Net Zero Twenty Five Limited

Maes Bach, Upper Boat, Pontypridd

Noise Assessment

REPORT REF. 2405430-ACE-XX-00-RP-C-0601

November 2024

HEAD OFFICE: 3rd Floor, The Hallmark Building, 52-56 Leadenhall Street, London, EC3M 5JE **T** | 020 7680 4088
EDINBURGH: Suite 35 4-5 Lochside Way Edinburgh EH12 9DT **T** | 0131 516 8111
ESSEX: 1 - 2 Crescent Court, Billericay, Essex, CM12 9AQ **T** | 01277 657 677
KENT: Suite 10, Building 40, Churchill Business Centre, Kings Hill, Kent, ME19 4YU **T** | 01732 752 155
MIDLANDS: Office 3, The Garage Studios, 41-43 St Mary's Gate, Nottingham, NG1 1PU **T** | 0115 697 0940
SOUTH WEST: City Point, Temple Gate, Bristol, BS1 6PL **T** | 0117 456 4994
SUFFOLK: Suffolk Enterprise Centre, 44 Felaw Street, Ipswich, IP2 8SJ **T** | 01473 407 321

Email: enquiries@ardent-ce.co.uk

Contents

Appendices

Document Control Sheet

Rev	Issue Purpose	Author	Checked	Approved	Date
-	Draft	JR	AS	Draft Only	29/10/24
-	Final	JR	AS	LD	06/11/24

Distribution

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1. Introduction

1.1. This Noise Assessment has been prepared by Ardent Consulting Engineers to accompany a planning application for the erection of a temporary Energy Storage System site at Maes Back, Upper Boat, Pontypridd on behalf of Firstway Energy (acting on behalf of Net Zero Twenty Five Limited).

Site Description

1.2. The site is situated to the west of Treforest Industrial Estate and east of Church Village, with Pontypridd to the north. The site is mostly surrounded by agricultural land, with a solar farm bordering the site to the south. Residential properties are scattered in all directions. The closest sensitive receptor is approximately 60m to the north-east of the site. The site and surrounding area is shown in Figure 1-1

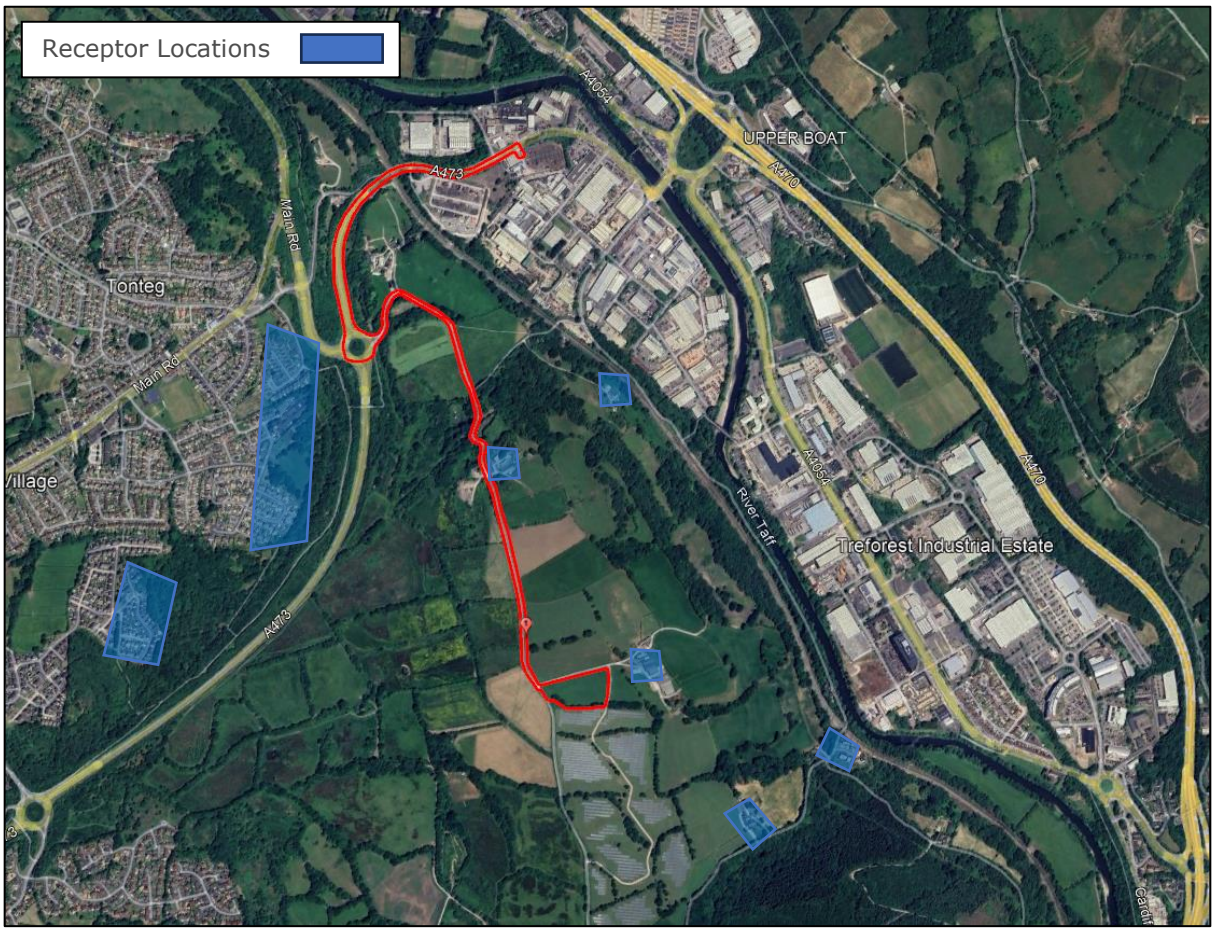


Figure 1-1: Site and Surrounding Area

Proposed Development

1.3. The development is for the erection of a temporary Energy Storage System (ESS) for a period of up to 40 years, together with associated infrastructure, site levelling works, site access, landscaping and ancillary works.

1.4. The proposed layout is shown in Figure 1-2 below.

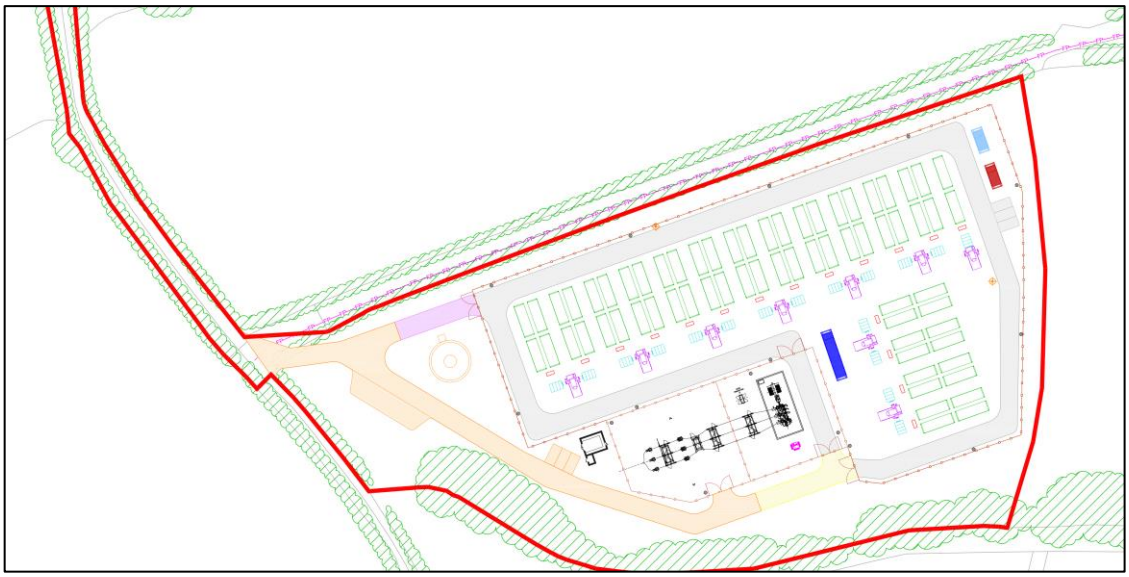


Figure 1-2: Proposed layout

2. Local Authority Liaison

2.1. Contact[1] has been made with officers at Rhondda Cynon Taf County Borough Council. Due to the initial response time, the noise survey was undertaken before Ardent had received the recommendations from the officers. The following was initially proposed in relation to the assessment criteria and methodology:

- The noise survey was proposed to cover a 7 day period to obtain ambient and background sound levels.
- Consideration should be given to Technical Advice Note (TAN) 11 for any assessment.
- Operational assessment of external equipment in accordance with BS 4142:2014.

2.2. Officers recommended that the noise survey be fully attended with the duration considered due to probability of railway works influencing noise measurements at this location.

2.3. Ardent have responded with justifications of the original noise survey proposals, to which a response has not yet been received.

2.4. A summary of relevant guidance and policy is shown in Appendix D.

[1] Email contact with Neil Pilliner on 06/09/24, response on 03/10/24

3. Environmental Noise Levels

3.1. An environmental noise survey was undertaken between 10th and 17th September 2024. The acoustic environment in the area included road traffic on the A470 and A473, local farm traffic on Maesmawr Road and agricultural noise.

3.2. Upon collection of the data, the meter had failed at approximately 13:00 on Sunday 15th September with no data being obtained after this period. The noise survey still considers day and night periods for both weekdays and weekends with the data obtained.

3.3. The measurement position is shown in Figure 3-1. Measurement position was selected to obtain representative baseline sound levels due to the main observed sources relative to the receptors around the site to the east, north and west of the site.

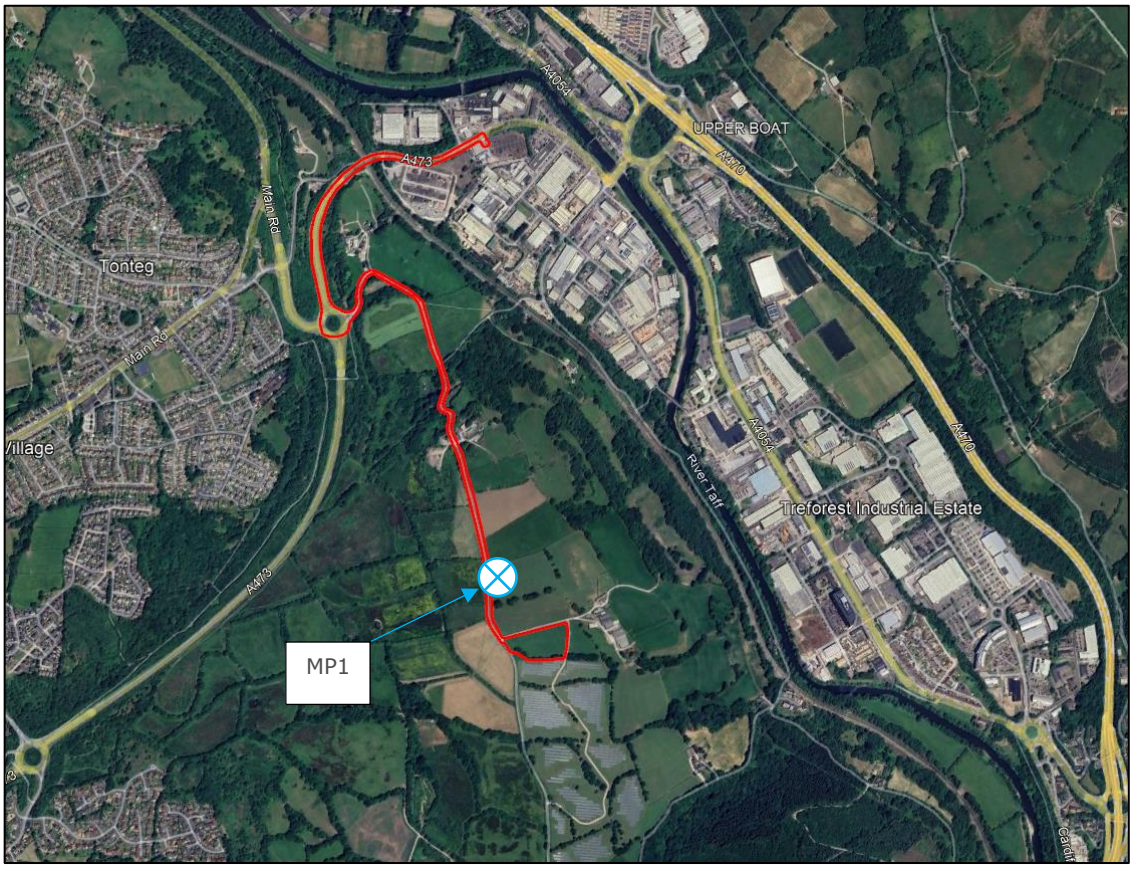


Figure 3-1: Measurement Positions

3.4. A description of the measurements positions is as follows:

- **Measurement Position 1** – Mounted atop pole fixed to a fencepost at a height of 2.5m along Maesmawr Road in freefield conditions, approximately 10m from the kerb of the Maesmawr road. This surrogate location was chosen for security of equipment away from livestock to represent the acoustic environment at the site.

3.5. The equipment used for the surveys was as follows:

- Cirrus CR:171C Sound Level Meter (serial number: G301575-A)
- Cirrus CR:515 Sound Calibrator (serial number: 72141)

3.6. All equipment used has been professionally calibrated. Field calibration of the sound level meters (and complete measurement signal chain) was undertaken before and after measurements to ensure no drift of the calibration signal. Calibration certificates are available upon request.

3.7. The weather conditions were considered generally suitable for environmental noise measurements with low wind speeds recorded. Precipitation was sporadic throughout the set-up between 11:15 to 13:30 on Tuesday 10th September. Weather conditions during set-up and collection are presented in Table 3-1 below.

Date	Position	Wind Direction	Wind Speed (m/s)	Temperature (°C)	Cloud Cover (%)	Precipitation
10/09/24	MP1 (setup)	North-west	3-4	17	100	Intermittent drizzle
17/09/24	MP1 (collection)	South-west	4-5	15	20	None

Table 3-1: Weather Conditions

3.8. Between 16:45 and 18:15 on Saturday 14th September, elevated noise levels were recorded. Upon collection of the equipment the hedges along Maesmawr Road had been cut with assistance from agricultural vehicles. This was confirmed by the individual who cut the hedge upon collection of the equipment stating the hedge cutting occurred on Saturday afternoon. This data has been excluded from the assessment.

3.9. A summary of the measurements is in Table 3-2 and time histories of measured noise levels are shown in Appendix A.

Monitoring Position	Ambient Sound Level dB $L_{Aeq, T}$ Range (Average)		Background Sound Level dB $L_{A90, T}$ Range (Average)	
	Day	Night	Day	Night
MP1 (Weekdays)	39-57 **(51)**	34-52 **(43)**	35-51 **(44)**	28-48 **(33)**
MP1 (Weekend)	43-59 **(49)**	33-48 **(41)**	36-46 **(40)**	23-36 **(26)**

Table 3-2: Summary of Measured Noise Levels

3.10. A histogram of day and night background sound levels is shown for both weekdays and the weekend in Figure 3-2 and 3-3.

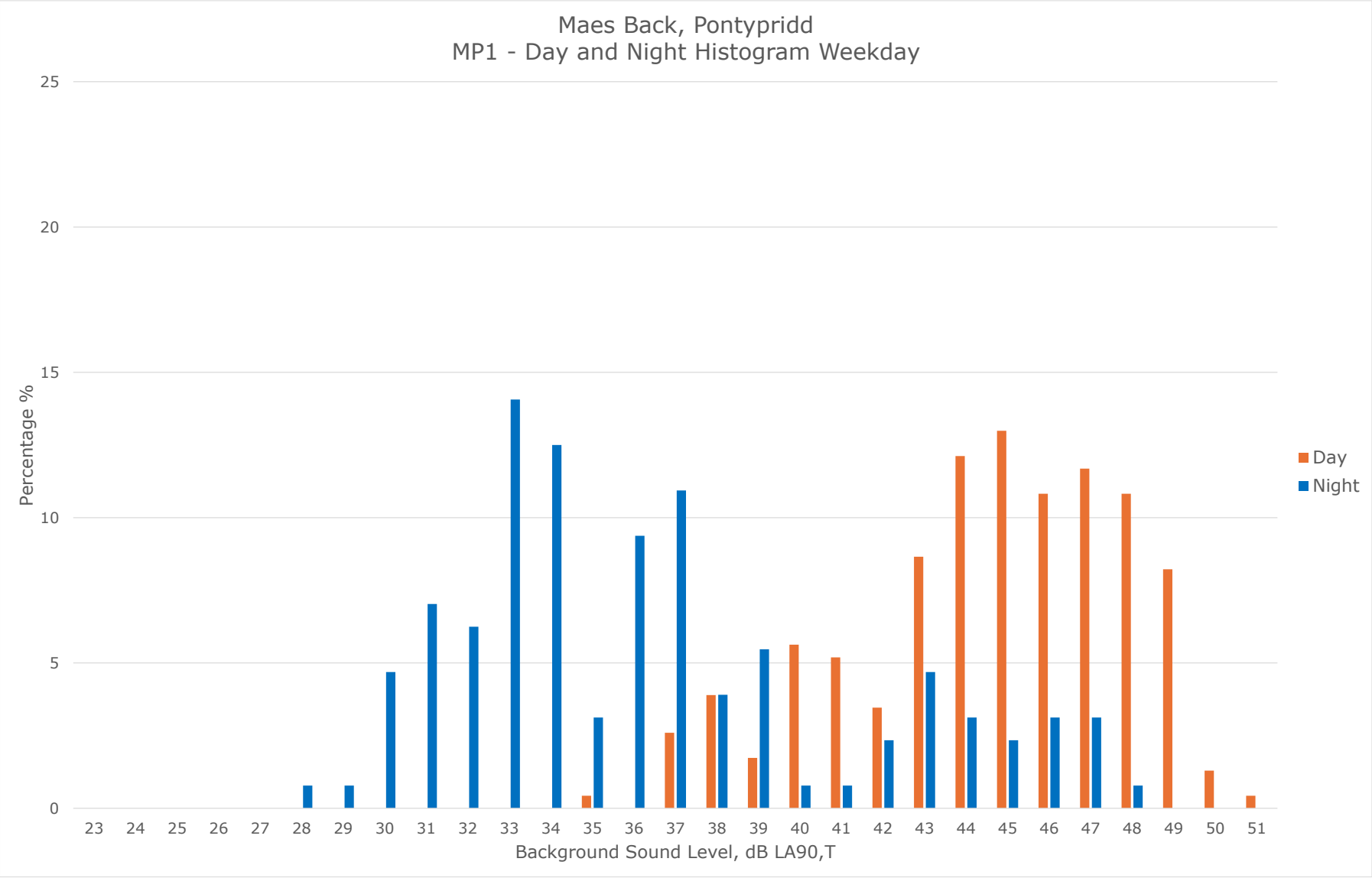


Figure 3-2: Measurement Position 1 - Weekday Histogram

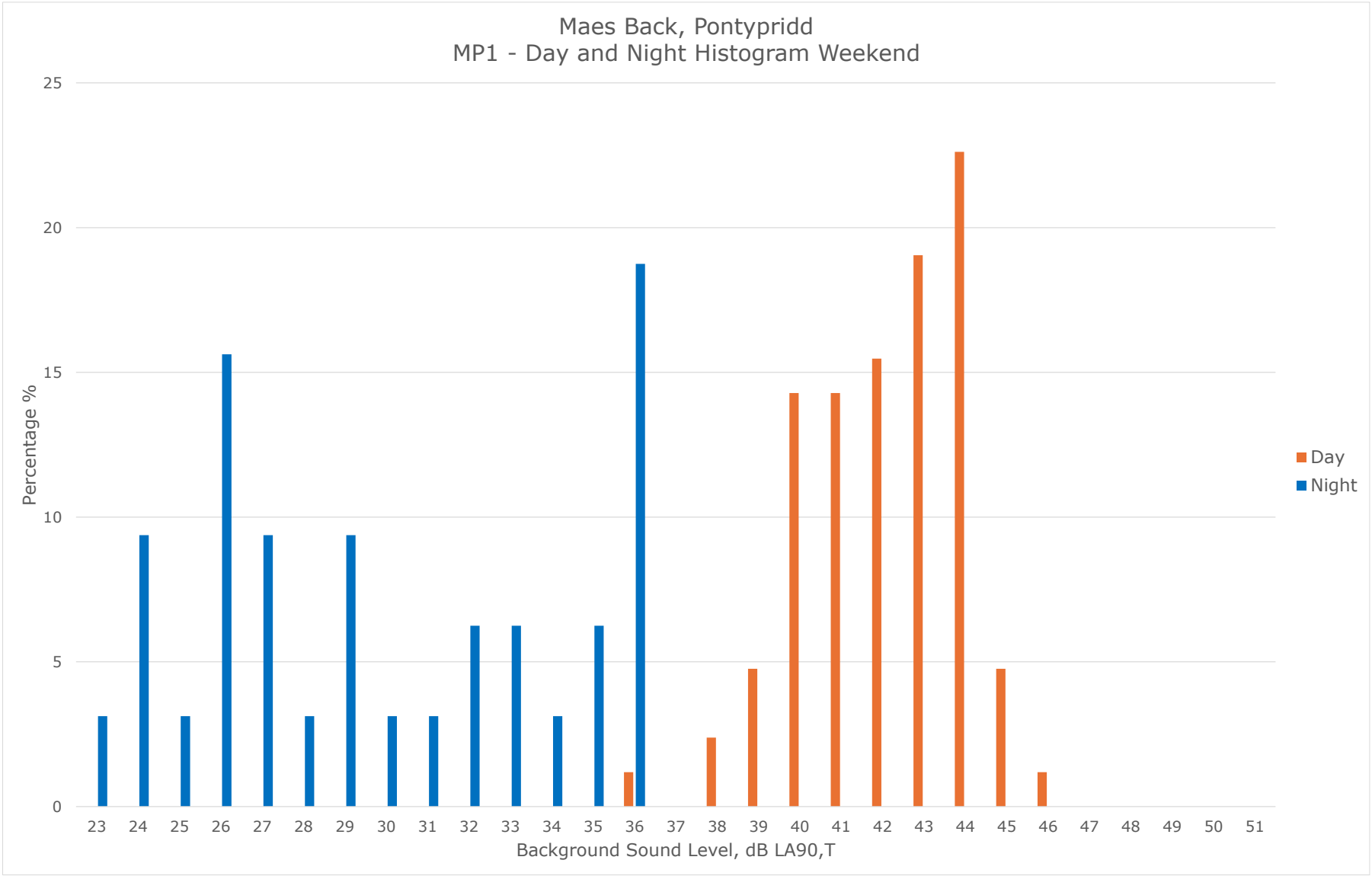


Figure 3-3: Measurement Position 1 - Weekend Histogram

3.11. During the weekdays a background sound level of **44 dB $L_{A90,T}$** has been used during the day and **33 dB $L_{A90,T}$** at night, representing the closest residential receptors to the site.

3.12. During the weekend a background sound level of **40 dB $L_{A90,T}$** has been used during the day and **26 dB $L_{A90,T}$** at night, representing the closest residential receptors to the site.

3.13. BS 4142:2014 notes that *'where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.'* Further contextual discussion has been included in Section 4.

3.14. Based on the measurements, a 3D computer based environmental noise model has been created using DataKustik 'CadnaA' Noise Mapping software. The following has been taken in account in the generation of the noise model:

- The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2: Acoustics – Attenuation of Sound propagation outdoors – Part 2: General Method of Calculation;
- The model has been set to include second order reflected noise from solid structures;
- The topography of the site and surrounding area has been taken into consideration in the assessment with use of provided Topographical data for the site and supplemented with DEFRA LiDAR data for the surround areas in the noise model;
- Acoustic screening and reflections afforded by nearby buildings, solid structures and fences/barriers;
- The model has been calibrated and verified using the noise survey data and the current baseline traffic flows for the surrounding road network.

3.15. The noise contour plot is shown in Appendix B.

4. Operational Assessment

4.1. Calculations have been conducted based on the provided equipment and sound power levels, which have been provided by the supplier of the system, are presented in Table 4-1 below.

Equipment	Quantity	Sound Power Level, L_{WA} dB (per unit)	Sound Pressure Level at 10m, dB L_{pA} (per unit)
Inverter Unit	17	79	51
Battery Cooling System	66	76	48
MV Transformer (Twin Skid)	9	71	43
HV Transformer	2	78	50

Table 4-1: Noise Specifications

4.2. The input parameters are intended as acoustic specifications, to determine the likely sources of noise impact and whether attenuation is likely to be required. It is intended to demonstrate acoustic feasibility for the purposes of the planning application.

4.3. The system should be designed, selected or attenuated so that it does not produce distinguishable acoustic characteristics, such as low frequency, tonal and impulsive characteristics as categorised in accordance with BS 4142.

4.4. The site has been assessed when operating at full capacity during both the day and night to assess a worst-case scenario. The sound power levels provided in Table 4-1 reflect the operations at full capacity.

4.5. Initial assessment of the equipment in the absence of mitigation results in exceedances of up to 5 dB L_{Aeq} above the background sound level during the day and 19 dB L_{Aeq} during the night at Maes Bach Farm.

4.6. Therefore, mitigation has been proposed at the site to minimise adverse impacts at the closest sensitive receptors. Mitigation has been included in the form of two 5m acoustic barrier around the eastern site boundary, substation and transformer. Localised 3m acoustic barriers are also included on the east of most of the inverter/twin skids.

4.7. The barrier should have a minimum surface mass of 15kg/m^2 with a thickness of 25mm. Panels should be abutted or overlapped to provide a continuous screen without gaps at the bottom or sides of the panels. The location of the barriers are shown in Figure 4-1 below.

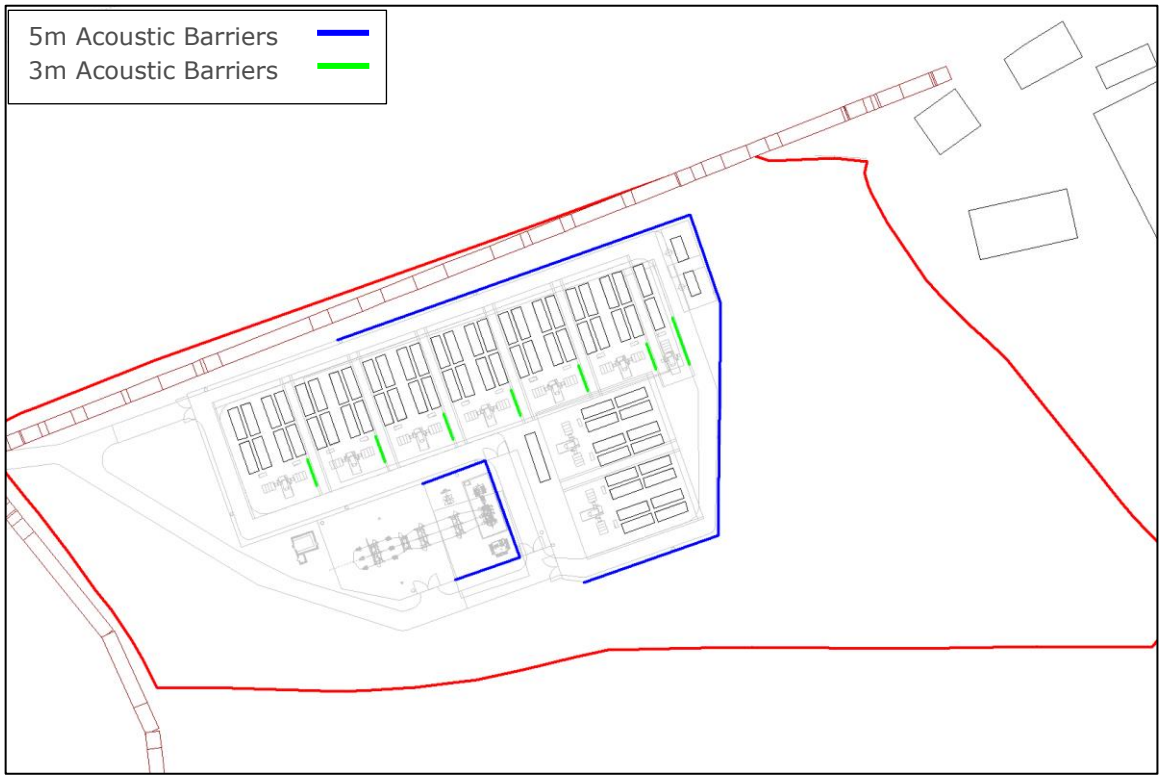


Figure 4-1: Acoustic Barrier Locations

4.8. In addition, attenuation of 10 dB has been applied to the battery cooling systems at the intake/extract fans, and 15 dB attenuation on the inverters has been included.

4.9. Table 4-2 below shows a summary of the assessment results and initial estimate of likely significance during the week including the above mitigation.

Closest Receptor	BS 4142 Assessment Day (07:00-23:00)	BS 4142 Assessment Night (23:00-07:00)
Residual Level, dB $L_{Aeq,T}$	51	43
Specific Level, dB $L_{Aeq,T}$	32	32
Acoustic Feature Correction, dB	0	0
Rating Level, dB $L_{Ar,Tr}$	32	32
Background sound level, dB $L_{A90,T}$	44	33
Excess over background, dB	-12	-1
Initial Assessment	Low Impact	Low Impact

Table 4-2: BS 4142 Assessment Weekday with Mitigation

4.10. The results show that the initial assessment of likely significance from operational noise equates to a low impact in the day and night, when assessed in accordance with BS 4142 at the closest sensitive residential receptors, depending on the context.

4.11. Table 4-3 below shows a summary of the assessment results and initial estimate of likely significance during the weekend including the above mitigation.

Closest Receptor	BS 4142 Assessment Day (07:00-23:00)	BS 4142 Assessment Night (23:00-07:00)
Residual Level, dB $L_{Aeq,T}$	49	41
Specific Level, dB $L_{Aeq,T}$	32	32
Acoustic Feature Correction, dB	0	0
Rating Level, dB $L_{Ar,Tr}$	32	32
Background sound level, dB $L_{A90,T}$	40	26
Excess over background, dB	-8	6
Initial Assessment	Low Impact	Adverse Impact

Table 4-3: BS 4142 Assessment Weekend with Mitigation

4.12. The results show that the initial assessment of likely significance from operational noise equates to a low impact during the day, and adverse impact during the night in accordance with BS 4142 at the closest sensitive residential receptors.

4.13. It is important to consider the context in which the sound occurs as recognised in BS 4142.

4.14. The assessment considers the ESS equipment operating simultaneously at 100% capacity during the day and night. In practice this is unlikely, as they will not be required to run at full load at all times, particularly during periods of low ambient temperature. It is also unlikely that all batteries will be required to charge/discharge simultaneously but the assessment has considered this to present a worst case assessment. If these factors were considered, this would further reduce the potential noise impact at the closest noise sensitive receptors.

4.15. As previously mentioned in Section 3, the representative background sound levels are considered very low and consideration of the absolute sound level and other guidance is considered appropriate.

4.16. Using a conservative 10 dB reduction for an open window and an absolute level of 32 dB L_{Aeq} at the closest sensitive receptor, the predicted internal noise level would be around 22 dB L_{Aeq}. This means that internal noise levels will be within guidance criteria detailed in BS 8233 and WHO to protect residential amenity.

4.17. It is considered that the criteria to not exceed the existing background is not reasonably attainable given the low background sound levels during the night. Best practicable means will be implemented through use of attenuation and screening at the noise source, promoting Good Acoustic Design.

4.18. Additionally, only the closest receptor at Maes Bach farm is predicted an initial adverse impact due to its close proximity to the development. All other receptors do not exceed 19 dB L_{Aeq} which would equate to 7 dB below the representative background level during the lower weekend night.

4.19. Whilst there is an initial adverse impact, the occupier of Maes Bach Farm is the landowner for the development and they are intrinsically involved with the development. Therefore, we expect them to be less sensitive to noise from the development given the personal interest in the scheme.

4.20. Considering the context of the site, surrounding areas, low background sound levels, proposed mitigation and predicted absolute noise levels, the assessment would present a low impact for both weekends and weekdays in accordance with BS 4142.

5. Conclusions

5.1. A noise survey has been undertaken on site, the measured sound levels and results of the noise model have been used to inform the operational noise assessment.

5.2. Initial assessment of the development presented a significant adverse impact in the absence of mitigation.

5.3. Mitigation is proposed in the form of 5m Acoustic Barriers, and localised 3m acoustic barriers. A combined 10 dB attenuation of the intake/extract fans for the battery cooling systems, and 15 dB attenuation on the inverters is included in the assessment.

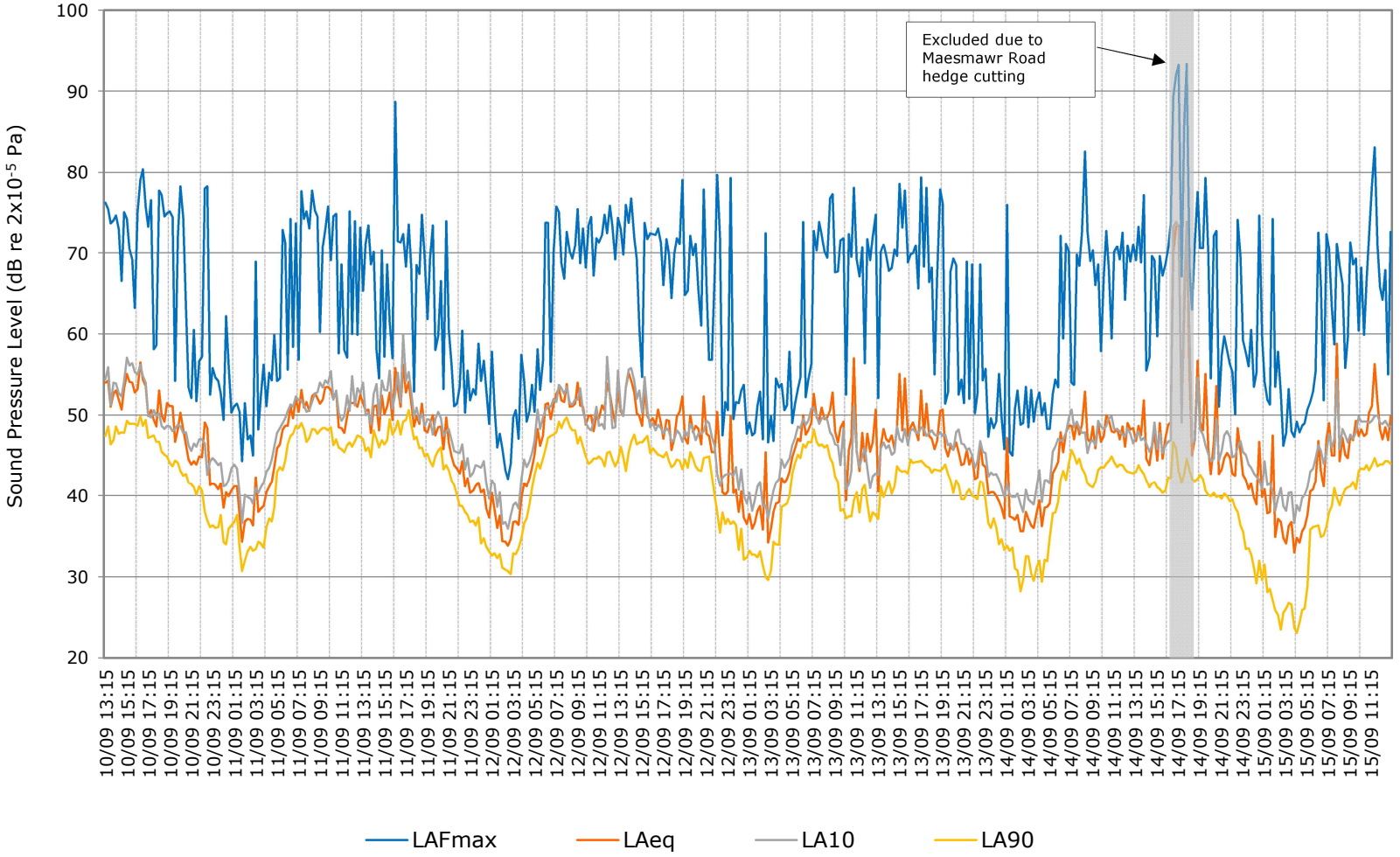
5.4. With the proposed mitigation in place and consideration of the context, operational noise from full load operation will result in a low impact at closest noise sensitive receptors, when assessed in accordance with BS 4142.

5.5. Therefore, this assessment demonstrates that the site is suitable for the proposed development subject to the recommendations included in this report.

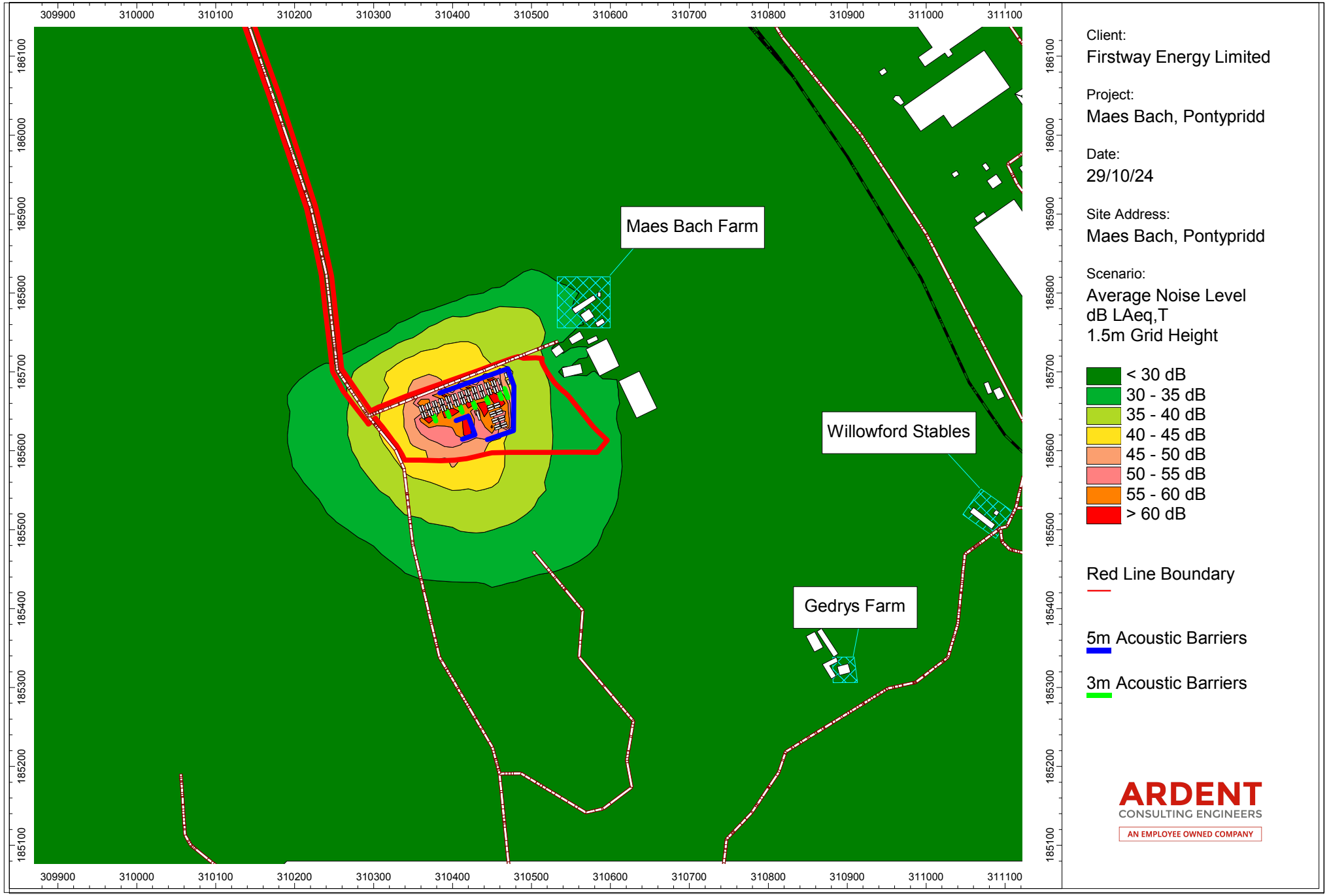
APPENDIX A

Position 1 - Maes Back, Pontypridd

Environmental Noise Time History
10th to 15th September 2024



APPENDIX B



Client:
Firstway Energy Limited

Project:
Maes Bach, Pontypridd

Date:
29/10/24

Site Address:
Maes Bach, Pontypridd

Scenario:
Average Noise Level
dB LAeq,T
1.5m Grid Height

- < 30 dB
- 30 - 35 dB
- 35 - 40 dB
- 40 - 45 dB
- 45 - 50 dB
- 50 - 55 dB
- 55 - 60 dB
- > 60 dB

Red Line Boundary

5m Acoustic Barriers

3m Acoustic Barriers

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APPENDIX C

Joe Rutt

From: Joe Rutt
Sent: 18 October 2024 11:31
To: Pilliner, Neil
Cc: Hart, David; Ashley Shepherd; Lee Dursley
Subject: [Filed on 2024-10-18] RE: Noise Assessment Methodology and Criteria - Maes Back, Upper Boat, Pontypridd

Categories: Filed to CloudFiler

Hi Neil,

Thank you for your response, which is useful.

Due to project timescales, our client was keen to progress with the work as they have an upcoming deadline to validate the planning application. We therefore had to carry out the noise survey in advance of seeing your comments.

We undertook unattended monitoring (with observations on set-up and collection) between 10-15th September to capture as much data as practical for both day and night periods. In this survey we captured a Saturday night to represent weekend levels which showed a drop in the background L_{A90} from 33 dB (during the week) to 26 dB. Given the low background levels during the weekend we believe that this does not include any railway works. To present a robust, worst-case assessment. We will use a background sound level of 26 dB to determine the likely level of impact.

We have explored a range of noise mitigation options to control noise levels from site operations as much as practicable. The level of mitigation isn't yet finalised, however we are currently calculating an absolute noise level of 32 dB L_{Aeq} at the closest receptor, with all plant operating simultaneously at maximum capacity. In reality, this is unlikely to occur.

The system will be designed, selected or attenuated so that it does not produce distinguishable acoustic characteristics, such as low frequency, tonal and impulsive characteristics as categorised in accordance with BS 4142. BS 4142 notes that where background and rating levels are low, absolute levels may be more appropriate. Given the context and low background sound levels in the area, we believe that an absolute level of 32 dB L_{Aeq} during the day and night is unlikely to result in an adverse impact on nearby receptors, would you agree?

Exceedances over the background sound level at night is less important when residents are likely to be indoors. An external absolute level of 32dB is also within guidance criteria contained in WHO and BS 8288 (assuming partially open window attenuation).

It should be noted that the above levels are only applicable to Maes Bach Farm approximately 70m to the north-east of the site. At all other nearby receptors the predicted noise level is no more than 19 dB L_{Aeq} which is 7 dB below the representative background sound level during the night and would be a low impact.

It's also worth noting that the occupier of Maes Bach Farm is the landowner for the development and they are intrinsically involved in the development therefore, we would expect them to be less sensitive to noise from the development given their own interests in the scheme. Considering this contextual information, the absolute level of 32 dB L_{Aeq}, which equates to 6 dB above the background, would not cause adverse impacts for the owners of Maes Bach Farm.

I trust the above approach is acceptable, and I would be happy to discuss this in more detail as needed.

Kind regards,

Joe Rutt
Acoustic Consultant

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T | 0115 697 0940 **M** | **E** | jrutt@ardent-ce.co.uk
Office 3 | The Garage Studios | 41-43 St Mary's Gate | The Lace Market | Nottingham NG1 1PU

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From: Pilliner, Neil <Neil.J.Pilliner@rctcbc.gov.uk>
Sent: 03 October 2024 17:12
To: Joe Rutt <jrutt@ardent-ce.co.uk>
Cc: Hart, David <David.M.Hart@rctcbc.gov.uk>
Subject: FW: Noise Assessment Methodology and Criteria - Maes Back, Upper Boat, Pontypridd

Hi Joe,

Apologies for the delayed response, I can see the intention is to carry out the assessment in line with relevant standards/policy which is welcomed. Please can you consider the following comments on undertaking the noise assessment:

- The nearest noise sensitive properties need to be identified at this location, in order to consider the impact of the proposed development.
- To assist with achieving representative residual and background sound levels, monitoring should be fully attended and duration considered due to probability of railway works influencing noise measurements at this location.

Thanks Neil

Neil Pilliner
Rheolwr Diogelu'r Amgylchedd a Safonau Tai,
Rhondda Cynon Tâf,
Iechyd a Diogelwch y Cyhoedd,
Tŷ Elai,
Dinas Isaf Dwyrain,
Williamstown,
Tonypandy
CF40 1NY

Neil Pilliner
Environmental Protection & Housing Standards Manager,
Rhondda Cynon Taf,
Public Health and Protection,
Tŷ Elai,
Dinas Isaf East,
Williamstown,
Tonypandy
CF40 1NY

Tel no: 01443 425001

From: Joe Rutt <jrutt@ardent-ce.co.uk>
Sent: 02 October 2024 13:53
To: Public Health Project Support <PublicHealthProjectSupport@rctcbc.gov.uk>
Cc: Ashley Shepherd <ashepherd@ardent-ce.co.uk>
Subject: RE: Noise Assessment Methodology and Criteria - Maes Back, Upper Boat, Pontypridd

Good afternoon,

I was wondering if someone had a chance to look at our proposals below as we will be completing the assessment soon?

Kind regards,

Joe Rutt
Acoustic Consultant

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T | 0115 697 0940 **M** | **E** | jrutt@ardent-ce.co.uk
Office 3 | The Garage Studios | 41-43 St Mary's Gate | The Lace Market | Nottingham NG1 1PU

From: Joe Rutt
Sent: 06 September 2024 12:01
To: PublicHealthProjectSupport@Rhondda-cynon-taff.gov.uk
Cc: Ashley Shepherd <ashepherd@ardent-ce.co.uk>
Subject: [Filed on 2024-09-06] Noise Assessment Methodology and Criteria - Maes Back, Upper Boat, Pontypridd

Dear Sir / Madam,

Please can you forward this email to the relevant person in your Environmental Health department.

Ardent are preparing a noise assessment to support a planning application for a battery energy storage facility located at Maes Back, Upper Boat, Pontypridd.

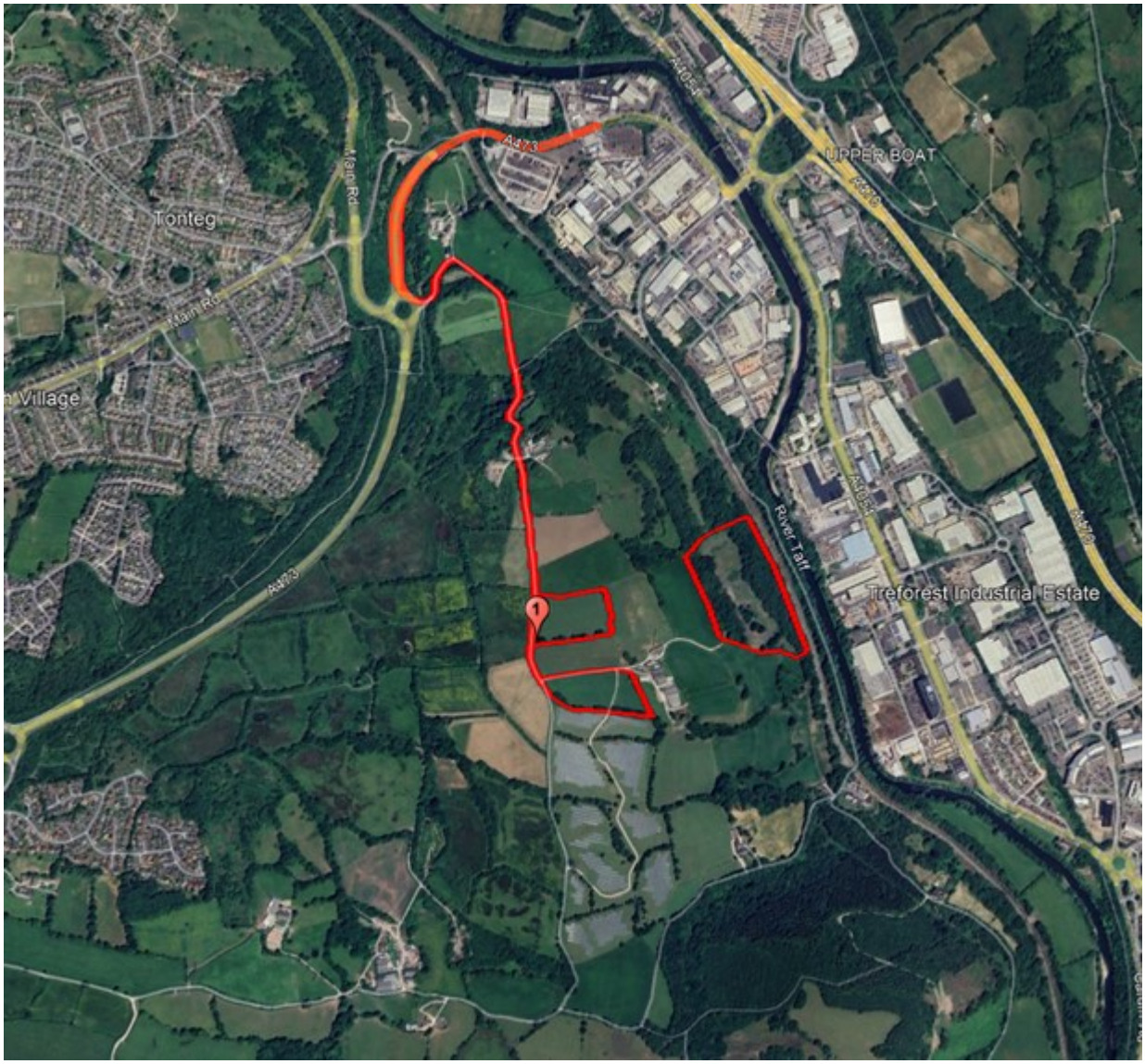
The survey is taking place next week and I wanted to run the monitoring positions and approach to the assessment past you please.

The aim of the survey will be to establish representative residual and background sound levels in the area for a period of up to 7 days, in which we expect the A470 and A473 to be the dominant source. Other local roads, nearby railway and commercial units are also likely to contribute.

We will endeavour to position the sound level meter as close to the residential properties as possible, however security may be a concern leaving equipment unattended. Failing that, we will locate the sound meter within the secure site boundary, which is under our client's control. The approximate location is provided in Figure 1 if we are required to leave the meter within our site boundary. The location might change during the set-up depending on site conditions, e.g. livestock in certain areas, but this will remain within the same red-line boundary parcel. This has been chosen as the most representative position away from excessive influence from the railway line to the east to form a robust assessment.

The noise survey and 3D noise model will be used to inform the assessment at existing residential dwellings which will be in accordance with TAN11, Wale Planning Policy and BS4142. We will also provide a contextual discussion considering other guidance on internal noise levels at sensitive receptors.

I trust the above is acceptable however I would appreciate any comments you may have on our approach, based on your local knowledge.



Kind Regards,

Joe Rutt
Acoustic Consultant

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APPENDIX D

RELEVANT POLICY & GUIDANCE

Planning Policy Wales, Edition 12 – February 2024

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarifications letters which together with PPW provide the national planning policy framework for Wales. Section 6.7 '*Air Quality and Soundscape'* provides some high level aims for developments with more detailed information regarding assessment and criterion provided in TAN11.

Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise - 1997

The Technical Advice Note (TAN) should be read in conjunction with 'Planning Guidance (Wales): Planning Policy', Technical Advice Notes and circulars should be taken into account by local planning authorities in Wales in preparation of development plans. This note provides advice on how the planning systems can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development. The following paragraphs are of particular interest to this application:

"8. Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.

9. Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require special consideration. In addition to noise from aircraft landing and taking off, noise from aerodromes is likely to result from engine testing as well as ground movements. The impact of noise from sport, recreation and entertainment will depend to a large extent on frequency of use and the design of facilities. Advice on assessing noise and on factors to consider in relation to the major noise sources

including roads, railways, airports, industrial and recreational noise and their measurement is given in Annex B."

11. Measures introduced to control the source of, or limit exposure to, noise should be proportionate and reasonable, and may include:

i. engineering: reduction of noise at point of generation (e.g. using quiet machines and/or quiet methods of working); containment of noise generated (e.g. insulating buildings which house machinery and/or providing purpose-built barriers around sites); protection of surrounding noise-sensitive buildings (e.g. improving sound insulation in these buildings and/or screening them by purpose-built barriers);

ii. lay-out: adequate distance between noise source and noise-sensitive building or area; screening by natural barriers, other buildings, or non-critical rooms in a building;

iii. administrative: limiting operating time of noise source; restricting activities allowed on the site; specifying an acceptable noise limit.

Control of Pollution Act 1974

The local authority has powers under the Control of Pollution Act 1974 to control noise from construction sites. Section 60 of the Act allows a local authority to serve a notice of its requirements for the control of site noise. This notice may include specification of plant that is or is not to be used, hours during which the construction works can be carried out and levels of noise emission. Section 61 of the Act allows a contractor or developer to take the initiative and agree with the local authority the methods of construction, steps to minimise noise and hours of work.

The Environmental Protection Act 1990

Local authorities have a duty to deal with statutory nuisances under the Environmental Protection Act 1990. For noise to amount to a statutory nuisance, it must be "prejudicial to health or a nuisance" as outlined in Section 79 of the Act. Any proposed development should not result in a statutory nuisance being declared.

Should the Local Authority declare a development to cause a statutory nuisance, an abatement notice can be served to the developer who has up to 21 days to appeal to Magistrates' Court, as detailed in Section 80 of the Act.

BS4142:2014 Methods for rating industrial and commercial sound

BS4142:2014 uses a comparison between the rating and background sound levels to establish an initial estimate of the likely significance of impact. The standard notes:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

The context of the assessment must then be considered, which can significantly alter the outcome of the assessment. Factors that might alter the outcome of the assessment include the absolute level of sound compared to the residual sound level, the character of the sound compared to the residual, the sensitivity of the receptor etc.

World Health Organisation

The WHO document Guidance on Community Noise specifies additional information for noise affecting noise sensitive receptors and forms the basis of many noise limitations and design ranges for internal and external ambient noise levels. It defines noise as 'a class of sounds that are considered unwanted' (by the listener), 'that adversely affects, or may affect the physiological and psychological wellbeing of people.' Much of the research around this study is based on transportation noise.

Further guidance on the recommended levels is given in the World Health Organisation (WHO) Guidelines for Community Noise. In this document it is stated that:

"To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB LAeq 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 50 dB LAeq."

WHO also states the following paragraph with regard to the effects of LAmax events in a night-time period:

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB LAmax more than 10-15 times per night (Vallet & Vernet 1991)."

WHO guidance 'Night Noise Guidelines for Europe' is concerned with the longer-term average noise levels that are covered by the EU Directive on Environmental Noise, although this does appear to suggest external maximum noise levels of around 57dBA outside bedrooms during the night to achieve internal maximum levels of 42dBA.

BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings

Formerly a Code of Practice, the 2014 revision of BS8233 is now presented and intended as a guidance document. The standard is mainly concerned with building design from an acoustic standpoint. It does however, contain information relevant to environmental noise more specifically by stating guidance for desirable internal noise levels for dwellings and other buildings.

An extract of Table 4 of the document relevant for residential development is reproduced in Table 5.

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

Table 4: Extract from Table 4 – Indoor ambient noise levels in dwellings

Whilst the above criteria is for dwellings, BS8233 states that these recommendations are similar for hotel guestrooms and therefore these have been adopted as the criteria for assessment.

The guidance of BS8233:2014 with regards to external amenity spaces is as follows:

"*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB* $L_{Aeq,T}$*, with an upper guideline value of 55 dB* $L_{Aeq,T}$ *which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited*."

APPENDIX E

ACOUSTIC TERMINOLOGY

The effects of noise on human beings may be expressed in terms of physiological damage and annoyance. It is, however, only the annoyance impacts that need to be considered in detail when addressing environmental noise impacts. Annoyance also includes the immediate effects of activity interference, for example sleep disturbance and speech interference.

The practice has become to measure sound levels in decibels (dB). The decibel scale is logarithmic rather than linear and it is useful to bear in mind that a noise level change of 3dB would be equivalent to doubling the energy level (for example doubling the volume of traffic) and that an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequency. The ear perceives high frequency sound of a given sound pressure level more loudly than a low frequency sound at the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It thus indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second, it is clearly impractical to specify the sound level continuously and thus time averaging is required. In practice human response has been related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of this report these include:

$L_{Aeq,T}$: the equivalent A-weighted continuous sound level.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hours for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period.

$L_{A10,T}$: the A-weighted level of sound exceeded for 10% of the time period T.

This unit is used for traffic noise measurement and is the preferred unit for prediction of traffic noise in the publication, 'Calculation of Road Traffic Noise'.

$L_{A90,T}$: the A-weighted level of sound exceeded for 90% of the time period T.

This unit is commonly used to represent the background noise and is used in assessing the effects of industrial noise in UK.

L_{Amax} : the maximum A-weighted level of sound over a period of measurement.

$L_{Ar,T}$: the rating level.

The specific Noise plus any adjustments for the characteristic features of the noise. Used for comparison between background levels with the noise source off.

SEL : the Sound Exposure Level.

Sound exposure level abbreviated as SEL and LAE, is the total noise energy produced from a single noise event condensed into a 1 second time period.

R_w : weighted sound reduction index.

A laboratory-measured value as defined in ISO717 Part 1.

D_{nTw} :

The equivalent of Rw, but measured onsite as oppose to in a laboratory