3	38.6	52.5	
21:45	15:00	41.6	43.9	37.0	50.0	
22:00	15:00	40.8	43.3	36.4	51.3	
22:15	15:00	39.3	41.3	36.4	46.4	
22:30	15:00	38.0	40.7	34.3	49.8	
22:45	15:00	38.6	40.6	35.7	50.0	
Average 1500-2300		47.5	49.5	43.8	46-66	

Noise Survey Results

Date: Saturday 4th - Sunday 5th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 26**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	37.0	39.6	32.5	47.8	
23:15	15:00	35.9	37.9	32.8	43.6	
23:30	15:00	35.3	37.9	30.9	42.5	
23:45	15:00	36.6	39.2	31.0	48.0	
00:00	15:00	36.0	36.7	31.3	64.7	
00:15	15:00	34.0	36.5	29.3	48.6	
00:30	15:00	34.1	36.2	30.3	41.5	
00:45	15:00	34.8	37.4	30.1	44.0	
01:00	15:00	32.6	35.2	28.5	47.4	
01:15	15:00	33.3	35.7	29.5	43.7	
01:30	15:00	31.8	34.3	26.3	49.9	
01:45	15:00	32.9	34.2	27.6	53.3	
02:00	15:00	32.0	34.2	27.7	43.5	
02:15	15:00	30.4	32.4	27.3	39.2	
02:30	15:00	34.0	37.0	29.4	45.0	
02:45	15:00	31.9	33.8	29.0	41.9	
03:00	15:00	31.0	32.5	27.7	41.8	
03:15	15:00	31.6	35.0	25.6	43.8	
03:30	15:00	33.5	36.8	28.4	45.7	
03:45	15:00	34.3	37.4	29.3	45.5	
04:00	15:00	33.9	35.5	31.0	43.6	
04:15	15:00	34.1	36.6	30.8	43.4	
04:30	15:00	35.1	37.3	31.2	44.0	
04:45	15:00	35.9	37.5	33.3	43.6	
05:00	15:00	38.2	40.1	34.6	49.1	
05:15	15:00	37.3	39.2	34.4	45.2	
05:30	15:00	37.3	39.0	35.0	43.8	
05:45	15:00	37.6	40.0	34.3	45.8	
06:00	15:00	39.2	40.1	35.2	61.0	
06:15	15:00	40.5	41.9	38.1	49.8	
06:30	15:00	40.9	41.7	37.9	60.9	
06:45	15:00	50.3	55.3	39.1	66.5	
Average 2300-0700		38.4	42.1	32.7	39-67	
Average 0700-2300		50.1	52.1	45.5	46-71	

Noise Survey Results

Date: Sunday 5th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 27**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	51.8	56.4	40.3	68.2	
07:15	15:00	46.5	49.6	40.2	62.9	
07:30	15:00	51.2	54.9	44.7	65.4	
07:45	15:00	52.4	56.1	45.5	64.4	
08:00	15:00	49.6	52.8	43.3	68.3	
08:15	15:00	50.7	54.5	43.6	65.2	
08:30	15:00	51.0	54.5	45.1	66.3	
08:45	15:00	48.9	51.3	43.4	67.5	
09:00	15:00	46.6	48.2	42.2	64.5	
09:15	15:00	50.8	54.6	42.2	68.7	
09:30	15:00	50.5	54.7	42.3	64.3	
09:45	15:00	68.4	46.2	40.6	68.0	
10:00	15:00	45.5	47.5	40.4	64.6	
10:15	15:00	46.0	48.7	40.8	58.6	
10:30	15:00	44.7	46.7	40.8	61.2	
10:45	15:00	45.3	47.2	40.6	62.5	
11:00	15:00	48.1	52.2	40.1	65.5	
11:15	15:00	47.1	49.3	39.5	66.8	
11:30	15:00	45.5	48.9	38.8	62.0	
11:45	15:00	47.9	49.6	39.5	66.5	
12:00	15:00	46.1	46.5	39.8	69.8	
12:15	15:00	45.4	46.9	38.7	71.7	
12:30	15:00	46.1	49.3	39.4	61.9	
12:45	15:00	43.7	44.3	37.6	70.1	
13:00	15:00	42.7	43.5	38.0	62.7	
13:15	15:00	45.6	47.2	38.8	62.2	
13:30	15:00	56.3	54.2	40.3	77.8	
13:45	15:00	44.8	47.5	39.0	59.3	
14:00	15:00	45.4	47.7	39.9	63.2	
14:15	15:00	43.6	45.8	38.2	59.5	
14:30	15:00	43.3	45.4	36.6	62.6	
14:45	15:00	40.2	42.1	36.4	53.4	
Average 0700-1500		54.5	51.2	41.1	53-78	

Noise Survey Results

Date: Sunday 5th February 2023 **TABLE 28**
Location: Kelham, Newark, Nottinghamshire
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
15:00	15:00	41.7	44.1	37.4	54.6	
15:15	15:00	44.4	47.2	38.9	58.6	
15:30	15:00	44.5	46.3	39.8	62.9	
15:45	15:00	45.3	47.9	40.0	60.2	
16:00	15:00	45.5	48.0	40.8	60.2	
16:15	15:00	47.0	48.9	41.9	63.9	
16:30	15:00	47.0	48.9	43.9	57.6	
16:45	15:00	51.0	51.7	47.2	71.2	
17:00	15:00	49.5	51.4	46.6	58.1	
17:15	15:00	51.5	55.1	44.5	65.1	
17:30	15:00	48.5	50.3	45.3	60.0	
17:45	15:00	47.8	50.1	43.8	54.5	
18:00	15:00	47.6	49.3	43.8	65.3	
18:15	15:00	47.0	49.2	43.5	53.9	
18:30	15:00	47.2	49.5	43.4	53.0	
18:45	15:00	47.1	49.7	42.9	55.3	
19:00	15:00	46.9	49.3	42.3	53.9	
19:15	15:00	47.1	49.5	42.1	54.7	
19:30	15:00	47.3	50.0	42.5	56.9	
19:45	15:00	46.3	49.3	40.2	56.5	
20:00	15:00	46.9	49.6	41.5	56.1	
20:15	15:00	45.4	47.7	40.5	53.2	
20:30	15:00	46.0	48.5	41.3	54.2	
20:45	15:00	45.7	48.2	41.6	55.9	
21:00	15:00	45.9	49.2	38.9	60.4	
21:15	15:00	46.7	48.6	39.6	60.2	
21:30	15:00	47.7	50.9	40.9	60.3	
21:45	15:00	47.8	51.4	41.3	58.5	
22:00	15:00	46.4	49.3	40.8	54.9	
22:15	15:00	47.3	50.7	41.1	62.6	
22:30	15:00	49.4	52.6	42.8	59.3	
22:45	15:00	48.0	51.7	41.8	57.0	
Average 1500-2300		47.3	49.9	42.5	53-71	

Noise Survey Results

Date: Sunday 5th - Monday 6th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 29**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
23:00	15:00	50.1	53.6	37.0	56.2	
23:15	15:00	48.9	52.5	36.2	55.6	
23:30	15:00	48.6	52.7	36.9	56.8	
23:45	15:00	48.8	52.9	34.6	55.9	
00:00	15:00	48.3	50.3	36.1	54.3	
00:15	15:00	44.6	47.6	31.2	54.2	
00:30	15:00	44.8	47.8	33.0	54.6	
00:45	15:00	45.1	48.6	30.6	55.9	
01:00	15:00	44.1	46.1	30.8	56.1	
01:15	15:00	42.8	45.8	28.2	53.2	
01:30	15:00	42.2	45.6	28.5	53.6	
01:45	15:00	41.9	46.1	27.6	52.2	
02:00	15:00	43.2	48.5	27.5	53.9	
02:15	15:00	43.7	47.9	29.3	56.4	
02:30	15:00	41.8	41.5	31.4	58.9	
02:45	15:00	47.4	50.8	31.0	61.5	
03:00	15:00	48.3	51.3	32.2	62.1	
03:15	15:00	47.6	51.9	33.8	61.5	
03:30	15:00	48.4	50.3	37.1	62.9	
03:45	15:00	49.4	52.1	38.6	61.2	
04:00	15:00	51.0	52.9	41.0	62.3	
04:15	15:00	49.9	55.0	40.4	64.8	
04:30	15:00	50.3	56.2	41.9	67.0	
04:45	15:00	50.3	55.8	44.7	67.3	
05:00	15:00	51.3	55.5	41.4	61.2	
05:15	15:00	51.8	56.2	46.0	62.8	
05:30	15:00	50.8	53.5	45.6	63.0	
05:45	15:00	51.9	54.9	46.7	63.3	
06:00	15:00	51.2	53.2	47.5	67.2	
06:15	15:00	51.7	53.5	47.8	65.8	
06:30	15:00	52.6	55.7	47.0	65.0	
06:45	15:00	52.2	53.2	47.9	61.1	
Average 2300-0700		49.0	52.5	41.7	52-67	
Average 0700-2300		52.3	50.6	41.8	53-78	

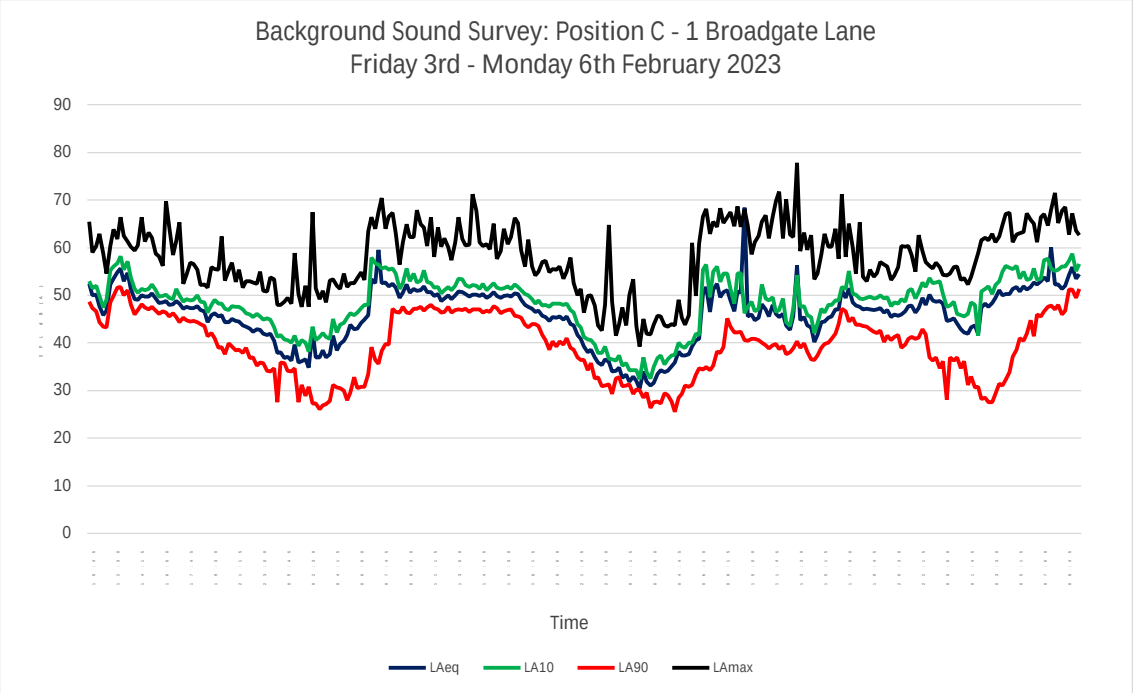
Noise Survey Results

Date: Sunday 5th - Monday 6th February 2023
Location: Kelham, Newark, Nottinghamshire **TABLE 30**
Client: Sirius Planning
Project: Solar Farm & BESS Facility
Data: **Baseline Sound Survey: Position C - 1 Broadgate Lane**
Instrumentation: Cirrus 171B Real Time Analyser (G056142)
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	53.0	53.5	48.0	66.3	
07:15	15:00	53.7	57.3	42.6	67.1	
07:30	15:00	53.0	57.6	43.3	64.6	
07:45	15:00	60.1	55.6	47.0	68.0	
08:00	15:00	52.2	55.1	46.1	71.5	
08:15	15:00	52.2	55.3	47.9	65.2	
08:30	15:00	51.3	56.0	46.0	67.8	
08:45	15:00	52.0	56.0	46.8	68.5	
09:00	15:00	54.3	57.2	51.2	62.7	
09:15	15:00	55.9	58.8	51.2	67.2	
09:30	15:00	53.5	55.1	49.5	63.6	
09:45	15:00	54.4	56.6	51.3	62.6	
Average 0700-1000		54.5	56.3	48.4	63-72	

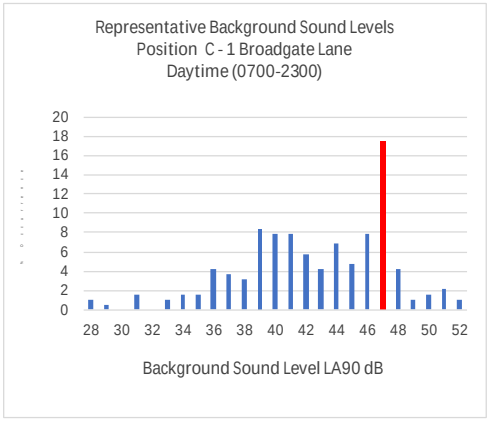
Overall Av. 2300-0700	**45.2**	**48.6**	**38.1**	**39-67**	
Overall Av. 0700-2300	**51.2**	**51.9**	**45.0**	**46-78**	

Average 0500-0700	**48**	**51.1**	**42.6**	**44-67**
			38	

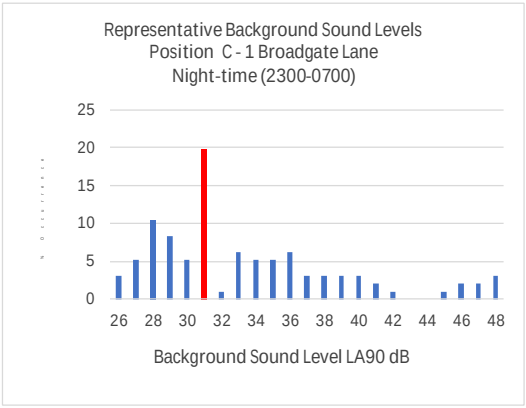


LA90 Representative Levels

LA90	% Occurrence
28	1.1
29	0.5
30	0
31	1.6
32	0.0
33	1.1
34	1.6
35	1.6
36	4.2
37	3.7
38	3.2
39	8.5
40	7.9
41	7.9
42	5.8
43	4.2
44	6.9
45	4.8
46	7.9
47	**17.5**
48	4.2
49	1.1
50	1.6
51	2.1
52	1.1



LA90	% Occurrence
26	3.1
27	5.2
28	10.4
29	8.3
30	5.2
31	**19.8**
32	1.0
33	6.3
34	5.2
35	5.2
36	6.3
37	3.1
38	3.1
39	3.1
40	3.1
41	2.1
42	1.0
43	0.0
44	0.0
45	1.0
46	2.1
47	2.1
48	3.1



Weather Conditions for Baseline Survey

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
03/02/2023	09:50	11.7	1.8	SE	783.3	0
03/02/2023	10:00	11.3	3.1	SE	783.3	0
03/02/2023	10:10	11.4	3.1	SE	783.5	0
03/02/2023	10:20	11.5	2.7	SE	783.5	0
03/02/2023	10:30	11.6	3.1	SE	783.4	0
03/02/2023	10:40	11.7	3.6	SE	783.5	0
03/02/2023	10:50	11.8	3.1	SE	783.6	0
03/02/2023	11:00	11.9	3.1	SE	783.8	0
03/02/2023	11:10	12.1	2.7	SE	783.9	0
03/02/2023	11:20	12.3	3.1	SE	783.8	0
03/02/2023	11:30	12.4	3.1	SE	784	0
03/02/2023	11:40	12.6	3.1	SE	784	0
03/02/2023	11:50	12.7	2.7	SSE	784.3	0
03/02/2023	12:00	12.7	2.2	S	784.4	0
03/02/2023	12:10	12.8	1.8	S	784.4	0
03/02/2023	12:20	13.1	2.7	SSE	784.5	0
03/02/2023	12:30	13	3.1	SE	784.5	0
03/02/2023	12:40	12.9	3.1	SE	784.2	0
03/02/2023	12:50	12.6	4	SE	784.2	0
03/02/2023	13:00	12.7	4	SE	784.3	0
03/02/2023	13:10	12.6	4	SE	784.3	0
03/02/2023	13:20	12.7	4	SE	784.4	0
03/02/2023	13:30	12.9	4.1	SE	784.5	0
03/02/2023	13:40	13.1	4.1	SE	784.5	0
03/02/2023	13:50	13	3.6	SE	784.4	0
03/02/2023	14:00	12.8	3.9	SE	784.2	0
03/02/2023	14:10	12.8	3.7	SE	784.5	0
03/02/2023	14:20	12.7	3.6	SE	784.5	0
03/02/2023	14:30	12.7	2.7	SE	784.5	0
03/02/2023	14:40	12.4	3.1	SE	784.6	0
03/02/2023	14:50	12.2	2.7	SE	784.7	0
03/02/2023	15:00	12.5	2.7	SE	784.6	0
03/02/2023	15:10	12.4	3.1	SE	784.8	0
03/02/2023	15:20	12.2	2.2	SE	784.9	0
03/02/2023	15:30	12	2.2	SE	784.9	0
03/02/2023	15:40	12.1	3.1	SE	784.9	0
03/02/2023	15:50	12	2.7	SE	785.1	0
03/02/2023	16:00	11.9	2.2	SE	785.1	0
03/02/2023	16:10	11.9	1.8	SE	785.4	0
03/02/2023	16:20	12	1.8	SE	785.5	0
03/02/2023	16:30	11.9	2.2	SE	785.4	0
03/02/2023	16:40	11.7	1.8	SE	785.6	0
03/02/2023	16:50	11.5	2.2	SE	785.7	0
03/02/2023	17:00	11.3	1.8	SE	786	0
03/02/2023	17:10	11.3	2.2	SE	786.1	0
03/02/2023	17:20	11.2	2.2	SE	786.1	0
03/02/2023	17:30	11.1	1.8	SE	786.2	0
03/02/2023	17:40	10.9	1.8	SE	786.1	0

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
03/02/2023	17:50	10.6	1.8	SE	786.3	0
03/02/2023	18:00	10.2	1.8	SE	786.2	0
03/02/2023	18:10	9.9	1.3	SE	786.1	0
03/02/2023	18:20	9.4	0.9	ESE	786.3	0
03/02/2023	18:30	9.1	0.4	SE	786.3	0
03/02/2023	18:40	8.6	0.4	ESE	786.3	0
03/02/2023	18:50	8.5	0.9	ESE	786.3	0
03/02/2023	19:00	8.7	1.3	SE	786.4	0
03/02/2023	19:10	8.6	0.4	ESE	786.6	0
03/02/2023	19:20	8.2	0	---	786.7	0
03/02/2023	19:30	7.9	0	SSE	786.7	0
03/02/2023	19:40	7.6	0	SSE	786.7	0
03/02/2023	19:50	7.4	0	SSE	786.7	0
03/02/2023	20:00	6.3	0	SE	786.8	0
03/02/2023	20:10	7.3	0.9	SE	786.8	0
03/02/2023	20:20	8	1.3	SE	786.9	0
03/02/2023	20:30	8.1	0.9	SE	787	0
03/02/2023	20:40	7.7	0.4	SSE	787	0
03/02/2023	20:50	7.2	0.4	ESE	787	0
03/02/2023	21:00	7.3	0.4	SE	787	0
03/02/2023	21:10	7.9	0.4	SE	787.1	0
03/02/2023	21:20	7.9	0.9	SE	787.1	0
03/02/2023	21:30	7.8	0.9	ESE	787.2	0
03/02/2023	21:40	7.9	0	WSW	787.5	0
03/02/2023	21:50	7.7	0	---	787.4	0
03/02/2023	22:00	7.9	0.4	ESE	787.3	0
03/02/2023	22:10	8.1	0.4	E	787.5	0
03/02/2023	22:20	8.1	0	---	787.6	0
03/02/2023	22:30	8.1	0	---	787.7	0
03/02/2023	22:40	7.9	0	---	787.7	0
03/02/2023	22:50	8.1	0.4	E	787.8	0
03/02/2023	23:00	8.2	0.4	SE	787.6	0
03/02/2023	23:10	8.3	0.4	ESE	787.8	0
03/02/2023	23:20	8.3	0.4	ESE	787.7	0
03/02/2023	23:30	8.3	0.4	ESE	787.9	0
03/02/2023	23:40	8.3	0	SSE	787.9	0
03/02/2023	23:50	8.2	0	SSE	788.2	0
04/02/2023	00:00	8	0.4	ESE	788.1	0
04/02/2023	00:10	8.1	0.4	E	788.1	0
04/02/2023	00:20	8.1	0	E	788.3	0
04/02/2023	00:30	8.1	0	SE	788.3	0
04/02/2023	00:40	8.1	0	---	788.3	0
04/02/2023	00:50	8.1	0	SE	788.3	0
04/02/2023	01:00	8.2	0	SE	788.2	0
04/02/2023	01:10	8.2	0	SE	788.3	0
04/02/2023	01:20	8.3	0.4	SE	788.2	0
04/02/2023	01:30	8.3	0.4	ESE	788.3	0
04/02/2023	01:40	8.4	0	SSE	788.5	0

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
04/02/2023	01:50	8.4	0	---	788.5	0
04/02/2023	02:00	8.4	0.4	ESE	788.5	0
04/02/2023	02:10	8.5	0.4	ESE	788.5	0
04/02/2023	02:20	8.4	0.4	ESE	788.5	0
04/02/2023	02:30	8.4	0	E	788.3	0
04/02/2023	02:40	8.3	0	ESE	788.3	0
04/02/2023	02:50	8.4	0.4	ESE	788.2	0
04/02/2023	03:00	8.4	0.4	ESE	788.3	0
04/02/2023	03:10	8.4	0.9	ESE	788.2	0
04/02/2023	03:20	8.5	0.9	ESE	788.1	0
04/02/2023	03:30	8.7	1.3	ESE	788.2	0
04/02/2023	03:40	8.7	0.9	SE	788.1	0
04/02/2023	03:50	8.8	1.3	ESE	788.2	0
04/02/2023	04:00	8.8	1.3	SE	788.2	0
04/02/2023	04:10	8.9	1.3	SE	788.2	0
04/02/2023	04:20	8.8	1.3	ESE	788.2	0
04/02/2023	04:30	8.9	1.8	ESE	788.2	0
04/02/2023	04:40	8.9	1.8	ESE	788.3	0
04/02/2023	04:50	8.8	1.3	ESE	788.4	0
04/02/2023	05:00	8.9	1.3	ESE	788.5	0
04/02/2023	05:10	8.9	1.3	ESE	788.5	0
04/02/2023	05:20	8.9	1.3	ESE	788.5	0
04/02/2023	05:30	8.9	1.3	ESE	788.5	0
04/02/2023	05:40	8.8	1.3	ESE	788.5	0
04/02/2023	05:50	8.8	1.3	ESE	788.6	0
04/02/2023	06:00	8.8	1.3	ESE	788.6	0
04/02/2023	06:10	8.8	1.3	SE	788.7	0
04/02/2023	06:20	8.8	1.3	ESE	788.7	0
04/02/2023	06:30	8.8	1.3	ESE	788.7	0
04/02/2023	06:40	8.8	1.8	ESE	788.7	0
04/02/2023	06:50	8.8	1.3	ESE	788.7	0
04/02/2023	07:00	8.8	1.8	ESE	788.6	0
04/02/2023	07:10	8.7	1.8	ESE	788.7	0
04/02/2023	07:20	8.7	1.3	ESE	788.8	0
04/02/2023	07:30	8.8	1.3	ESE	788.9	0
04/02/2023	07:40	8.7	1.3	ESE	788.9	0
04/02/2023	07:50	8.7	1.3	ESE	789.1	0
04/02/2023	08:00	8.6	0.9	ESE	789.1	0
04/02/2023	08:10	8.7	1.8	ESE	789.2	0
04/02/2023	08:20	8.7	1.3	ESE	789.4	0
04/02/2023	08:30	8.7	1.3	ESE	789.4	0
04/02/2023	08:40	8.7	1.3	ESE	789.5	0
04/02/2023	08:50	8.8	1.3	ESE	789.6	0
04/02/2023	09:00	8.8	1.3	ESE	789.6	0
04/02/2023	09:10	8.9	1.8	ESE	789.6	0
04/02/2023	09:20	9	1.8	ESE	789.6	0
04/02/2023	09:30	9.1	1.8	ESE	789.6	0
04/02/2023	09:40	9.2	1.8	ESE	789.5	0

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
04/02/2023	09:50	9.3	1.8	ESE	789.6	0
04/02/2023	10:00	9.5	2.2	ESE	789.6	0
04/02/2023	10:10	9.5	2.2	ESE	789.7	0
04/02/2023	10:20	9.6	2.2	ESE	789.7	0
04/02/2023	10:30	9.6	2.2	ESE	789.7	0
04/02/2023	10:40	9.7	2.2	ESE	789.7	0
04/02/2023	10:50	9.7	2.2	ESE	789.8	0
04/02/2023	11:00	9.7	2.7	ESE	789.9	0
04/02/2023	11:10	9.8	2.7	ESE	789.9	0
04/02/2023	11:20	9.8	2.7	ESE	790.1	0
04/02/2023	11:30	9.8	2.7	ESE	790.1	0
04/02/2023	11:40	9.8	2.7	ESE	790	0
04/02/2023	11:50	9.8	2.7	ESE	790	0
04/02/2023	12:00	9.8	2.2	ESE	790.1	0
04/02/2023	12:10	9.8	2.2	ESE	790.1	0
04/02/2023	12:20	9.8	1.8	ESE	790	0
04/02/2023	12:30	9.8	1.8	ESE	790.2	0
04/02/2023	12:40	9.7	2.2	ESE	790.2	0
04/02/2023	12:50	9.6	2.2	ESE	790.2	0
04/02/2023	13:00	9.7	1.8	ESE	790.2	0
04/02/2023	13:10	9.7	1.3	ESE	790.1	0
04/02/2023	13:20	9.6	2.2	ESE	790.1	0
04/02/2023	13:30	9.7	1.8	ESE	790.1	0
04/02/2023	13:40	9.7	1.3	ESE	790.1	0
04/02/2023	13:50	9.8	1.8	ESE	790	0
04/02/2023	14:00	9.9	1.8	ESE	789.9	0
04/02/2023	14:10	9.9	1.8	ESE	789.7	0
04/02/2023	14:20	9.8	1.8	ESE	789.7	0
04/02/2023	14:30	9.8	1.8	ESE	789.7	0
04/02/2023	14:40	9.8	2.2	E	789.6	0
04/02/2023	14:50	9.8	1.8	E	789.6	0
04/02/2023	15:00	9.7	1.8	E	789.5	0
04/02/2023	15:10	9.7	1.3	E	789.5	0
04/02/2023	15:20	9.7	1.3	E	789.5	0
04/02/2023	15:30	9.7	1.3	E	789.6	0
04/02/2023	15:40	9.7	1.3	E	789.6	0
04/02/2023	15:50	9.6	1.3	ESE	789.7	0
04/02/2023	16:00	9.6	1.8	ESE	789.7	0
04/02/2023	16:10	9.6	1.3	ESE	789.8	0
04/02/2023	16:20	9.6	2.2	ESE	789.9	0
04/02/2023	16:30	9.5	1.3	ESE	789.9	0
04/02/2023	16:40	9.4	1.3	ESE	790	0
04/02/2023	16:50	9.4	1.3	ESE	790	0
04/02/2023	17:00	9.3	1.3	ESE	790	0
04/02/2023	17:10	9.3	1.3	ESE	790	0
04/02/2023	17:20	9.2	1.3	ESE	790.1	0
04/02/2023	17:30	9.2	0.9	E	790.2	0
04/02/2023	17:40	9.2	1.8	E	790	0

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
04/02/2023	17:50	9.1	1.8	E	790.1	0
04/02/2023	18:00	9.1	0.9	ESE	790.2	0
04/02/2023	18:10	9.1	1.3	ESE	790.3	0
04/02/2023	18:20	9.1	1.3	E	790.2	0
04/02/2023	18:30	9	1.3	E	790.2	0
04/02/2023	18:40	9	1.3	ESE	790.3	0
04/02/2023	18:50	9.1	1.3	ESE	790.4	0
04/02/2023	19:00	9	1.3	ESE	790.5	0
04/02/2023	19:10	8.9	1.3	ESE	790.5	0
04/02/2023	19:20	9	1.3	ESE	790.5	0
04/02/2023	19:30	9.1	1.3	ESE	790.5	0
04/02/2023	19:40	8.8	0.9	E	790.4	0
04/02/2023	19:50	8.4	0.4	E	790.4	0
04/02/2023	20:00	7.8	0.9	ESE	790.5	0
04/02/2023	20:10	7.3	0.9	ESE	790.6	0
04/02/2023	20:20	6.9	0.4	W	790.5	0
04/02/2023	20:30	7.4	0.4	W	790.6	0
04/02/2023	20:40	7.6	0.4	W	790.6	0
04/02/2023	20:50	7.6	0.4	W	790.4	0
04/02/2023	21:00	7.7	0.4	WSW	790.5	0
04/02/2023	21:10	7.4	0.4	WSW	790.6	0
04/02/2023	21:20	7.4	0	W	790.7	0
04/02/2023	21:30	7.7	0.4	SSE	790.7	0
04/02/2023	21:40	7.9	0.4	W	790.8	0
04/02/2023	21:50	8.1	0.9	SSW	790.9	0
04/02/2023	22:00	8.6	1.3	SW	790.9	0
04/02/2023	22:10	8.8	1.3	SW	790.9	0
04/02/2023	22:20	8.9	1.3	SW	791.1	0
04/02/2023	22:30	9.1	1.8	SSW	791.1	0
04/02/2023	22:40	9.2	3.1	S	791.1	0
04/02/2023	22:50	9.1	2.7	S	791.4	0
04/02/2023	23:00	8.8	3.1	S	791.6	0
04/02/2023	23:10	8.4	2.7	S	791.7	0
04/02/2023	23:20	8.2	3.1	S	791.8	0
04/02/2023	23:30	7.7	2.2	S	791.8	0
04/02/2023	23:40	7.3	1.8	S	791.8	0
04/02/2023	23:50	7.3	2.2	S	792.1	0
05/02/2023	00:00	6.8	1.3	S	792	0
05/02/2023	00:10	6.2	1.3	SSW	792.3	0
05/02/2023	00:20	5.6	0.9	SSW	792.5	0
05/02/2023	00:30	5.6	0.9	SSW	792.7	0
05/02/2023	00:40	5.2	0.9	SSW	792.9	0
05/02/2023	00:50	4.9	0.9	SSW	792.9	0
05/02/2023	01:00	5.1	1.3	S	792.6	0
05/02/2023	01:10	5.3	1.8	S	793	0
05/02/2023	01:20	5.1	1.3	S	792.9	0
05/02/2023	01:30	5	1.3	S	793.2	0
05/02/2023	01:40	4.7	1.3	S	793.1	0

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
05/02/2023	01:50	4.3	0.9	SSE	793.1	0
05/02/2023	02:00	4.1	0.9	S	793.4	0
05/02/2023	02:10	4.2	1.3	S	793.6	0
05/02/2023	02:20	3.9	0.9	S	793.7	0
05/02/2023	02:30	4.1	1.8	S	794.1	0
05/02/2023	02:40	4.1	1.8	S	794.3	0
05/02/2023	02:50	4	1.3	S	794.4	0
05/02/2023	03:00	4.1	1.8	S	794.6	0
05/02/2023	03:10	3.9	1.3	S	794.7	0
05/02/2023	03:20	3.7	1.8	S	794.7	0
05/02/2023	03:30	3.6	1.3	S	794.8	0
05/02/2023	03:40	3.4	0.9	S	794.9	0
05/02/2023	03:50	3.1	0.9	SSE	794.9	0
05/02/2023	04:00	3	0.9	S	794.9	0
05/02/2023	04:10	2.9	1.3	S	795.3	0
05/02/2023	04:20	2.9	1.3	S	795.3	0
05/02/2023	04:30	3.1	1.8	S	795.1	0
05/02/2023	04:40	2.9	1.8	S	795.1	0
05/02/2023	04:50	3.1	2.2	S	795.4	0
05/02/2023	05:00	2.9	1.8	S	795.7	0
05/02/2023	05:10	2.8	1.3	S	795.8	0
05/02/2023	05:20	3.3	2.2	S	795.9	0
05/02/2023	05:30	3.4	2.2	S	796	0
05/02/2023	05:40	3.6	2.2	S	796.2	0
05/02/2023	05:50	3.3	1.8	S	796.4	0
05/02/2023	06:00	3.3	2.2	S	796.6	0
05/02/2023	06:10	3.4	2.7	S	796.7	0
05/02/2023	06:20	3.3	2.2	S	796.7	0
05/02/2023	06:30	3.3	2.2	S	796.7	0
05/02/2023	06:40	3.3	2.7	S	796.6	0
05/02/2023	06:50	3.3	1.8	SW	796.7	0
05/02/2023	07:00	3.2	1.8	SSW	796.8	0
05/02/2023	07:10	3.5	2.2	SW	796.7	0
05/02/2023	07:20	3.5	1.8	SSW	796.8	0
05/02/2023	07:30	3.6	1.8	SW	796.9	0
05/02/2023	07:40	3.4	1.8	SW	797.2	0
05/02/2023	07:50	3.1	1.3	WSW	797.3	0
05/02/2023	08:00	3.1	1.3	SW	797.5	0
05/02/2023	08:10	3.2	1.3	SSW	797.6	0
05/02/2023	08:20	3.3	1.8	SW	797.6	0
05/02/2023	08:30	3.3	1.8	SSW	797.7	0
05/02/2023	08:40	3.3	1.3	S	797.9	0
05/02/2023	08:50	3.4	1.3	SSW	797.8	0
05/02/2023	09:00	3.8	1.3	SW	797.8	0
05/02/2023	09:10	4	0.9	SSW	797.8	0
05/02/2023	09:20	4.2	0.4	SW	797.8	0
05/02/2023	09:30	4.4	0.4	S	797.8	0
05/02/2023	09:40	4.7	0.4	WSW	797.5	0

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
05/02/2023	09:50	4.9	0.9	S	797.5	0
05/02/2023	10:00	5.2	0.9	S	797.5	0
05/02/2023	10:10	5.6	0.4	S	797.8	0
05/02/2023	10:20	5.7	0.9	S	797.5	0
05/02/2023	10:30	5.9	0.9	SSW	797.4	0
05/02/2023	10:40	6.1	0.9	WSW	797.6	0
05/02/2023	10:50	6.2	1.3	WSW	797.7	0
05/02/2023	11:00	6.6	1.3	W	797.9	0
05/02/2023	11:10	6.6	1.3	WSW	797.9	0
05/02/2023	11:20	6.6	1.3	W	797.5	0
05/02/2023	11:30	6.6	1.3	W	797.5	0
05/02/2023	11:40	6.7	1.3	W	797.6	0
05/02/2023	11:50	6.9	1.3	W	797.9	0
05/02/2023	12:00	7.1	1.3	SW	797.9	0
05/02/2023	12:10	7.4	0.9	SW	797.9	0
05/02/2023	12:20	7.8	0.9	S	797.8	0
05/02/2023	12:30	7.7	1.3	WSW	798	0
05/02/2023	12:40	8.1	0.9	S	797.7	0
05/02/2023	12:50	7.8	0.4	WSW	797.8	0
05/02/2023	13:00	7.9	0.9	W	797.7	0
05/02/2023	13:10	7.8	0.9	W	797.6	0
05/02/2023	13:20	8.1	0	W	797.6	0
05/02/2023	13:30	7.9	0.4	S	797.4	0
05/02/2023	13:40	8.3	0.4	E	797.2	0
05/02/2023	13:50	8.1	0.9	E	797.2	0
05/02/2023	14:00	7.8	0.4	ESE	797.2	0
05/02/2023	14:10	8.2	0.4	S	797	0
05/02/2023	14:20	8.3	0.4	SSW	797.2	0
05/02/2023	14:30	8.2	0.4	SSW	797.1	0
05/02/2023	14:40	8.2	0	SSW	797	0
05/02/2023	14:50	7.9	0.4	ESE	796.8	0
05/02/2023	15:00	7.8	0	SSE	797	0
05/02/2023	15:10	8.2	0	S	797.1	0
05/02/2023	15:20	8.1	0.4	W	797.2	0
05/02/2023	15:30	8.1	0.4	S	797.2	0
05/02/2023	15:40	7.8	0	S	796.9	0
05/02/2023	15:50	7.7	0	W	796.8	0
05/02/2023	16:00	7.6	0	W	796.9	0
05/02/2023	16:10	7.3	0	W	796.9	0
05/02/2023	16:20	7.1	0	W	796.7	0
05/02/2023	16:30	6.8	0	---	796.8	0
05/02/2023	16:40	6.1	0	W	796.7	0
05/02/2023	16:50	5	0	W	796.7	0
05/02/2023	17:00	4.9	0	W	796.5	0
05/02/2023	17:10	4.8	0	---	796.5	0
05/02/2023	17:20	4.3	0	---	796.6	0
05/02/2023	17:30	4.5	0	---	796.6	0
05/02/2023	17:40	4.1	0	W	796.7	0

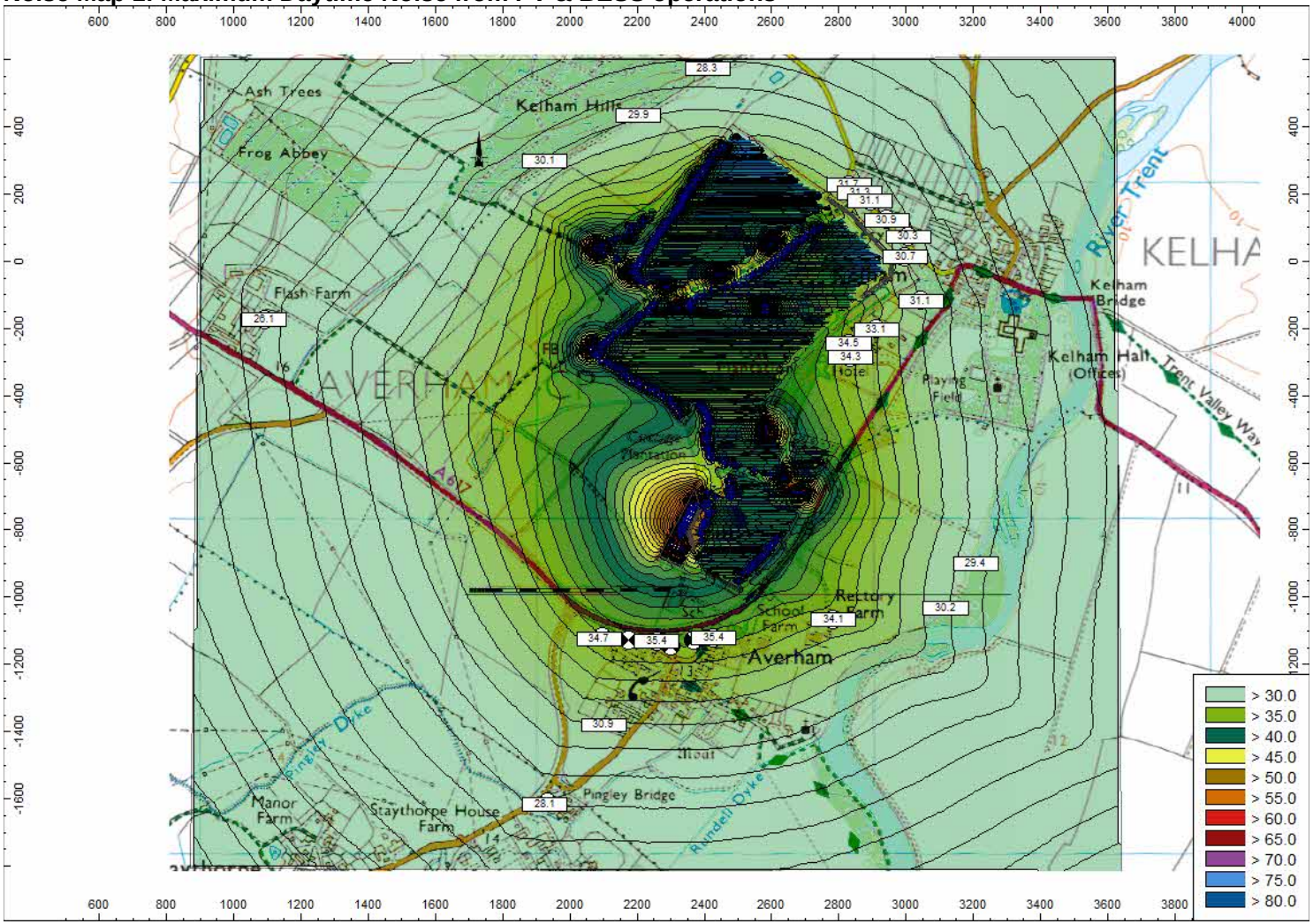
Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
05/02/2023	17:50	4.1	0	---	796.7	0
05/02/2023	18:00	3.8	0	S	796.8	0
05/02/2023	18:10	3.1	0	S	797.1	0
05/02/2023	18:20	2.8	0	S	797.1	0
05/02/2023	18:30	2.4	0	S	796.9	0
05/02/2023	18:40	2.3	0	S	797.1	0
05/02/2023	18:50	2.4	0	S	797.2	0
05/02/2023	19:00	2.3	0	SSE	797	0
05/02/2023	19:10	2.8	0	SSE	797.2	0
05/02/2023	19:20	2.6	0	SSE	797.2	0
05/02/2023	19:30	2.1	0	---	797.1	0
05/02/2023	19:40	1.7	0	SSE	797	0
05/02/2023	19:50	1.9	0	SSE	797	0
05/02/2023	20:00	1.8	0	SSW	797.1	0
05/02/2023	20:10	1.6	0	SW	797.1	0
05/02/2023	20:20	1.3	0	---	797.1	0
05/02/2023	20:30	1.3	0	SW	797.2	0
05/02/2023	20:40	1.2	0	SW	797.3	0
05/02/2023	20:50	1.1	0	---	797.3	0
05/02/2023	21:00	1.2	0	SW	797.3	0
05/02/2023	21:10	1.2	0	SW	797.1	0
05/02/2023	21:20	1.2	0	---	797.1	0
05/02/2023	21:30	1.1	0	---	797	0
05/02/2023	21:40	1.1	0	---	797	0
05/02/2023	21:50	1.1	0	---	797.1	0
05/02/2023	22:00	1.1	0	---	797.2	0
05/02/2023	22:10	1.1	0	---	797.1	0
05/02/2023	22:20	-0.4	0	---	797.2	0
05/02/2023	22:30	-0.7	0	SSW	797	0
05/02/2023	22:40	-1.3	0	SSW	796.9	0
05/02/2023	22:50	-0.3	0	---	796.9	0
05/02/2023	23:00	-0.4	0	---	796.8	0
05/02/2023	23:10	-2.5	0	---	796.8	0
05/02/2023	23:20	-2.1	0	---	796.7	0
05/02/2023	23:30	-2.1	0	---	796.4	0
05/02/2023	23:40	-2.1	0	---	796.4	0
05/02/2023	23:50	-2.7	0	---	796.6	0
06/02/2023	00:00	-2.4	0	---	796.5	0
06/02/2023	00:10	-2.3	0	---	796.5	0
06/02/2023	00:20	-2.9	0	---	796.4	0
06/02/2023	00:30	-2.6	0	---	796.2	0
06/02/2023	00:40	-1.8	0	---	796.2	0
06/02/2023	00:50	-2.1	0	---	796.1	0
06/02/2023	01:00	-2.3	0	---	796.1	0
06/02/2023	01:10	-2.3	0	---	796.2	0
06/02/2023	01:20	-2.8	0	---	796.3	0
06/02/2023	01:30	-3	0	---	796.2	0
06/02/2023	01:40	-2.9	0	---	796.2	0

Date	Time	Temp Out	Wind Speed	Wind Dir	Bar	Rain
06/02/2023	01:50	-2.7	0	---	796	0
06/02/2023	02:00	-2.6	0	---	796.1	0
06/02/2023	02:10	-2.8	0	---	796.2	0
06/02/2023	02:20	-2.9	0	---	796.2	0
06/02/2023	02:30	-3	0	---	796.1	0
06/02/2023	02:40	-3.4	0	---	796.1	0
06/02/2023	02:50	-3.6	0	---	796	0
06/02/2023	03:00	-2.7	0	---	795.9	0
06/02/2023	03:10	-2.9	0	---	795.8	0
06/02/2023	03:20	-2.6	0	---	795.8	0
06/02/2023	03:30	-2.3	0	---	795.7	0
06/02/2023	03:40	-2.2	0	---	795.8	0
06/02/2023	03:50	-2.2	0	---	795.7	0
06/02/2023	04:00	-2.4	0	---	795.7	0
06/02/2023	04:10	-2.1	0	---	795.9	0
06/02/2023	04:20	-1.7	0	---	795.8	0
06/02/2023	04:30	-2.2	0	---	795.7	0
06/02/2023	04:40	-2.7	0	---	795.7	0
06/02/2023	04:50	-2.7	0	---	795.8	0
06/02/2023	05:00	-2.9	0	---	795.8	0
06/02/2023	05:10	-3.4	0	---	795.7	0
06/02/2023	05:20	-3.3	0	---	795.6	0
06/02/2023	05:30	-3.2	0.4	WSW	795.5	0
06/02/2023	05:40	-2.3	0.4	WSW	795.5	0
06/02/2023	05:50	-2.2	0	W	795.5	0
06/02/2023	06:00	-3.1	0	---	795.4	0
06/02/2023	06:10	-2.4	0	WSW	795.4	0
06/02/2023	06:20	-2.4	0	---	795.4	0
06/02/2023	06:30	-2.5	0	---	795.1	0
06/02/2023	06:40	-2.3	0	---	795.4	0
06/02/2023	06:50	-2.7	0	---	795.4	0
06/02/2023	07:00	-2.4	0.4	WSW	795.2	0
06/02/2023	07:10	-2.2	0.4	WSW	795.2	0
06/02/2023	07:20	-2.4	0.4	WSW	795.2	0
06/02/2023	07:30	-2.1	0	W	795.2	0
06/02/2023	07:40	-1.8	0.4	WSW	795	0
06/02/2023	07:50	-2.2	0.4	WSW	795.1	0
06/02/2023	08:00	-2.6	0	SW	795.1	0
06/02/2023	08:10	-2.8	0	SW	795	0
06/02/2023	08:20	-2.7	0	SW	795.1	0
06/02/2023	08:30	-1.9	0	SW	795	0
06/02/2023	08:40	-1.4	0	SW	795	0
06/02/2023	08:50	-1.5	0	SW	794.9	0
06/02/2023	09:00	-1.2	0	SW	794.4	0
06/02/2023	09:10	-1.1	0.4	SW	794.5	0

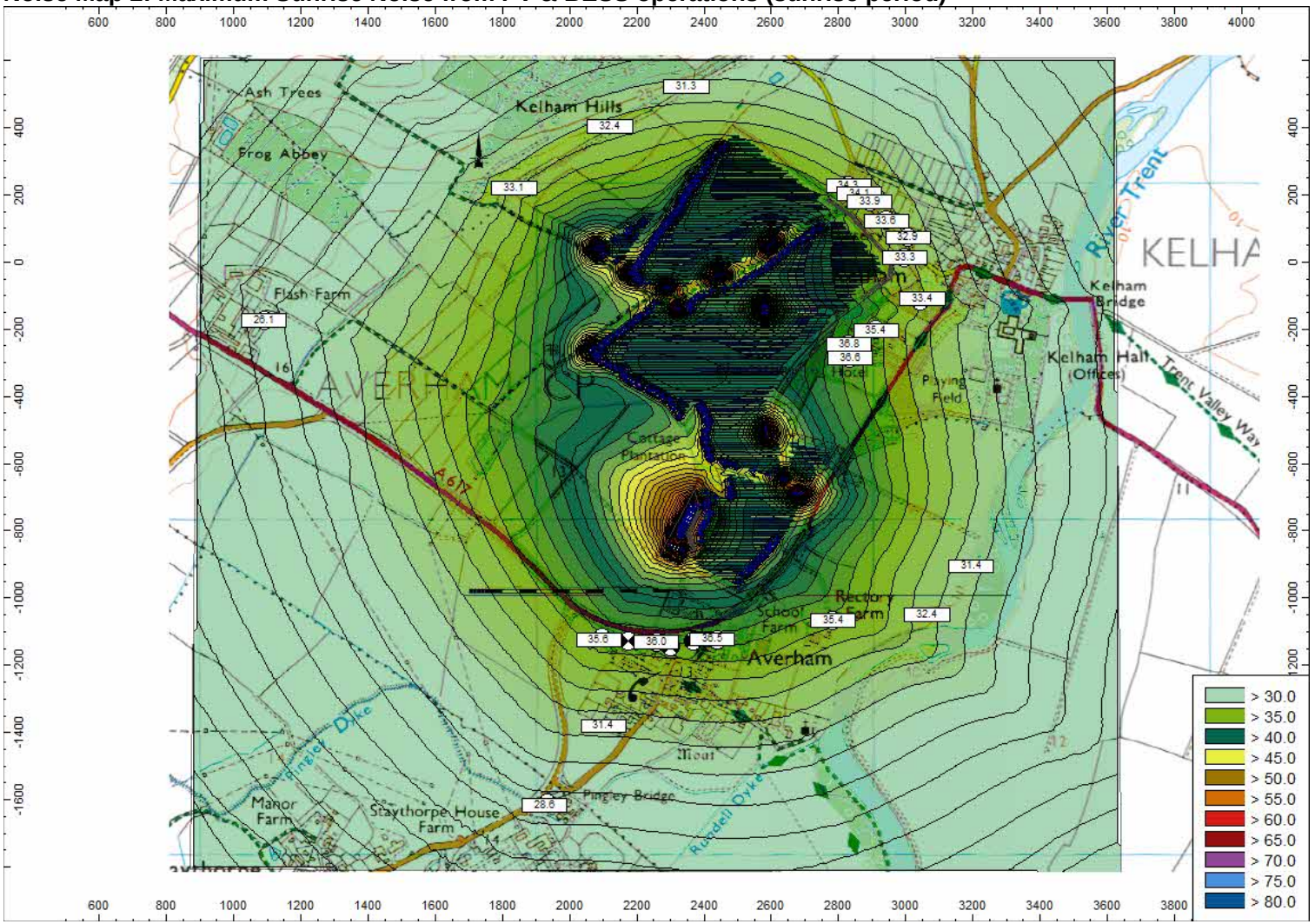
Appendix 3

Noise Mapping Results

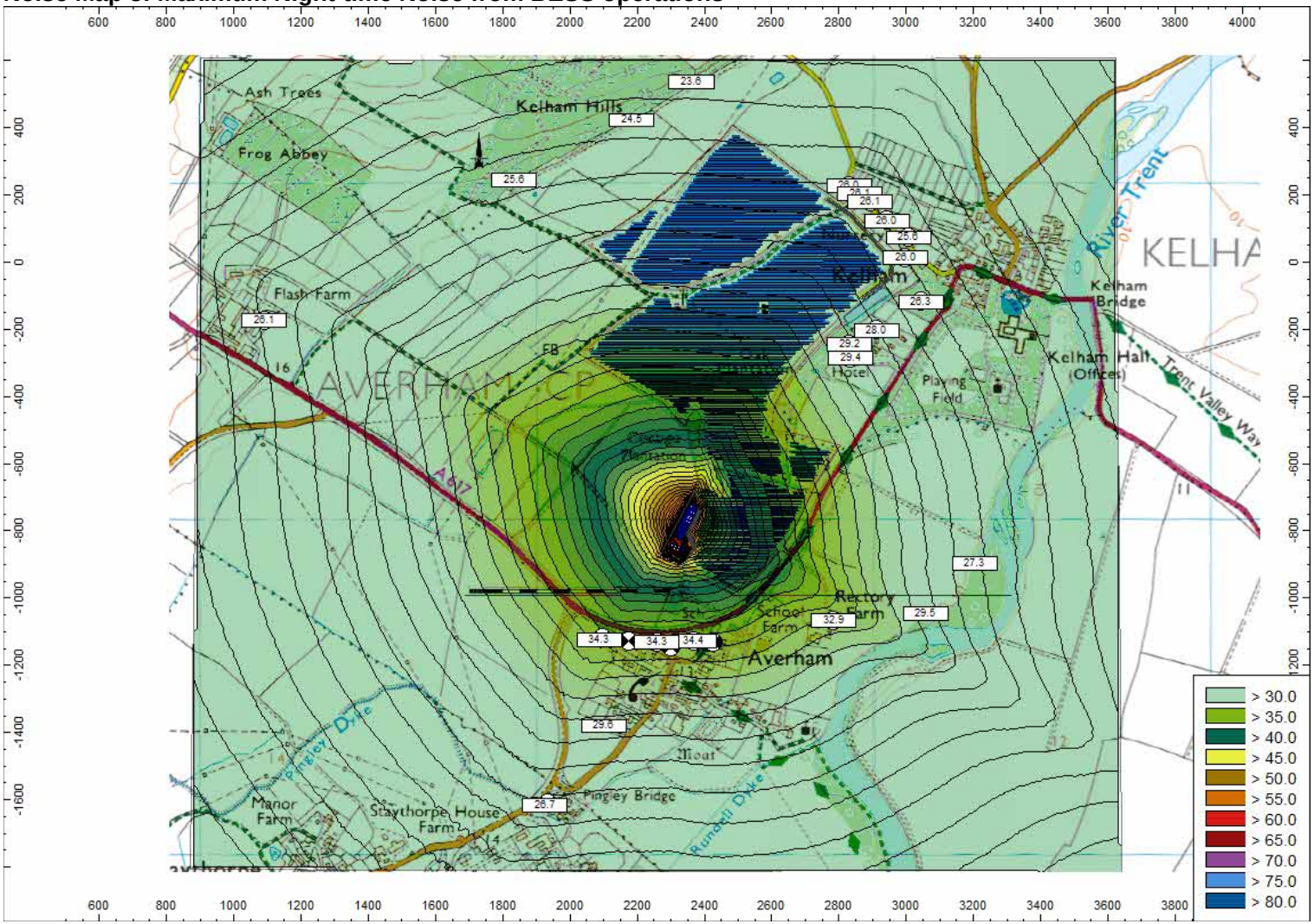
Noise Map 1: Maximum Daytime Noise from PV & BESS operations



Noise Map 2: Maximum Sunrise Noise from PV & BESS operations (sunrise period)



Noise Map 3: Maximum Night-time Noise from BESS operations



Appendix 4

Vibration Terminology

Ground Borne Vibrations

For any source of vibration on or near the surface of the ground, energy propagates away from the source via:

a) Elastic body (or compression) waves – which radiate energy into the ground in all directions
b) Surface (or shear) waves – which carry energy along the ground surface, caused when body waves are reflected back into the ground at the ground-surface interface

Thus, at any point away from that source, the ground motion is the sum of all the wave motions at that point. When wave motion has been generated, the waves will be attenuated as they travel away from the source. The two main mechanisms for attenuation are:

a) Enlargement of the wavefront as the distance from the source increases, and
b) Internal damping of the transmitting medium (the ground)

Ground borne vibration is therefore made up of a combination of different waves, travelling in different directions, at different speeds and at different frequencies. The frequency component of the vibration will affect the rate at which attenuation occurs since the internal damping of the ground is frequency dependent.

Since vibration enters buildings through the foundations, the hard structure of the building is normally affected to a greater degree than by air borne vibration. Often ground borne vibrations are more noticeable when standing or sitting near the middle of suspended wooden floors.

Ground Borne Vibration Measurement Units

Ground borne vibration is caused when the individual particles making up the strata are caused to oscillate by the passage of a pressure wave. The resulting vibration can be summarized in terms of 4 main parameters:

a) **Velocity** – how fast the particles move when they are oscillating. Since the velocity of these particles continually change as the pressure wave passes the most useful value that is often reported is the maximum or peak particle velocity (PPV). PPVs are usually expressed in terms of ms^{-1} or mms^{-1}.

b) **Acceleration** – is the rate at which the particle velocity changes during oscillation. It is usually measured in ms^{-2} mms^{-2} or "g's". 1g is that acceleration imparted to an object by the earth's gravitational pull and is approximately 9.81 ms^{-2}.

c) **Displacement** – is the distance moved by oscillating particles. This is usually very small and measured in mm or even µm.

d) **Frequency** – is the number of oscillations per second which a particle undergoes due to the passage of a vibration wave. It is measured in cycles per second or Hertz (Hz).

The movement of particles induced to oscillate by vibration waves are usually measured in three mutually perpendicular directions to fully describe the vibration intensity, as particles will be oscillating in three dimensions. These are:

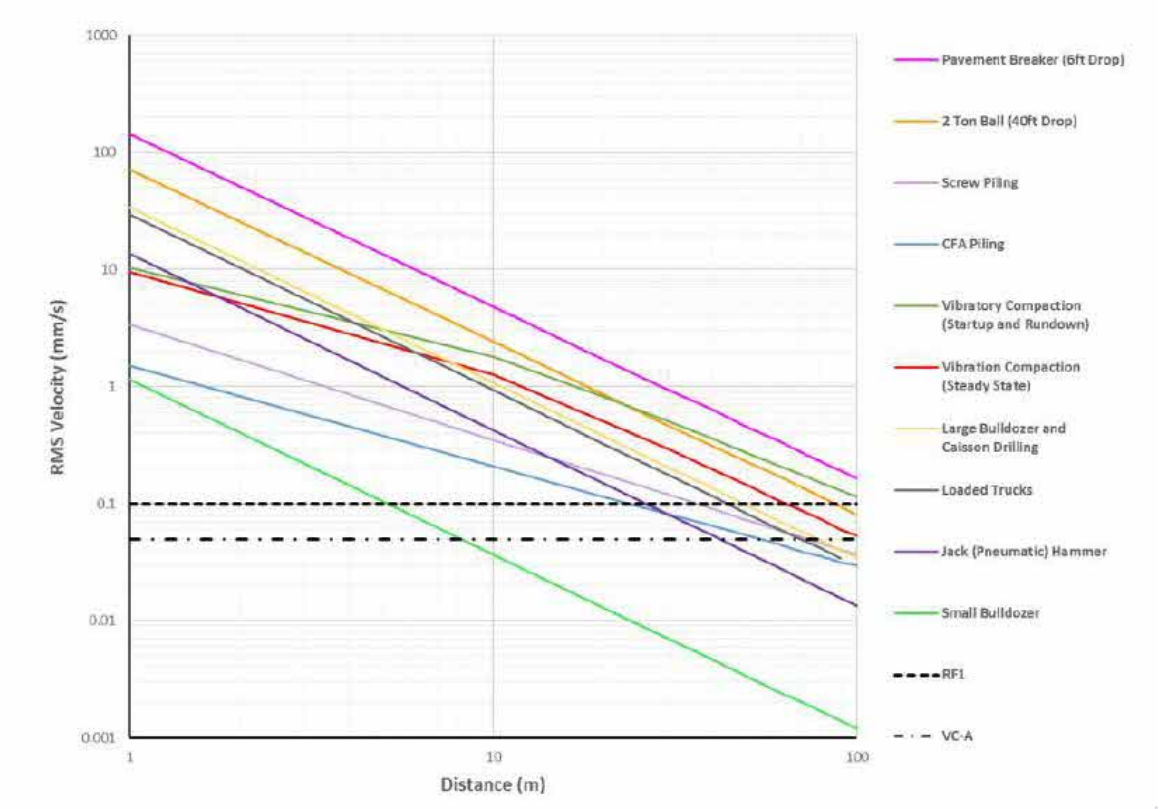
a) **Longitudinal** – back and forth particle movement in the same direction that the vibration wave is travelling.

b) **Vertical** – up and down movement perpendicular to the direction the vibration wave is travelling.

c) **Transverse** – left and right particle movement perpendicular to the direction the vibration wave is travelling.

Appendix 5

Vibration Levels from a Range of Construction Activities



Appendix 6

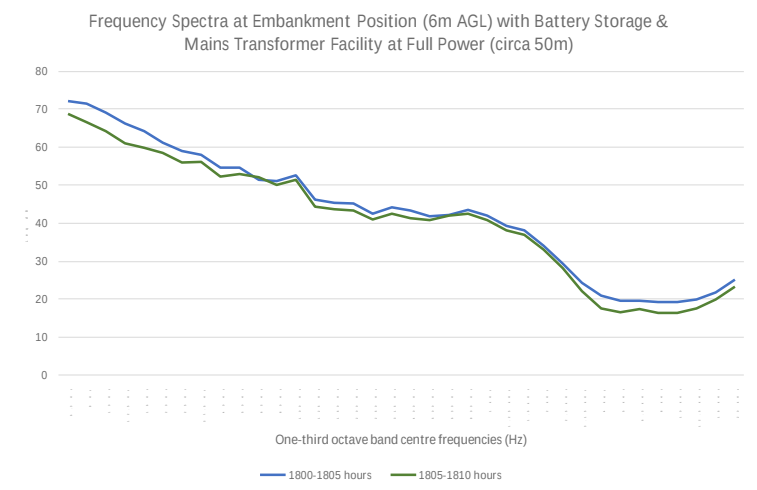
Plant Noise Levels

Assumed Noise Levels for Site Plant

Plant Type	Sound Pressure Level LAeq [dB]	Assumed % Operating Time	Example of mitigation	Period of Operation
Battery Storage Units (compound)	65 @ 1m	100	Design (no tonality at NSR)	Daytime & Night-time
Battery/Auxiliary Transformers (compound)	72 @ 1m	100	Design of plant or inside container (no tonality at NSR)	Daytime & Night-time
Battery Inverters (compound)	75 @ 1m	100	Design of plant or inside container (no tonality at NSR)	Daytime & Night-time
PV Transformers	72 @ 1m	100	Design of plant or inside enclosure (no tonality at NSR)	Daytime & Sunrise hours
PV String Inverters	<65 @ 1m	100	Design	Daytime & Sunrise hours
Sub-station Transformer	55 @ 10m	100	Design of plant	Daytime & Night-time

Typical Frequency Spectra from BESS & Transformer Noise

Freq (Hz)	1800-1805 Leq dB	1805-1810 Leq dB
6.3 Hz	72.1	68.7
8 Hz	71.4	66.7
10 Hz	69.2	64.2
12.5 Hz	66.2	60.9
16 Hz	64.3	59.9
20 Hz	61.2	58.4
25 Hz	59.1	55.9
31.5 Hz	58	56
40 Hz	54.6	52.2
50 Hz	54.7	53
63 Hz	51.5	52
80 Hz	51.1	50
100 Hz	52.6	51.4
125 Hz	46.3	44.3
160 Hz	45.3	43.7
200 Hz	45.2	43.3
250 Hz	42.5	41
315 Hz	44	42.5
400 Hz	43.2	41.4
500 Hz	41.7	40.8
630 Hz	42.3	42
800 Hz	43.4	42.4
1 kHz	42	40.7
1.25 kHz	39.3	38
1.6 kHz	38	36.9
2 kHz	34	32.9
2.5 kHz	29.3	28.2
3.15 kHz	24.3	22
4 kHz	21	17.7
5 kHz	19.6	16.5
6.3 kHz	19.4	17.4
8 kHz	19.3	16.4
10 kHz	19.2	16.4
12.5 kHz	20	17.7
16 kHz	21.8	19.9
20 kHz	25.1	23.2



Appendix 7

Consultant's Experience & Qualifications

Consultant: Dean Robert Kettlewell - MSc MIOA MAE I.Eng
(Director - Principal Acoustic Consultant)

Précis

As Director and Principal Acoustic Consultant with Noise & Vibration Consultants Ltd, Dean has over 35 years background experience in a wide range of issues relating to environmental, industrial and commercial noise and vibration assessment. He currently manages corporate and unit specific contracts for:

- Assessment of Environmental & Industrial Noise
- Environmental Noise Impact Assessments
- Expert Witness representation for Planning Appeals
- Integrated Pollution Prevention and Control (IPPC) Applications
- Industrial Noise Assessment and Control
- Planning Issues for Residential and Commercial Development
- Noise at Work Regulations Assessments
- Building Acoustics and Sound Insulation Tests
- Wind Farm Noise Impact Assessments
- Entertainment Noise Assessment and Control
- Architectural Acoustics
- Specialist knowledge in the Design of Noise Control Systems
- Ground borne vibration measurement and assessment
- Project Management of Noise Control Systems

Relevant Work Experience

Director & Principal Consultant - Noise & Vibration Consultants Ltd	2001- to date
Senior Acoustic Consultant - Vibrock Limited	1998 - 2001
Associate & Principal Acoustic Consultant - John Savidge & Associates	1994 - 1998
Technical Manager – LBJ Limited (Noise Control Division)	1990 - 1994
Technical Engineer/Technical Manager (1988) - Vibac (Noise Control) Ltd	1982 - 1990

Qualifications and Education

M.Sc. Applied Acoustics (Derby University – Distinction)
HNC Electrical & Electronic Engineering
IOA Diploma in Acoustics & Noise Control
IOA Certificate in Law and Administration
Certificate of Competence in Workplace Noise Assessment
Certificate of Competence in Ground Vibration Monitoring

Affiliations: Member of Institute of Acoustics (MIOA)
Member of Academy of Experts (MAE)
Member of Association of Noise Consultants (ANC)
Incorporated Engineer (I.Eng)


NVC
Noise &
Vibration
Consultants Ltd.