
NOISE IMPACT ASSESSMENT REPORT

PLAS GRONO FARM, ERDDIG, WREXHAM LL13 0YR

Client:

Report Ref: P5327-R1-V1

Issue Date: 28th April 2022

Document Status: Version 1



DATE ISSUED: 28th APRIL 2022

REPORT REFERENCE P5327-R1-V1

MR PAUL GREY

NOISE IMPACT ASSESSMENT REPORT

PLAS GRONO FARM, ERDDIG, WREXHAM LL13 0YR

REPORT VERSION CONTROL:

Document Reference	Date	Report Prepared by:	Report Checked by:	Report Authorised by:
P5327-R1-V1	28/04/22	Joshua McLelland, Ba(Hons), PGDip AMIOA	M. J. Malone, MIOA	M. J. Malone, MIOA

This report has been prepared by NoiseAir Limited with all reasonable skill, care and diligence, within the terms of the contract with the client. The report is confidential to the Client and NoiseAir Limited accept no responsibility of whatever nature to third parties to whom this report may be made known.

No part of this document may be reproduced without the prior written approval of NoiseAir Limited.

CONTENTS

1	INTRODUCTION	1
2	ASSESSMENT METHODOLOGY AND SCOPE OF WORKS	3
3	ACOUSTIC SURVEY	12
4	3D SOUND MODEL	16
5	TAN 11 NOISE EXPOSURE CATEGORY ASSESSMENT	20
6	SOUND INSULATION SCHEME	24
7	CONCLUSIONS	27

APPENDICES

APPENDIX A - REPORT LIMITATIONS

APPENDIX B – METER READINGS

APPENDIX C - BS 12354-3:2000 CALCULATIONS

APPENDIX D - GLOSSARY

1 INTRODUCTION

1.1.1 By instruction from Mr Paul Grey ('the client'), NoiseAir was commissioned to undertake a noise impact assessment (NIA) for a proposed change of use of an existing barn to a residential dwelling at Plas Grono Farm, Erddig, Wrexham LL13 0YR, herein referred to as the 'development site'.

1.1.2 This noise report has been prepared in support of a planning application (planning ref: P/2020/0742) and assesses the results of a noise survey carried out in accordance with current guidance and includes recommendations and mitigation as appropriate.

1.2 Site Description

1.2.1 At the time of writing, the development site is a disused barn building with associated stables. The development site is situated on Plas Grono Farm c. 21 m to the south of Plas Grono Farm House.

1.2.2 Immediately surrounding the site is agricultural land, which is the predominant land use type in the area.

1.2.3 At a distance of c. 93 m to the west of the site is a railway line that was observed to be in use at the time of the acoustic survey. Beyond this railway line is a small industrial estate comprising of c. five separate businesses.

1.2.4 Further to the west, at a distance of c. 430 m is the A483, a major trunk road that connects Swansea to Chester. The A483 is a dual carriageway road that is heavily trafficked with vehicles at speeds of up to 70 mph.

1.2.5 **Figure 1** shows an aerial photograph of the development site with respect to the local area and its context.



Figure 1: Site aerial photograph

1.3 Development Proposals

- 1.3.1 The development proposals comprise the refurbishment of the existing barn / stable structure to form a residential two bedroom dwelling with associated pool house to the south and first floor balcony to the first floor.
- 1.3.2 **Figure 2** shows the proposed layout for the dwelling.



Figure 2: Development proposals

2 ASSESSMENT METHODOLOGY AND SCOPE OF WORKS

2.1 Planning Guidance and Noise

2.1.1 This acoustic report has been prepared in support of a proposed planning application and therefore it is considered that reference should be made to the appropriate planning guidance documentation, specifically:

- Planning Policy Wales – Edition 10 (PPW), 2018; and,
- Planning Guidance (Wales) – Technical Advice Note 11 - Noise (TAN11), 1997.

2.1.2 A summary of the relevant planning documentation and its relevance with respect to noise is provided below.

Planning Policy Wales [PPW 2018]

2.1.3 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales.

2.1.4 The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation.

2.1.5 Section 6.7 of the PPW outlines planning policy with respect to Air Quality and Noise. PPW outlines that the planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.

2.1.6 PPW also aligns with the agent of change principle which says that a business or person responsible for introducing a change is responsible for managing that change. In practice, for example, this means a developer would have to ensure that solutions to address air

quality or noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable.

2.1.7 In proposing new development, planning authorities and developers must, therefore:

- address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors
- not create areas of poor air quality or inappropriate soundscape; and
- seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.

2.1.8 Furthermore, PPW states that the potential impacts of noise pollution arising from existing development (be this commercial, industrial, transport related or cultural venues i.e., music venues, theatres or arts centres), must be fully considered to ensure the effects on new development can be adequately controlled to safeguard amenity. Any necessary measures and controls should be incorporated as part of the proposed new development. This will help to prevent the risk of restrictions or possible closure of existing premises or adverse impacts on transport infrastructure due to noise and other complaints from occupiers of new developments. It will be important that the most appropriate level of information is provided, and assessment undertaken.

Technical Advice Note (Wales) - Noise [TAN 11 1997]

2.1.9 TAN 11 was introduced in 1997 and sets out guidance on the assessment of noise in Wales. It should be noted however that this document is currently under review.

2.1.10 TAN 11 sets out a series of Noise Exposure Categories (NECs) which have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources. The NECs are set out in Annex A of TAN 11.

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

- 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);

- layout: adequate distance between noise source and noise-sensitive building or area; screening by natural barriers, other buildings, or non-critical rooms in a building;
- administrative: limiting operating time of noise source; restricting activities allowed on the site; specifying an acceptable noise limit.

2.1.12 TAN 11 states the following regarding noise exposure categories for dwellings:

*“When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) (**Table 1**) the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as below:“*

Table 1: TAN 11 Noise Exposure Categories	
Category	
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

2.1.13 TAN 11 goes on to provide recommended noise exposure categories for new dwellings near existing noise sources. These are reproduced in **Table 2** below.

Table 2: Recommended Noise Exposure Categories for New Dwellings Near Existing Noise Sources

Noise Source	Noise Exposure Category			
	A	B	C	D
Road Traffic: 0700-2300 2300-0700	<55 <45	55-63 45-57	63-72 57-66	>72 >66
Rail Traffic: 0700-2300 2300-0700	<55 <45	55-66 45-59	66-74 59-66	>74 >66
Air Traffic: 0700-2300 2300-0700	<57 <48	57-66 45-57	66-72 57-66	>72 >66
Mixed Sources: 0700-2300 2300-0700	<55 <45	55-63 45-57	63-72 57-66	>72 >66

- 2.1.14 Annex B of TAN 11 outlines guidance of assessment of noise from different sources. When considering noise from industrial and commercial developments TAN 11 outlines the following guidance.
- 2.1.15 The likelihood of complaints about noise from industrial development can be assessed, where the Standard is appropriate, using guidance in BS 4142: 1990. Tonal or impulsive characteristics of the noise are likely to increase the scope for complaints and this is taken into account by the "rating level" defined in BS 4142. This "rating level" should be used when stipulating the level of noise that can be permitted. The likelihood of complaints is indicated by the difference between the noise from the new development (expressed in terms of the rating level) and the existing background noise. The Standard states that, 'A difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance'. Since background noise levels vary throughout a 24 hour period it will usually be necessary to assess the acceptability of noise levels for separate periods (e.g., day and night) chosen to suit the hours of operation of the proposed development. Similar considerations apply to developments that will emit significant noise at the weekend as well as during the week. In addition, general guidance on acceptable noise levels within buildings can be found in BS 8233:1987
- 2.1.16 It should be noted that the British standard documents referenced in TAN 11 have been superseded, specifically BS 4142:2014 the latest main issue being in 2014, BS 4142:2014 is therefore considered the appropriate assessment document for assessment of noise from commercial and industrial sites.

2.2 Consultation and Scope of Works

2.2.1 Based on the information provided and the subsequent site visits, it is considered that an NIA should be undertaken to assess the potential for adverse impact from the ambient noise levels at the development site.

2.2.2 Comments received from the local planning authority are as follows:

"No part of the development shall commence until a noise survey in order to determine noise levels for both day and night has been carried out, and a detailed report of the survey findings together with a detailed scheme of noise attenuation and/or noise insulation measures has been submitted to and approved in writing by the Local Planning Authority. The measures as are approved shall be fully implemented prior to the first occupation / use of the development."

2.2.3 The scope of the assessment includes consideration of noise at sensitive areas of the proposed development, i.e., proposed residential areas / bedrooms and amenity areas, specifically in terms of the potential impact of local noise sources.

2.2.4 NoiseAir contacted Wrexham Planning Department to agree and confirm the appropriate assessment strategy on the 12th April 2022. It was agreed with Matthew Phillips – Interim Head of Service Planning Policy at Wrexham Council – that the assessment should be undertaken in line with the guidance presented in TAN 11 whilst also taking into consideration the most up to date British Standards.

2.3 Assessment Criteria

2.3.1 To achieve noise levels which are considered to be in alignment with the planning approaches and policies discussed in Section 2.1, it is considered that all efforts are made to ensure that future occupants are unlikely to be exposed to noise levels which might breach the NEC category A.

2.3.2 It is therefore considered that the noise assessment and subsequent sound insulation scheme should also make reference to BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings (BS 8233:2014) and BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound, a summary of which is provided below.

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

2.4.1 BS8233: 2014 sets out the following internal sound levels which are considered suitable to protect residential amenity which have been reproduced in **Table 3**.

Table 3: Summary of internal noise guidelines.			
Activity	Location	0700 – 2300 hours	2300 – 0700 hours
Resting	Living Room	35 dB L _{Aeq,16hr}	-
Dining	Dining room / area	40 dB L _{Aeq,16hr}	-
Sleeping (daytime resting)	Bedroom	35 dB L _{Aeq,16hr}	30 dB L _{Aeq,8hr} 45 dB L _{AMax}

2.4.2 The guidelines presented in **Table 3** reflect and extend current practice contained in BS 8233:2014.

2.4.3 BS 8233:2014 states that “the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB L_{Aeq,16hr}”. The standard continues... “These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited.”

2.5 BS 4142:2014+A1:2019 – Methods for Rating and Assessing Industrial and Commercial Sound [BS 4142:2014]

2.5.1 BS 4142:2014 provides methods for rating and assessing sound of an industrial / commercial nature, which includes sound from industrial and manufacturing processes, fixed services plant, sound generated by the unloading of goods and sound from mobile plant / vehicles associated with industrial / commercial premises (e.g., fork-lift trucks).

2.5.2 BS 4142:2014 uses various descriptors to assess the likelihood of adverse impact relating to proposed / existing industrial / commercial activities on existing or proposed noise-sensitive receivers.

2.5.3 The magnitude of impact is assessed by subtracting the measured background sound level at a location representative of the nearest noise-sensitive receiver, from the ‘rating level’ (the specific sound source to be introduced into the locality, corrected for acoustically distinguishing characteristics which may make it more subjectively prominent).

2.5.4 Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142:2014 suggests that this should be considered in the context-of the site and surrounding being assessed.

2.5.5 As a guideline, BS 4142:2014 suggests that:

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

2.5.6 BS 4142:2014 requires qualified engineering consultants and technical planning professionals (e.g., Environmental Health Officers) to use a combination of quantitative assessment techniques and rational qualitative judgments to come to a reasoned conclusion.

Definitions;

2.5.7 BS 4142:2014 uses several specific terms to define the various levels used in assessments, as follows:

- Specific sound – the commercial / industrial noise source under consideration.
- Residual sound – the sound level at the noise-sensitive receivers in the absence of the specific sound.
- Ambient sound – the sound level at the noise-sensitive receivers in the presence of the specific sound (i.e., ambient = residual + specific).
- Background level - the sound pressure level which is exceeded by the residual sound for 90% of the measurement period.
- Rating level – the specific sound, corrected for acoustically distinguishing characteristics.

Background level;

2.5.8 BS 4142:2014 suggests that the background level (LA90,T) should be considered as a range of levels and not an absolute value. Background sound measurements should be normally not less than 15 minutes, the suggestion is on obtaining a level for use in assessment that is representative of typical conditions at the noise-sensitive receivers.

2.5.9 An example methodology by which this typical value may be obtained is given in BS 4142:2014. The example suggests that where monitoring of LA90,15mins is undertaken during periods which represent when the specific noise will be operational. After obtaining a

sequence of representative results, the mode average value is considered representative of the 'typical' background level and may be adopted for the assessment.

Specific sound;

- 2.5.10 BS 4142:2014 requires that the specific sound (LAeq,T) is obtained over a reference period of 1 hour (daytime) and 15 mins (at night). Ideally, where possible measurements should be taken of the ambient sound and residual sound at the assessment location, with these measurements used to accurately calculate the specific sound (ambient – residual = specific).
- 2.5.11 Where the source (specific sound) is not yet operational, it is permissible to measure the specific sound elsewhere (or to use known manufacturers' or library data) and then model the impact of this against the known background level.

Rating level;

- 2.5.12 Once the specific sound level has been determined, this should be corrected in terms of the need to consider the subjective prominence of the impact of the sound at noise-sensitive receptors.
- 2.5.13 BS 4142:2014 states that this is normally possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:
- **Tonality:** +2 dB for a 'just perceptible' tone, +4 dB for 'clearly perceptible', +6 dB for 'highly perceptible' tones.
 - **Impulsivity:** +3 dB for 'just perceptible' impulsivity, +6 dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity.
 - **Intermittency:** if the on / off-time of the specific sound is readily distinctive at the noise- sensitive receivers, +3 dB.
 - **Other sound characteristics:** up to +3 dB may be added for sound characteristics which are considered adverse to the receptor being clearly / highly perceptible. It should be noted that a correction for other sound characteristics is rare.
- 2.5.14 It should be noted that where one feature is clearly perceived as dominant, it may be applicable to correct for that feature only. Where multiple features are likely to affect perception and response, each should be added arithmetically.

2.6 Noise Survey

2.6.1 As part of this assessment, NoiseAir has carried out an unattended noise survey to measure the existing sound levels at the site and at the closest identified noise sensitive receptors.

2.6.2 The primary noise sources assessed are:

- Road traffic noise from the A483; and,
- Train noise, although occasional in nature.

2.6.3 The above noise sources have been assessed in relation to the below identified receptors:

- Future occupants at the development site.

2.6.4 It should be noted that although the proposed development is in close proximity to a nearby industrial estate, industrial / commercial noise was not audible at the development site. Therefore, this has not been considered as part of the assessment.

3 ACOUSTIC SURVEY

3.1 Acoustic Survey Details

3.1.1 NoiseAir carried out fixed position noise monitoring between 7th March 2022 to 8th March 2022 at the development site.

3.1.2 Noise monitoring was undertaken at one monitoring location (ML1), noise monitoring location (ML1) is shown in **Figure 3** and described in **Table 4** below.



Figure 3: Site layout plan and noise monitoring locations.

Table 4: Summary of Noise Monitoring Locations				
Monitor Location Number	Location Description	Time Period Monitored		Attended or Unattended Monitoring
		Start	End	
ML1	Tripod mounted microphone c. 2 m above local ground level. Positioned in centre of garden.	13:15 07/03/22	19:00 08/03/22	Unattended

3.1.3 The monitoring location was positioned to be representative of the typical noise levels at the approximate location of the development site.

3.1.4 The noise measurements were made using one Class 1, integrating sound level meter (SLM).

3.1.5 The acoustic equipment was calibrated to comply with Section 4.2 of BS7445-1:2003¹ before and after the noise monitoring periods.

3.1.6 Details of the SLM and associated field calibration can be found in **Table 5** below;

Table 5: Summary of SLM's used for survey and associated field calibration						
SLM (Serial Number)	Preamp (Serial Number)	Microphone (Serial Number)	Calibrator (Serial Number)	Start Calibration	End Calibration	Drift (dB)
NOR140 (1405015)	NOR1209 (14517)	NOR1225 (42327)	B&K4231 (2482550)	-26.3 dB	-26.2 dB	0.1

3.1.7 The weather conditions were noted to be as outlined in **Table 6** during the site visits at the start and end of the monitoring periods.

Table 6: Summary of weather conditions noted at the start and end of the monitoring duration.		
	7 th March 2022	8 th March 2022
Roads (Wet / Dry)	Dry	Dry
Temperature (°C)	8	9
Wind speed (ms ⁻¹)	< 5	< 5
Cloud Cover (Approx. %)	80	50
Humidity (%)	84	72

3.1.8 A-weighted² L_{eq}^3 and L_{Amax}^4 noise levels were measured to comply with the requirements of TAN 11 and BS 8233:2014. A-weighted L_{90}^5 were also measured to provide additional information. The measured noise levels are set out in full in **Appendix B**.

3.1.9 Attending the development site at the start and end of the survey monitoring period provided opportunity for observations and detailed notes to be made of the significant noise sources which contribute to each of the measured levels.

ML1

Distant road traffic: Non-descript traffic noise was the dominant source of noise at ML1.

Train Noise: Train noise was audible at ML1, however, it was occasional in nature.

¹ BS7445-2003 "Description and measurement of environmental noise – Part 1: Guide to quantities and procedures.

² An electronic filter in a sound level meter which mimics the human ear's response to sounds at different frequencies under defined conditions.

³ Equivalent continuous noise level; the steady sound pressure which contains an equivalent quantity of sound energy as the time-varying sound pressure levels.

⁴ The instantaneous maximum noise level recorded for a measurement period.

⁵ The noise level which is exceeded for 90% of the measurement period.

3.2 Measured Sound Levels

3.2.1 The results for the monitoring locations during the daytime and night-time periods are presented in **Table 7** below.

Table 7: Average Measured Daytime and Night-time Noise Levels				
Monitoring Location	Time	Measured Noise Level		
		dB $L_{Aeq,16hour}$ / dB $L_{Aeq,8hour}$	dB $L_{Aeq,1hour}$ / dB $L_{Aeq,15mins}$	dB $L_{A90,1hour}$ / dB $L_{A90,15mins}$
ML1	07:00-23:00	47.0 – 52.2	44.0 – 54.6	39.4 – 50.5
	23:00-07:00	48.0	35.9 – 60.1	30.7 – 45.7

3.2.2 The maximum night-time noise levels exceeded more than 10 times at ML1 are presented in **Table 8**.

Table 8: Summary of the Maximum Night-time Noise Levels (Figures in dB L_{AFmax}).	
Monitoring Location	Measured Maximum Noise Level During the Night-Time Period (dB(A))
ML1	58

3.2.3 Data is shown in **Figure 4** detailing a level vs time graph of the recorded L_{Amax} , L_{Aeq} and L_{A90} sound level over 15-minute time periods for ML1 for the entire measurement durations.

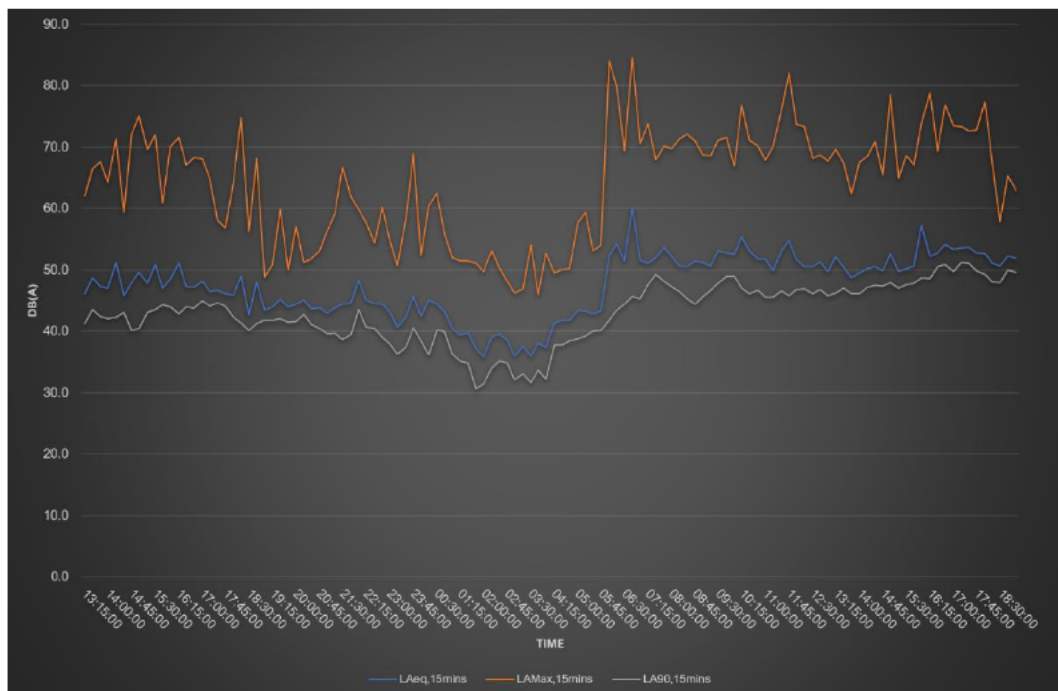


Figure 4: Level vs. time graph showing L_{Amax} , L_{Aeq} and L_{A90} sound levels – ML1

3.3 Background Sound Levels

3.3.1 A histogram showing the distribution of existing $L_{Aeq,1hour}$ sound levels for the daytime are presented in **Figure 5** for ML1.

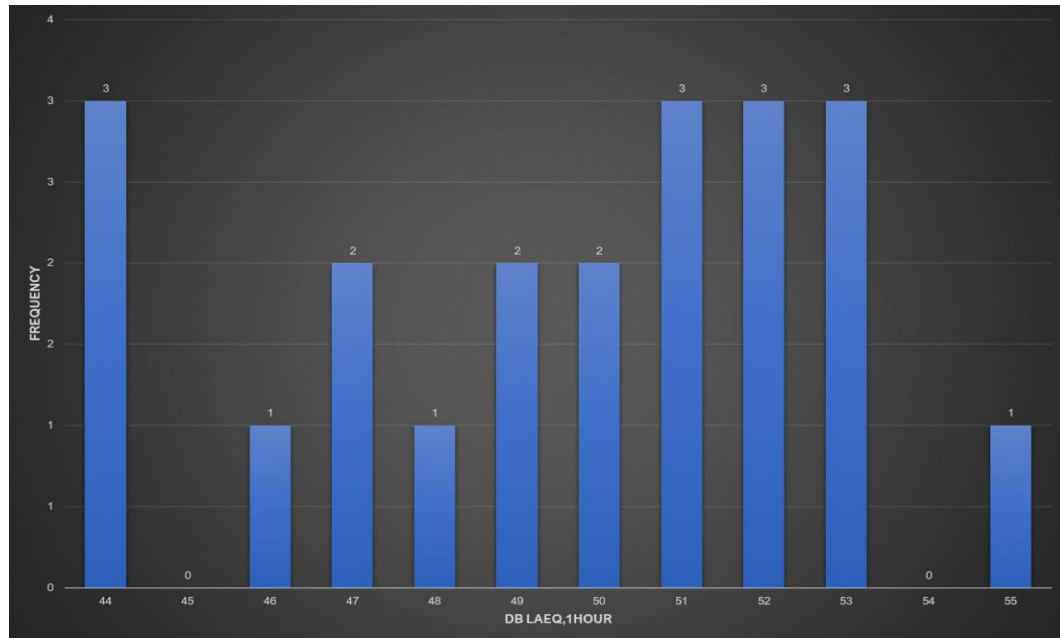


Figure 5: Histogram showing frequency distribution of $L_{A90,1hour}$ noise readings at ML1 – Daytime.

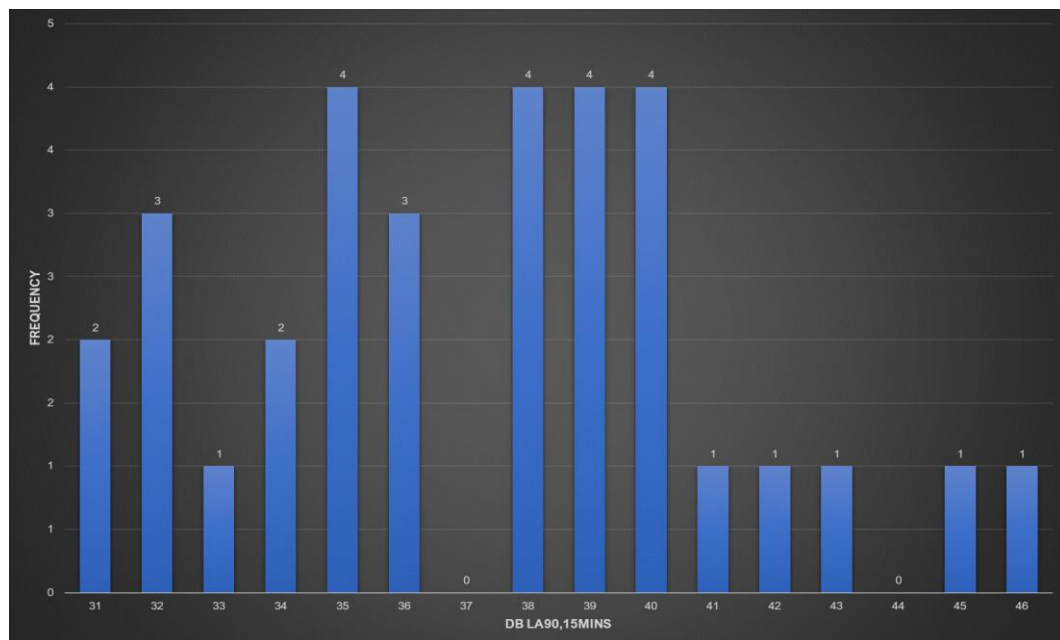


Figure 6: Histogram showing frequency distribution of $L_{A90,15min}$ noise readings at ML1 – Night-time.

3.3.2 For daytime hours at ML1, a worst case background $L_{A90,1hour}$ sound level of 44 dB has been adopted for this assessment being considered a conservative value given the dataset. For the night-time period, a typical value of 35 dB $L_{A90,15min}$ has been selected.

4 3D SOUND MODEL

- 4.1.1 A 3D sound model has been constructed in SoundPLAN™ to calculate the predicted sound pressure levels at selected potential receiver facades. The model uses the calculation method from ISO 9613-2:1996⁶ to account for the distance between the source and receiver and any screening or reflections provided by the surrounding buildings. The model is based on and calibrated against data collected during the survey presented in Section 3.2 of this report.
- 4.1.2 The 3D noise model specifically includes the following noise sources:
- **Road traffic noise from the A483** – Line source at 0.5 m above ground level calibrated to site measurements and spectrum corresponding to that acquired at ML1 of 92.0 dB(A) L_{WA} , night-time 92 dB(A) L_{WA} , and night-time 94.0 dB L_{Amax} .
 - **Train noise from nearby railway line** – Line source at 0.5 m above ground level calibrated to site measurements and spectrum corresponding to that acquired at ML1 of 87.4 dB(A) L_{WA} , night-time 77.0 dB(A) L_{WA} , and night-time 115.3 dB L_{Amax} .
- 4.1.3 A noise contour plot illustrating the propagation of the sound from source to receptor during the daytime ($L_{Aeq, 16hour}$), night time ($L_{Aeq, 8hour}$) and night time (L_{AFmax}) condition is given in **Figure 7, Figure 8 and Figure 9** respectively.

⁶ ISO9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation"

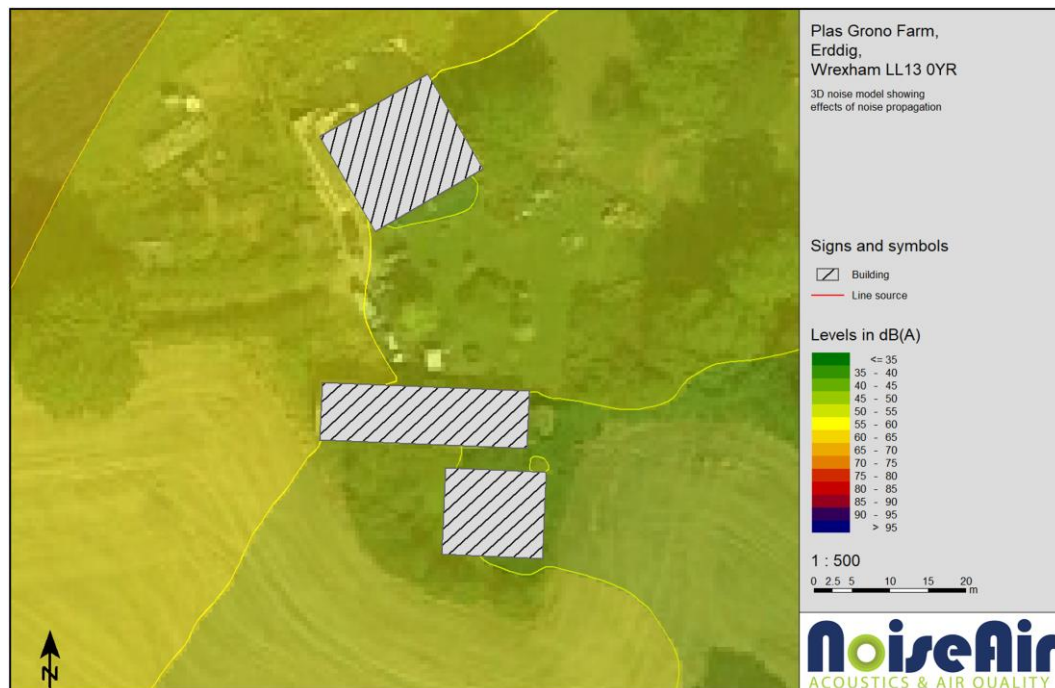


Figure 7: Noise contour plot illustration of the predicted propagation of sound to the proposed development during the daytime – $L_{Aeq,16hour}$.

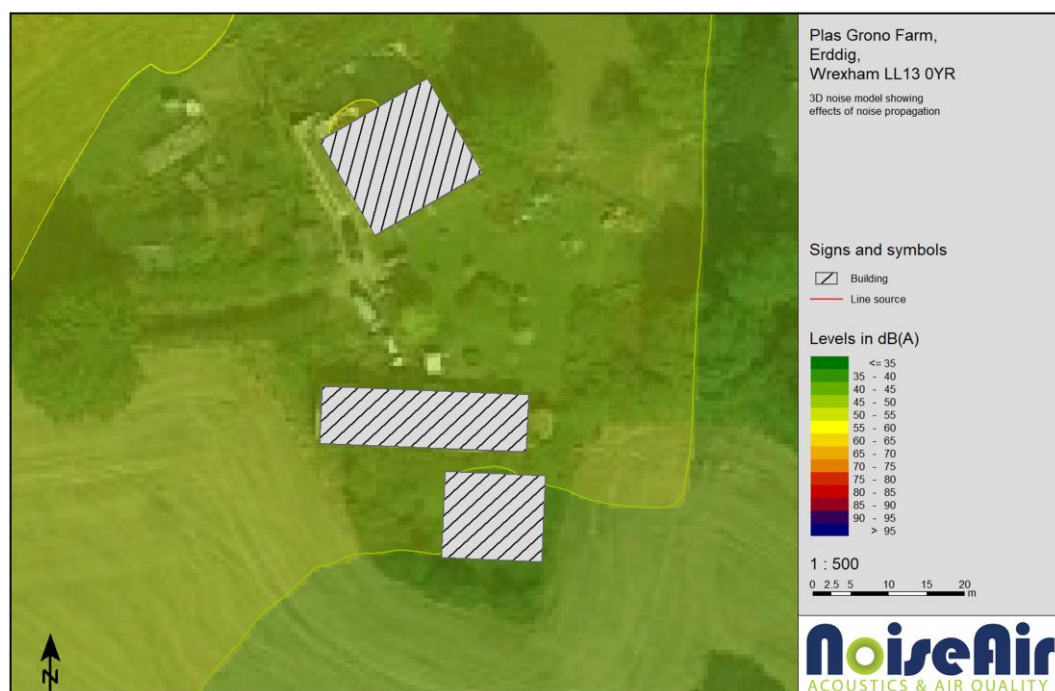


Figure 8: Noise contour plot illustration of the predicted propagation of sound to the proposed development during the night-time – $L_{Aeq,8hour}$.

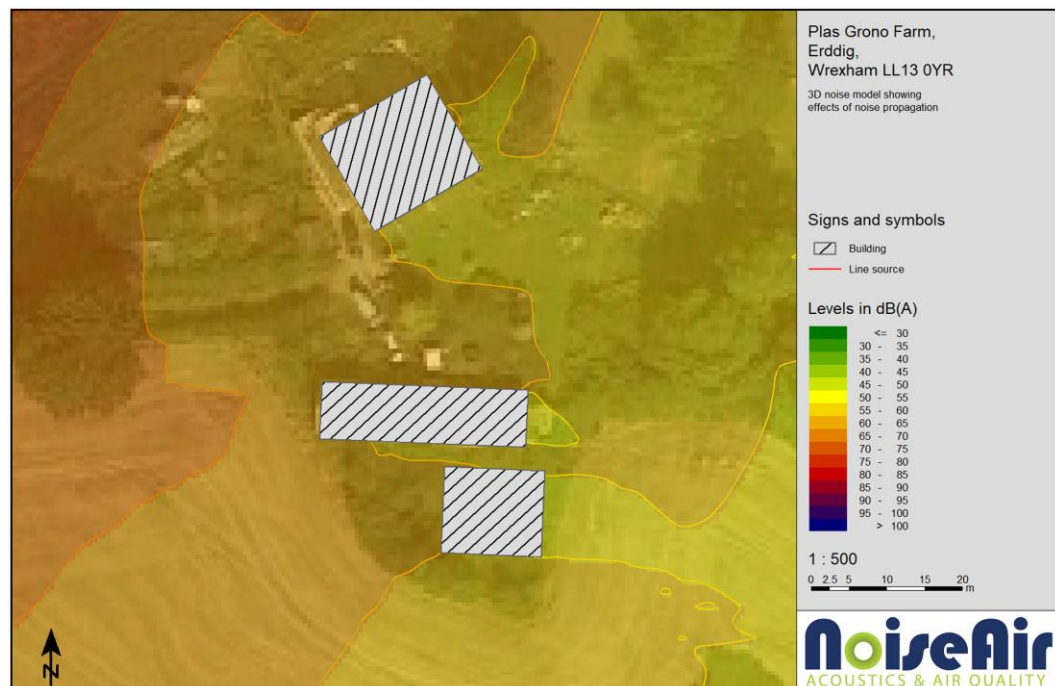


Figure 9 Noise contour plot illustration of the predicted propagation of instantaneous maximum sound to the proposed development during the night-time – L_{Amax} .

4.1.4 Receptor locations used in the noise model with calculated façade levels are presented in **Figure 10** below.



Figure 10: Illustration of the 3D sound model Receptor Locations.

4.1.5 **Table 9** below details the predicted noise levels at each façade receptor location.

Table 9: Predicted Façade Receptor Noise Levels					
Receptor Number	Facade	Floor	dB $L_{Aeq,16hours}$ Daytime	dB $L_{Aeq,8hours}$ Night-Time	dB $L_{Amax, Night}$
1	Balcony	1.FI	51.7	44.1	58.9
2	North	GF	51.8	45.0	59.6
3	South	GF	48.3	43.2	57.0
4	West	GF	54.3	46.4	61.2

5 TAN 11 NOISE EXPOSURE CATEGORY ASSESSMENT

- 5.1.1 Based on the results of the 3D sound model and in accordance with the TAN 11, a Noise Exposure Category Assessment (NECA) has been conducted. The NECA assesses the initial risk of noise to have an adverse impact on a proposed development based on the overall measured levels with no mitigation in place.
- 5.1.2 The results of noise measurements undertaken during the daytime and night-time periods are presented in **Table 10**, and have been compared to the information provided in **Table 1** and **Table 2**.

Table 10: Stage 1 Risk Assessment of Noise Levels					
Receptor Point	Façade	Daytime Noise Level (dB L _{Aeq})	Noise Exposure Category	Night-time Noise Level (dB L _{Aeq})	Noise Exposure Category
2	North	52	A	45	B
3	South	48	A	43	A
4	West	54	A	46	B

- 5.1.3 **Table 10** indicates that during the daytime and night-time periods, proposed receptors of the development fall into categories A and B as per the guidance presented in TAN 11.
- 5.1.4 TAN 11 states that:

Noise levels in category A need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.

Noise levels in category B should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection. The Site Noise Risk Assessment shows that local noise mitigation and good acoustic design will be required to ensure that the potential risk of the noise impact is minimised, and guideline internal and external noise levels are achieved.

5.2 Acoustic Design Statement

- 5.2.1 The results of the TAN11 NECA shows that receptors at the proposed development are likely to be exposed to noise levels that are in both categories A and B as per the guidance presented in TAN 11. Therefore, an assessment against the criteria in BS 8233:2014 has been undertaken with reference to the general sound levels at the site.

BS 8233:2014 Assessment of Daytime Noise Levels in Outdoor Living Areas

- 5.2.2 The proposals at the time of writing indicate there is to be amenity space on the roof of the pool house in the form of a balcony.
- 5.2.3 The worst case daytime $L_{Aeq,16hour}$ for the amenity spaces is calculated at 51.7 dB(A).
- 5.2.4 This value is above the BS 8233:2014 guidelines for people being moderately annoyed but below the BS 8233:2014 guidelines for people being seriously annoyed.
- 5.2.5 A 1.7 dB(A) exceedance is considered marginal and is considered likely to be acceptable to future residents.
- 5.2.6 While the option exists to install acoustic barriers around the perimeter of the balcony, such barriers would likely have to be in excess of 1.8 m in height and therefore unlikely to be a viable option.

5.3 BS 8233:2014 Assessment of Daytime / Night-time Noise Levels in Living Rooms and Bedrooms

- 5.3.1 The predicted noise levels at the façades of the proposed building structures, as detailed in **Figure 10** and **Table 9** for the daytime period, together with the level of attenuation required to achieve 35 dB $L_{Aeq,16hour}$ in living rooms and 30 dB $L_{Aeq,8hour}$ / 45 dB L_{Amax} in bedroom areas in accordance with BS 8233: 2014, are presented in **Table 11**. It is noted from the proposal drawings that there no windows proposed for the northeast and southeast facades.

Table 11: Level of Attenuation Required to Achieve the Internal Noise Guideline Levels.			
Façade Colour	Daytime ($L_{Aeq,16hours}$) / Night-Time ($L_{Aeq,8hours}$ / L_{Amax})	Worst Case Noise Level at the Façade of the Property	Worst Case Level of Attenuation Required
North	Daytime $L_{Aeq,16hours}$	51.8	17
	Night-Time $L_{Aeq,8hours}$	45.0	15
	Night-Time L_{Amax}	59.6	15
South	Daytime $L_{Aeq,16hours}$	48.3	13
	Night-Time $L_{Aeq,8hours}$	43.2	13
	Night-Time L_{Amax}	57.0	12
West	Daytime $L_{Aeq,16hours}$	54.3	19

Table 11: Level of Attenuation Required to Achieve the Internal Noise Guideline Levels.

Façade Colour	Daytime ($L_{Aeq,16hours}$) / Night-Time ($L_{Aeq,8hours}$ / L_{Amax})	Worst Case Noise Level at the Façade of the Property	Worst Case Level of Attenuation Required
	Night-Time $L_{Aeq,8hours}$	46.4	16
	Night-Time L_{Amax}	61.2	16
*Red text indicates the worst case façade noise levels at each façade.			

5.4 Preliminary BS 4142:2014 Assessment for potential Pool House Extraction

- 5.4.1 Proposals for the development site have the potential to include extraction units to service the pool house to the south of the development.
- 5.4.2 At the time of writing there is no detail with respect to any active ventilation systems or extraction units to be installed at the development site. It is therefore considered that a preliminary BS 4142:2014 assessment should be undertaken accounting for the likely character corrections applied to such noise sources and also the measured background sound levels at the development site to determine an acceptable level of noise breakout for any mechanical ventilation system which may be installed at roof level of the proposed development or to the rear of the development.
- 5.4.3 The results of this preliminary BS 4142:2014 can therefore be used as a design target for the future detailed design of the active ventilation system at the development site.

Background Sound Level

- 5.4.4 The measured background sound levels have been measured and presented within Section 3.3 of this report.
- 5.4.5 For daytime and night-time at the development site, typical background L_{A90} sound levels of 44 dB(A) and 35 dB(A) respectively have been adopted for this assessment.

Character Corrections

- 5.4.6 NoiseAir have experience of assessment of extraction units and therefore based on historical knowledge of such systems have applied the following character corrections:
- **Tonality** – A character correction of +4 dB has been applied for modest tones being ‘clearly perceptible’ from the noise source. Active ventilation systems are typically

likely to generate modest tones at the low to mid frequency bands which in some circumstances can be persistent with respect to local residents.

- **Impulsivity** – Active ventilation systems typically operate on a continuous / intermittent basis and do not exhibit impulsive characteristics therefore no character correction has been applied for impulsivity; and,
- **Intermittency** – While extraction systems often operate on a continual basis for extended periods of time, it is possible for such systems to be turned on and off based on demand. As such, a +3 dB correction has been applied for intermittency.

Assessment to Determine Specific Sound Level

- 5.4.7 A preliminary BS 4142:2014 assessment is presented in **Table 12** to determine the acceptable level of noise breakout from the potential pool house extraction system.

Table 12: Preliminary BS 4142:2014 Assessment to Determine the Acceptable Level of Noise Breakout from the Potential Mechanical Ventilation System		
Quantity	Sound Level dB(A)	
	Daytime	Night-time
Typical background sound level, dB L_{A90}	44	35
Character corrections		
Tonality	+4	+4
Impulsivity	0	0
Intermittency	+3	+3
Acceptable level of noise breakout @ 1 m.	37	28

6 SOUND INSULATION SCHEME

6.1 Building Envelope Requirements – Windows Closed

- 6.1.1 Proposals for the development site at the time of writing outline residential use to the first floor and above. Noise sensitive rooms are proposed to all facades of the property. Therefore, internal noise levels are required to not exceed 35 dB L_{Aeq} during the daytime hours in all rooms and 30 dB L_{Aeq} and 45 dB L_{Amax} during the night-time hours in bedrooms.
- 6.1.2 When assessing sound levels in habitable areas of the proposed development, the sound attenuation provided by the overall building facade should be considered. To mitigate sound levels, the composition of the building facade can be designed to provide the level of attenuation required. Glazing is generally the building element which attenuates noise the least, so the proportion of glazing in a building facade is an important consideration when assessing overall sound attenuation. Additionally, any façade penetrations should also be considered such as for ventilation, e.g., trickle ventilation.
- 6.1.3 Based on the design details forwarded, worst case façade attenuation calculations have been undertaken in accordance with BS EN ISO 12354-3:2017. Full details of the calculations undertaken are presented in **Appendix D**.
- 6.1.4 Calculations show that to achieve a reasonable internal acoustic environment in habitable rooms as specified within BS 8233:2014, the building envelope constructions should be selected to meet the sound reduction index (SRI) values presented in **Table 13**.
- 6.1.5 The building envelope construction is based on a passive ventilation system being installed. However, if an active ventilation system is required, relaxed glazing specifications are also presented.

Table 13: Summary of Building Envelope Performance Requirements to all Facades		
Walls	50 R_w+C_{tr}	Typical example: 100 mm brick exterior wall, 100 mm cavity with 60 mm 10 kg / m ³ fiberglass insulation, 100 mm lightweight concrete block / breeze block and two layers of plasterboard.
Roof	47 R_w+C_{tr}	Typical Example: Tiles on felt pitched roof, lath, and plaster ceiling.
Glazing	25 R_w+C_{tr}	Typical example: Double glazed unit consisting of 4 mm pane, 6-16 mm air filled cavity and 4 mm pane ⁷ .
Acoustic Vent (Up to 2 no. trickle vents per room)	25 $D_{n,e,w}+C_{tr}$	Typical example: DucoTop 60 Corto SR. Other manufacturer may be suitable as long as the units comply with 25 $D_{n,e}+C_{tr}$ in the open position.

⁷ Glazing acoustic values are based on those presented in BS 12758:2011. Specialist glazing advice should be sought.

6.2 Building Envelope Performance – Windows Open

- 6.2.1 The sound performance requirements for bedrooms, living and dining rooms at the development during the daytime and night-time in rooms with windows closed are summarised in Section 6.1.
- 6.2.2 However, with windows open, the attenuation provided by the façade will be approximately 10-15 dB(A). This would potentially allow the recommended internal noise limit to be exceeded in most rooms at the development during certain parts of a typical day / night.
- 6.2.3 **Table 14** shows the level of exceedance for partially open windows at the front, rear and side facades.

Table 14: Summary of Internal Noise Levels with Windows Partially Open (based on a Partially Open Window Providing up to 15 dB(A) Attenuation).				
Façade	Room Type	Day / Night	Yes / No	Excess (dB)
North	Living/Dining/Kitchen Room	Day	Yes	+2
	Bedroom	Night	Yes	0
South	Living/Dining/Kitchen Room	Day	Yes	-2
	Bedroom	Night	Yes	-2
West	Living/Dining/Kitchen Room	Day	Yes	+4
	Bedroom	Night	Yes	+1

- 6.2.4 It is considered that in many circumstances, such as urban / sub-urban developments, an exceedance of up to 5 dB(A) in accordance with BS 8233:2014 is likely to be acceptable to future residents and therefore is unlikely to breach the LOEL criteria discussed in Section 2 of this report.
- 6.2.5 Where exceedances are likely to be greater than +5 dB, on occasions, this may be acceptable to a resident, but when quiet conditions are required, the resident should be able to close the windows whilst maintaining adequate ventilation.

6.3 Ventilation Requirements

- 6.3.1 It is recommended that the acoustic ventilation proposed at the site should, as a minimum, comply with Building Regulations 2000 Approved Document F1 Means of Ventilation and British Standard BS5925 1991: "Code of Practice for Ventilation Principles and Designing for

Natural Ventilation". Acoustic ventilation is only recommended for noise sensitive rooms, which are bedrooms and living/dining rooms.

- 6.3.2 Where a passive ventilation system is incorporated into the design, ventilators should be acoustically treated for habitable rooms to all facades. Ventilation openings to these rooms should match or exceed the minimum values set out in **Table 13**.
- 6.3.3 The implementation of the recommended glazing would ensure that the required internal daytime and night-time noise limits are achieved.
- 6.3.4 It should be further noted that the glazing configurations within this report are for guidance only. Similar products to those used in NoiseAir calculations may achieve a similar level of sound reduction, however this should be verified by the manufacturer.
- 6.3.5 As detailed in Section 6.2 it is likely that noise levels in noise sensitive rooms within all of the proposed rooms will be low enough that windows can remain open throughout the day should the occupants require.

7 CONCLUSIONS

- 7.1.1 By instruction from Mr Paul Grey ('the client'), NoiseAir was commissioned to undertake a noise impact assessment (NIA) for a proposed change of use of an existing barn to a residential dwelling at Plas Grono Farm, Erddig, Wrexham LL13 0YR, herein referred to as the 'development site'.
- 7.1.2 It is understood that a planning application is to be submitted to the Local Planning Authority (planning ref: P/2020/0742) to redevelop the existing barn and stables into a two bedroom residential dwelling with associated balcony and pool house.
- 7.1.3 The primary noise sources assessed are:
- Railway noise from the railway line to the west of the development site; and,
 - Road traffic noise breakout from the A483.
- 7.1.4 The results of the TAN11 Noise Exposure Category Assessment indicates that receptors at the proposed development are likely to be subject to noise levels in categories A and B.
- 7.1.5 Calculations show that to achieve a reasonable internal acoustic environment in habitable rooms as specified within BS 8233:2014, the building envelope constructions should be selected to meet the sound reduction index (SRI) values presented in **Table 13**. Based on traditional building construction techniques, standard glazing with a $R_w + C_{tr}$ rating of 25 dB could be used with a corresponding passive ventilation strategy of 25 dB(A) $D_{n,e} + C_{tr}$.
- 7.1.6 **Table 14** demonstrates that acceptable internal noise levels are likely to be achieved with windows in the partially open position.
- 7.1.7 A preliminary BS 4142:2014 assessment is presented in **Table 12** to determine the acceptable level of noise breakout from the potential pool house extraction system. Noise levels at 1 m from any proposed plant should not exceed 34 dB(A) and 28 dB(A) during the daytime and night time respectively.

APPENDIX A - REPORT LIMITATIONS

This Report is presented to Mr Paul Grey and may not be used or relied on by any other person or by the client in relation to any other matters not covered specifically by the scope of this report.

Notwithstanding anything to the contrary contained in the report, NoiseAir Limited is obliged to exercise reasonable skill, care and diligence in the performance of the services required by Mr Paul Grey and NoiseAir shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

This report has been prepared by NoiseAir Limited. No individual is personally liable in connection with the preparation of this report. By receiving this report and acting on it, the client or any other person accepts that no individual is personally liable whether in contract, tort, for breach of statutory duty or otherwise.

The conclusions and recommendations contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from who it has been requested and that such information is accurate. Information obtained by NoiseAir Limited has not been independently verified by NoiseAir Limited unless otherwise stated in the report and should be treated accordingly.

Where assessments of works or costs identified in this report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Where / if estimates and projects are made within this report, are made based on reasonable assumptions as of the date of this report, such statements however by their very nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. NoiseAir Limited specifically does not guarantee or warrant any estimates or projects contained in this report.

DISCLAIMER- This report was prepared by NoiseAir Limited. The material in it contains NoiseAir Limited best judgment in light of the information available at the time of preparation of this report. Any use which a third party makes of this report, or any reliance on, or decisions based on it are the responsibility of such third parties. NoiseAir Limited accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

APPENDIX B – METER READINGS

ML1

Start Date	Start Time	Duration	L _{Aeq} , 15min	L _{AFMax} , 15min	L _{A90} , 15min
dd/mm/yyyy	hh:mm:ss	hh:mm:ss	dB	dB	dB
07/03/2022	13:15:00	00:15:00	46.1	62.1	41.3
07/03/2022	13:30:00	00:15:00	48.8	66.5	43.5
07/03/2022	13:45:00	00:15:00	47.3	67.6	42.4
07/03/2022	14:00:00	00:15:00	47.0	64.2	42.1
07/03/2022	14:15:00	00:15:00	51.2	71.3	42.3
07/03/2022	14:30:00	00:15:00	45.8	59.4	43.1
07/03/2022	14:45:00	00:15:00	48.0	72.1	40.1
07/03/2022	15:00:00	00:15:00	49.6	75.1	40.5
07/03/2022	15:15:00	00:15:00	47.8	69.7	43.1
07/03/2022	15:30:00	00:15:00	50.9	72.0	43.6
07/03/2022	15:45:00	00:15:00	47.0	61.0	44.3
07/03/2022	16:00:00	00:15:00	48.5	70.1	44.0
07/03/2022	16:15:00	00:15:00	51.1	71.6	42.9
07/03/2022	16:30:00	00:15:00	47.3	67.0	44.0
07/03/2022	16:45:00	00:15:00	47.2	68.3	43.8
07/03/2022	17:00:00	00:15:00	48.2	68.1	45.0
07/03/2022	17:15:00	00:15:00	46.5	64.8	44.1
07/03/2022	17:30:00	00:15:00	46.7	58.1	44.7
07/03/2022	17:45:00	00:15:00	46.1	56.9	44.1
07/03/2022	18:00:00	00:15:00	45.9	64.4	42.3
07/03/2022	18:15:00	00:15:00	49.1	74.9	41.4
07/03/2022	18:30:00	00:15:00	42.6	56.2	40.2
07/03/2022	18:45:00	00:15:00	48.1	68.2	41.3
07/03/2022	19:00:00	00:15:00	43.4	48.9	41.9
07/03/2022	19:15:00	00:15:00	44.0	50.9	41.9
07/03/2022	19:30:00	00:15:00	45.2	59.8	42.1
07/03/2022	19:45:00	00:15:00	44.0	50.0	41.5
07/03/2022	20:00:00	00:15:00	44.4	57.1	41.6
07/03/2022	20:15:00	00:15:00	45.1	51.2	42.8
07/03/2022	20:30:00	00:15:00	43.7	51.8	41.2
07/03/2022	20:45:00	00:15:00	43.9	53.2	40.5
07/03/2022	21:00:00	00:15:00	43.0	56.4	39.6
07/03/2022	21:15:00	00:15:00	43.9	59.3	39.7
07/03/2022	21:30:00	00:15:00	44.4	66.7	38.7
07/03/2022	21:45:00	00:15:00	44.7	62.0	39.5
07/03/2022	22:00:00	00:15:00	48.3	59.8	43.5
07/03/2022	22:15:00	00:15:00	45.1	57.8	40.7
07/03/2022	22:30:00	00:15:00	44.6	54.4	40.5
07/03/2022	22:45:00	00:15:00	44.5	60.2	39.0
07/03/2022	23:00:00	00:15:00	43.2	55.0	38.0
07/03/2022	23:15:00	00:15:00	40.7	50.7	36.3
07/03/2022	23:30:00	00:15:00	42.3	58.4	37.5
07/03/2022	23:45:00	00:15:00	45.8	69.0	40.6
08/03/2022	00:00:00	00:15:00	42.4	52.4	38.5
08/03/2022	00:15:00	00:15:00	45.1	60.5	36.2
08/03/2022	00:30:00	00:15:00	44.5	62.5	40.3
08/03/2022	00:45:00	00:15:00	43.2	55.9	39.9

Start Date	Start Time	Duration	L _{Aeq} , 15min	L _{AFMax} , 15min	L _{A90} , 15min
dd/mm/yyyy	hh:mm:ss	hh:mm:ss	dB	dB	dB
08/03/2022	01:00:00	00:15:00	40.5	52.0	36.3
08/03/2022	01:15:00	00:15:00	39.4	51.5	35.2
08/03/2022	01:30:00	00:15:00	39.8	51.5	34.8
08/03/2022	01:45:00	00:15:00	37.2	51.1	30.7
08/03/2022	02:00:00	00:15:00	35.9	49.8	31.4
08/03/2022	02:15:00	00:15:00	39.1	53.1	34.1
08/03/2022	02:30:00	00:15:00	39.6	50.3	35.2
08/03/2022	02:45:00	00:15:00	38.6	48.2	34.9
08/03/2022	03:00:00	00:15:00	36.0	46.3	32.1
08/03/2022	03:15:00	00:15:00	37.7	46.9	33.1
08/03/2022	03:30:00	00:15:00	36.0	54.0	31.7
08/03/2022	03:45:00	00:15:00	38.1	46.0	33.7
08/03/2022	04:00:00	00:15:00	37.5	52.7	32.2
08/03/2022	04:15:00	00:15:00	41.4	49.5	37.8
08/03/2022	04:30:00	00:15:00	41.8	50.1	37.8
08/03/2022	04:45:00	00:15:00	41.9	50.2	38.5
08/03/2022	05:00:00	00:15:00	43.4	57.8	38.8
08/03/2022	05:15:00	00:15:00	43.3	59.4	39.3
08/03/2022	05:30:00	00:15:00	42.9	53.2	40.0
08/03/2022	05:45:00	00:15:00	43.3	54.0	40.2
08/03/2022	06:00:00	00:15:00	52.4	84.0	41.8
08/03/2022	06:15:00	00:15:00	54.3	79.9	43.4
08/03/2022	06:30:00	00:15:00	51.4	69.4	44.5
08/03/2022	06:45:00	00:15:00	60.1	84.6	45.7
08/03/2022	07:00:00	00:15:00	51.6	70.6	45.4
08/03/2022	07:15:00	00:15:00	51.1	73.8	47.6
08/03/2022	07:30:00	00:15:00	52.0	68.0	49.3
08/03/2022	07:45:00	00:15:00	53.7	70.2	48.2
08/03/2022	08:00:00	00:15:00	52.2	69.8	47.3
08/03/2022	08:15:00	00:15:00	50.7	71.4	46.5
08/03/2022	08:30:00	00:15:00	50.5	72.1	45.3
08/03/2022	08:45:00	00:15:00	51.5	71.0	44.4
08/03/2022	09:00:00	00:15:00	51.2	68.7	45.7
08/03/2022	09:15:00	00:15:00	50.7	68.6	46.7
08/03/2022	09:30:00	00:15:00	53.1	71.1	47.8
08/03/2022	09:45:00	00:15:00	52.8	71.6	49.0
08/03/2022	10:00:00	00:15:00	52.6	66.9	49.0
08/03/2022	10:15:00	00:15:00	55.4	76.9	47.1
08/03/2022	10:30:00	00:15:00	53.2	71.1	46.2
08/03/2022	10:45:00	00:15:00	51.8	70.2	46.7
08/03/2022	11:00:00	00:15:00	51.8	67.8	45.6
08/03/2022	11:15:00	00:15:00	49.9	70.1	45.6
08/03/2022	11:30:00	00:15:00	53.2	76.1	46.6
08/03/2022	11:45:00	00:15:00	54.8	82.1	45.8
08/03/2022	12:00:00	00:15:00	51.7	73.7	46.8
08/03/2022	12:15:00	00:15:00	50.5	73.4	46.9
08/03/2022	12:30:00	00:15:00	50.6	68.2	46.1
08/03/2022	12:45:00	00:15:00	51.3	68.7	46.8

Start Date	Start Time	Duration	L _{Aeq} , 15min	L _{AFMax} , 15min	L _{A90} , 15min
dd/mm/yyyy	hh:mm:ss	hh:mm:ss	dB	dB	dB
08/03/2022	13:00:00	00:15:00	49.8	67.7	45.8
08/03/2022	13:15:00	00:15:00	52.1	69.6	46.3
08/03/2022	13:30:00	00:15:00	50.4	67.4	47.0
08/03/2022	13:45:00	00:15:00	48.8	62.4	46.2
08/03/2022	14:00:00	00:15:00	49.5	67.5	46.2
08/03/2022	14:15:00	00:15:00	50.2	68.5	47.2
08/03/2022	14:30:00	00:15:00	50.5	70.9	47.5
08/03/2022	14:45:00	00:15:00	49.9	65.5	47.4
08/03/2022	15:00:00	00:15:00	52.7	78.6	48.0
08/03/2022	15:15:00	00:15:00	49.8	65.0	47.1
08/03/2022	15:30:00	00:15:00	50.2	68.6	47.6
08/03/2022	15:45:00	00:15:00	50.7	67.0	47.8
08/03/2022	16:00:00	00:15:00	57.2	74.0	48.7
08/03/2022	16:15:00	00:15:00	52.3	78.8	48.6
08/03/2022	16:30:00	00:15:00	52.8	69.3	50.5
08/03/2022	16:45:00	00:15:00	54.2	76.9	50.9
08/03/2022	17:00:00	00:15:00	53.4	73.5	49.8
08/03/2022	17:15:00	00:15:00	53.6	73.4	51.2
08/03/2022	17:30:00	00:15:00	53.7	72.7	51.1
08/03/2022	17:45:00	00:15:00	52.8	72.8	49.9
08/03/2022	18:00:00	00:15:00	52.7	77.3	49.3
08/03/2022	18:15:00	00:15:00	51.1	67.4	48.1
08/03/2022	18:30:00	00:15:00	50.7	57.9	48.0
08/03/2022	18:45:00	00:15:00	52.3	65.4	50.0
08/03/2022	19:00:00	00:15:00	51.9	63.0	49.6

APPENDIX C - BS 12354-3:2000 CALCULATIONS

Plas Grono Farm, Erddig, Wrexham, LL13 0YR
BA Outside1.baf - Interior level calculations

Bedroom - Front / Plas Grono Farm, Erddig, Wrexham, LL13 0YR

Room type:	Bedroom	Ground area:	11.00 m ²
L _{2,nT} valid:	30.0 dB	L _{2,nT} existent / improved:	23.4 / 23.4 dB

North Facade

Facade geometry:	3.60 m x 2.80 m = 10.08 m ²
L _{2,nTi} existent / improved:	23.4 / 23.4 dB

Assessment level Day:	45.0 dB(A)
Correction for facade structure by EN 12354-3	0.0 dB
Correction by user:	0.0 dB
Exterior level:	45.0 dB

ser.	Component existent	Count	Area (m ²)	R' _w (dB)	D _{n,e} (dB)	Component improved	Count	Area (m ²)	R' _w (dB)	D _{n,e} (dB)	Fan
1	Wall	1	7.28	50	*	= Wall	1	7.28	50	*	*
2	Window	1	1.00	25	*	= Window	1	1.00	25	*	*
3	Window	1	1.60	25	*	= Window	1	1.60	25	*	*
4	Air Vent	2	0.10	*	25	= Air Vent	2	0.10	*	25	*

Plas Grono Farm, Erddig, Wrexham, LL13 0YR
BA Outside1.baf - Interior level calculations

Bedroom - Front Max Levels / Plas Grono Farm, Erddig, Wrexham, LL13 0YR

Room type:	Bedroom Max	Ground area:	11.00 m ²
L2,nT valid:	45.0 dB	L2,nT existent / Improved:	35.4 / 35.4 dB

North Facade

Facade geometry:	3.60 m x 2.80 m = 10.08 m ²
L2,nTi existent / Improved:	35.4 / 35.4 dB

Assessment level Day:	57.0 dB(A)
Correction for facade structure by EN 12354-3	0.0 dB
Correction by user:	0.0 dB
Exterior level:	57.0 dB

ser. No.	Component existent	Count	Area (m ²)	R' _w (dB)	Dn,e (dB)	Component improved	Count	Area (m ²)	R' _w (dB)	Dn,e (dB)	Fan
1	Wall	1	7.28	50	*	= Wall	1	7.28	50	*	*
2	Window	1	1.00	25	*	= Window	1	1.00	25	*	*
3	Window	1	1.60	25	*	= Window	1	1.60	25	*	*
4	Air Vent	2	0.10	*	25	= Air Vent	2	0.10	*	25	*

Plas Grono Farm, Erddig, Wrexham, LL13 0YR
BA Outside1.baf - Interior level calculations

Living Area / Plas Grono Farm, Erddig, Wrexham, LL13 0YR

Room type:	Living Room	Ground area:	40.00 m ²
L2,nT valid:	35.0 dB	L2,nT existent / improved:	25.3 / 25.3 dB

North Facade

Facade geometry:	10.30 m x 2.80 m = 28.84 m ²
L2,nTi existent / improved:	24.7 / 24.7 dB

Assessment level Day:	51.0 dB(A)
Correction for facade structure by EN 12354-3	0.0 dB
Correction by user:	0.0 dB
Exterior level:	51.0 dB

ser. Component existent No.	Count	Area (m ²)	R' _w (dB)	D _{n,e} (dB)	Component improved	Count	Area (m ²)	R' _w (dB)	D _{n,e} (dB)	Fan
1 Wall	1	20.84	50	*	= Wall	1	20.84	50	*	*
2 Window	2	1.60	25	*	= Window	2	1.60	25	*	*
3 French Doors	1	4.60	25	*	= French Doors	1	4.60	25	*	*
4 Air Vent	2	0.10	*	25	= Air Vent	2	0.10	*	25	*

South Facade

Facade geometry:	6.70 m x 2.80 m = 18.76 m ²
L2,nTi existent / improved:	16.4 / 16.4 dB

Assessment level Day:	51.0 dB(A)
Correction for facade structure by EN 12354-3	0.0 dB
Correction by user:	0.0 dB
Exterior level:	51.0 dB

ser. Component existent No.	Count	Area (m ²)	R' _w (dB)	D _{n,e} (dB)	Component improved	Count	Area (m ²)	R' _w (dB)	D _{n,e} (dB)	Fan
1 Wall	1	14.76	50	*	= Wall	1	14.76	50	*	*
2 Window	1	1.60	25	*	= Window	1	1.60	25	*	*
3 Window	1	2.40	25	*	= Window	1	2.40	25	*	*

APPENDIX D - GLOSSARY

A-weighted sound pressure, p_A	Value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network. <i>NOTE: The A-weighting network modifies the electrical response of a sound level meter with frequency in approximately the same way as the sensitivity of the human hearing system.</i>
A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure in decibels (dBA).
Acoustic environment	Sound from all sound sources as modified by the environment [BS ISO 12913-1:2013].
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far. <i>NOTE: The ambient sound comprises the residual sound and the specific sound when present.</i>
Ambient sound level, $L_a = L_{Aeq,T}$ (BS4142:2014)	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T <i>NOTE: The ambient sound level is a measure of the residual sound and the specific sound when present.</i>
Background sound	Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location.
Background sound level, $L_{A90,T}$ (BS4142:2014)	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Break-in	Noise transmission into a structure from outside.
Break-out	Noise transmission from inside a structure to the outside.
Cross-talk	Noise transmission between one room and another room or space via a duct or other path.
C_{tr}	Correction term applied against the sound insulation single-number values (R_w , D_w , and $D_{nT,w}$) to provide a weighting against low frequency performance. <i>NOTE: The reference values used within the C_{tr} calculation are based on urban traffic noise.</i>
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time.
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ (BS4142:2014)	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time.
Equivalent sound absorption area of a room, A	Hypothetical area of a totally absorbing surface without diffraction effects, expressed in square metres (m ²), which, if it were the only absorbing element in the room, would give the same reverberation time as the room under consideration
Facade level	Sound pressure level 1 m in front of the façade. <i>NOTE: Facade level measurements of L_{pA} are typically 1 dB to 2 dB higher than corresponding free-field measurements because of the reflection from the facade.</i>
Free-field level	Sound pressure level away from reflecting surfaces. <i>NOTE: Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the</i>

	source). Estimates of noise from aircraft overhead usually include a correction of 2 dB to allow for reflections from the ground.
Impact sound pressure level, L_i	Average sound pressure level in a specific frequency band in a room below a floor when it is excited by a standard tapping machine or equivalent.
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants. <i>NOTE: The location(s) within the room at which the ambient indoor noise is to be measured or calculated ought to be considered.</i>
Measurement time interval, T_m (BS4142:2014)	Total time over which measurements are taken. <i>NOTE: This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.</i>
Noise criteria	Numerical indices used to define design goals in a given space.
Noise rating, NR	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves.
Normalised impact sound pressure level, L_n	Impact sound pressure level normalized for a standard absorption area in the receiving room. <i>NOTE: Normalised impact sound pressure level is usually used to characterize the insulation of a floor in a laboratory against impact sound in a stated frequency band.</i>
Octave band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.
Percentile level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting "F", which is exceeded for $N\%$ of a specified time interval.
Reference interval, T_r (BS4142:2014)	Specified interval over which the specific sound level is determined. <i>NOTE: This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.</i>
Residual sound (BS4142:2014)	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level, $L_r = L_{Aeq,T}$ (BS4142:2014)	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T .
Rating level, L_{Ar,T_r}	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise. <i>NOTE: This is used in BS 7445 and BS 4142 for rating industrial noise, where the noise is the specific noise from the source under investigation.</i>
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped.
Sound exposure level, L_{AE}	Level of a sound, of 1 s duration, that has the same sound energy as the actual noise event considered.
Sound level difference, D	Difference between the sound pressure level in the source room and the sound pressure level in the receiving room.
Sound pressure, p	Root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound.

Sound pressure level, L_p	Quantity of sound pressure, in decibels (dB).
Sound reduction index, R	Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.
Specific sound level, $L_s = L_{Aeq,T_r}$ (BS4142:2014)	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .
Specific sound source (BS4142:2014)	Sound source being assessed.
Standardised impact sound pressure level, L'_{nT}	Impact sound pressure level normalized to a reverberation time in the receiving room of 0.5 s.
Standardised level difference, D_{nT}	Difference in sound level between a pair of rooms, in a stated frequency band, normalized to a reference reverberation time of 0.5 s for dwellings.
Groundborne noise	Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground. <i>NOTE Common sources of ground-borne noise include railways and heavy construction work on adjacent construction sites.</i>
Structure-borne noise	Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements. <i>NOTE Common sources of structure-borne noise include building services plant, manufacturing machinery and construction or demolition of the structure.</i>
Third octave band	Band of frequencies in which the upper limit of the band is 2% times the frequency of the lower limit.
Weighted level difference, D_w	Single-number quantity that characterizes airborne sound insulation between rooms, but which is not adjusted to reference conditions. <i>NOTE Weighted level difference is used to characterize the insulation between rooms in a building as they are. Values cannot normally be compared with measurements made under other conditions (see BS EN ISO 717-1).</i>
Weighted normalised impact sound pressure level, $L'_{n,w}$	Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or
Weighted standardised impact sound pressure level $L'_{nT,w}$	Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Weighted standardised level difference, $D_{nT,w}$	Single-number quantity that characterizes the airborne sound insulation between rooms.

Symbols

D_w	Weighted level difference (dB)
D_{nT}	Standardized level difference (dB)
$D_{nT,w}$	Weighted standardized level difference (dB)
L_{Amax}	Maximum noise level (dB)
$L_{Ar,T}$	Rating level (dB)
L_n	Normalised impact sound pressure level (dB)
L'_{nT}	Standardised impact sound pressure level (dB)
$L'_{nT,w}$	Weighted standardised impact sound pressure level (dB)
$L'_{n,w}$	Weighted normalised impact sound pressure level (dB)
L_p	Sound pressure level (dB)
L_{pA}	A-weighted sound pressure level (dB)
$L_{AN,T}$	Percentile level (dB)
L_{AE}	Sound exposure level (dB)
$L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level (dB)
p	Sound pressure (Pa)
p_A	A-weighted sound pressure (dB)

$p_{A(t)}$	Instantaneous A-weighted sound pressure (Pa)
R	Sound reduction index (dB)
R_w	Weighted sound reduction index (dB)
T	Time interval (also used for reverberation time) (s)
t_0	Reference time interval (s)

NoiseAir Limited

Specialist acoustic and air quality engineers providing a fast, professional, cost-effective service for all types of Acoustic Consultancy services across the UK.

Over 35 years of experience in the field.

Contact us now for a free, no obligation quote or to discuss your requirements.

NOISEAIR LIMITED, THE COUNTING HOUSE, HIGH STREET,
LUTTERWORTH. LE17 4AY

TEL. 0116 272 5908

EMAIL. INFO@NOISEAIR.CO.UK

WWW.NOISEAIR.CO.UK

