



Noise Impact Assessment

Site Address: Edenfield Road, Norden, Rochdale, OL12 7TT

Client: Mr. Chris McDermot

Project Reference No: NP-009297



Authorisation and Version Control

Revision	Date	Reported By	Approved By
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Contact Details

NOVA Acoustics Ltd,
Suite 13, Crown House,
94 Armley Road,
Leeds,
LS12 2EJ

0113 322 7977

www.novaacoustics.co.uk
technical@novaacoustics.co.uk

Delivering sustainable development by promoting good health and well-being through effective management of noise.

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise impact assessment for a restaurant/bar development with a function room ('the Proposed Development') at Edenfield Road, Norden, Rochdale, OL12 7TT ('the Site').

The applicant is preparing an application ('The Application') to be submitted to Rochdale Borough Council.

The following technical noise assessment has been prepared to accompany the planning application to the council. The report details an assessment of:

- Amplified music noise breaking out of the proposed site,
- Patron noise in the external areas,
- Background music within the external patron areas,
- Noise from fixed external plant equipment.

Based on the level of noise impact expected, a series of sound insulation and noise control measures are outlined within the report to reduce the likelihood of impact and to protect the amenity of the closest Noise Sensitive Receptors (where required).

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.1 Scope & Objectives

The scope of the noise assessment can be summarised as follows:

- Baseline sound monitoring survey to evaluate the prevailing ambient and background sound levels at the closest Noise Sensitive Receptors to the proposed development.
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources.

1.2 Legislation, Policy & Guidance

The following legislation, policy and guidance has been considered to ensure good acoustic design in the assessment:

- National Planning Policy Framework (2021)
- Noise Policy Statement for England (2010)
- British Standard BS4142:2014+A1:2019 – 'Methods for Rating and Assessing Industrial and Commercial Sound'
- Entertainment Noise Legislation
- IEMA Guidelines on Noise Impact Assessments

Further information on the above legislation can be found in Appendix B.

1.3 Proposal Brief

The proposed development will include the following:

- A ground floor single story function room,

- A restaurant/bar spanning the 1st and 2nd floors,
- A glazed extension leading to an external patron area (terrace).

It is expected that the highest levels of noise impact will be caused during functions. The client has stated that all amplified music will only take place within the function room and is likely to be played by DJs, however, it is thought it is possible that live bands could play in the future.

The client has indicated that there could be occasional use of low-level background music in the external patron terrace. Within the bar and restaurant, only background level music for ambience will take place.

The proposed operational times of the development are as follows:

- Monday to Thursday – 11:30 to 22:30
- Fridays – 11:30 to 01:00
- Saturdays – 10:00 to 01:00
- Sundays – 10:00 to 00:00

1.4 Acoustic Design Criteria

It is understood that the Local Authority do not have any specific criteria for assessing entertainment noise or noise from patrons. As such, the following criteria have been adopted to minimise the likelihood of adverse impact at the nearby residential receptors:

- The L_{eq} associated with noise breaking out of the proposed development shall be controlled to not exceed the L_{90} (without the site in operation) in each octave band at the boundary of the nearest residential premises.
- Noise from the external patron area will not significantly increase the existing ambient noise level at nearby receptors. Significance criteria are provided in Appendix B.
- The cumulative rating noise level ($L_{A,T}$) from fixed external plant shall not exceed the measured background sound Level (L_{A90}) when measured at the nearby residential receptors.

2. Environmental Noise Survey

2.1 Measurement Methodology

Location	Survey Period	Measurement Details
MP1	11/03/22 – 14/03/22	The microphone was mounted on a lamppost at a height of approximately 3.5m and away from any other reflective surfaces.

Table 1 – Environmental Noise Survey Details

The figure below outlines the site surroundings and measurement location:



Figure 1 – Site Location & Surrounding Area

2.2 Subjective Impression & Context

The area surrounding the site is primarily agricultural with a minority of residential dwellings. The closest NSRs to the site are located to the south and southeast of the proposed development building. The acoustic environment of the area would be classed as 'low' and is dominated by traffic noise emissions from Edenfield Road (A680).

2.3 Environmental Survey Results

Background Noise Monitoring

The following tables outline the background and ambient sound levels measured during the most sensitive period of the proposed operational hours (Sunday, 13/03/22: 23:00 – 00:00) that will be used in subsequent assessments. Full time history results can be found in Appendix C.

Location	Description	Octave Band L ₉₀ (Hz, dB)							Overall L _{A90} (dB)
		63	125	250	500	1k	2k	4k	
MP1	L _{90,1hr}	42	38	34	31	29	25	23	34

Table 2 – Octave Band Background Sound Levels

Measurement Position MP1	
Measurement Period ('t')	L _{Aeq,t} (dB)
Sunday, 13/03/22: 23:00 – 00:00	49

Table 4 – Existing Ambient Sound Level

3. Noise Impact Assessment

3.1 Typical Internal Noise Levels

The following table presents unweighted sound pressure levels thought to be typical for live music events. These are based on a previous assessment undertaken by NOVA Acoustics Ltd.

The measurements were taken in the centre of a dance floor with a maximum capacity of 100 patrons dancing, and a band playing amplified music through a 4kW P.A. system. This is thought to present a robust assessment baseline for the proposed development.

Sound Source	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music	91	92	93	93	90	86	83	95

Table 3 – Predicted Amplified Music Level

3.2 Building Envelope Sound Reduction

The following assumptions have been made regarding the sound reduction provided by the building envelope elements (façade, roof, doors and glazing).

- The exterior façades are thought to be constructed from brick and block cavity walls.
- The roof of the building is thought to be constructed from a standard flat roof construction.
- All glazing will be a minimum of standard double glazing (6mm glass, 16mm air cavity, 4mm glass).

The sound reduction values for the building elements have been modelled in INSUL 9.0 prediction software and the results are shown in the table below.

Description	1/1 Octave Frequency Band (Hz, SRI dB)							R_w (dB)
	63	125	250	500	1k	2k	4k	
Masonry (Cavity Wall)	41	46	45	48	58	68	78	55
Double Glazing (6mm Glass, 16mm Air Cavity, 4mm Glass)	21	21	20	26	38	37	39	31
Roof	16	29	44	53	61	61	78	53

Table 4 – Building Envelope Sound Reduction

3.3 Predictive Noise Modelling

The specific sound levels at the NSRs have been calculated using SoundPlan 9.0, which undertakes its calculations in accordance with the guidance given in ISO9613 – 1:1993 and ISO9613 – 2:1996.

The following assumptions have been made within the calculation software:

- To accurately model the land surrounding the development the topographical data has been taken from Google Maps, it is assumed this has an accuracy within the last 3 years.
- The ground between the source and receptor is composed primarily of acoustically 'soft' surfaces.

- The sound power levels of the building elements have been calculated within the SoundPlan software using the formula: $L_W = L_P + 10\log(s)$.
- The sound map below is shown at a grid height of 1.5m, however, the specific sound levels at the NSRs are taken from the most affected area of the façade, which could be any floor of the building.
- As a worst-case scenario, it is assumed entertainment noise could be breaking out of the function room and the bar/restaurant simultaneously. To provide a 'worst-case' scenario, it is assumed in the model that noise levels in the restaurant/bar are equal to the noise levels within the function room. It is unlikely this will frequently be the case,

The sound map showing the specific noise emissions due to entertainment noise breakout can be seen in the figure below.

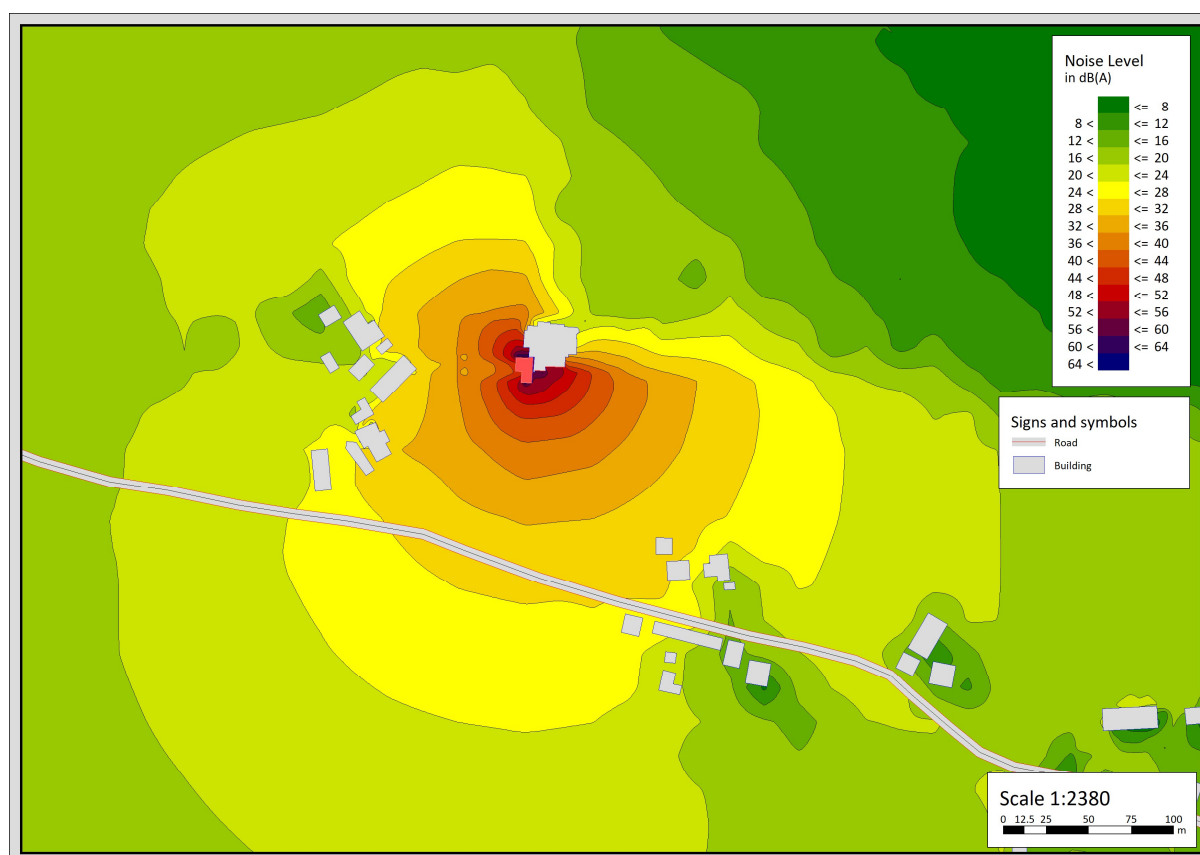


Figure 2 – Specific Sound Level Map

A summary of the predicted sound levels at the most affected Noise Sensitive Receptors can be seen in the following table.

NSR	Z-weighted Octave Band Sound Pressure Level (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
1	35	31	35	30	15	12	3	30
2	36	32	33	30	15	11	3	29
3	30	25	27	24	9	4	-7	23

Table 5 – Breakout Noise at NSRs Summary

The breakout noise levels are compared with the prevailing background sound levels in the table below.

Description	Z-weighted Octave Band Sound Pressure Level (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Specific Noise Level at NSR1	35	31	35	30	15	12	3	30
Background Noise Level	42	38	34	31	29	25	23	34
Exceedance of Background Noise Level	-7	-7	+1	-1	-14	-13	-20	-4

Table 6 – Noise Impact Assessment

Discussion

As can be seen in the assessment above, the breakout noise levels are predicted to marginally exceed the background noise levels in the 500 Hz octave band. In order to achieve low impact, it is recommended that a music limiter is installed within the function room. This is explained further in Section 6.

4. External Music Noise Assessment

The client has indicated that on occasion there may low level background music within the external patron areas of the development. In the following section, limit levels are calculated so that background music should be inaudible at the NSRs when compared with the background sound level of the area.

Considering a conservative distance correction of 90m between the Noise Sensitive Receptor and the external areas of the site, the music limit level is outlined in the table below:

External Music Limit Level								
Sound Source	Octave Band L _{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
External Music Limit Level 1m from Speaker	71	67	63	60	58	54	52	63

Table 7 – External Music Limit Level

The following table shows the external music level at the NSR compared with the background sound level to assess the potential noise impact.

External patron Area Music Assessment								
Sound Source	Octave Band L _{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
External Music Limit Level 1m from Speaker	71	67	63	60	58	54	52	63
Distance Attenuation to NSR (90m)	-39	-39	-39	-39	-39	-39	-39	-39
Music Noise Level at NSR	32	28	24	21	19	15	13	24
Background sound Level (L ₉₀)	42	38	34	31	29	25	23	34
Level Above Background	-10	-10	-10	-10	-10	-10	-10	-10

Table 8 – External Patron Area Music Assessment

As can be seen in the assessment above, providing the external area music limit level is not exceeded the music levels at the NSR fall a minimum of 10 dB below the background sound level and as such, are expected to be inaudible.

5. Recommendations and Noise Control Measures

Music Limit Levels

It is recommended that noise level limiting devices are installed within the function room and external patron terrace. The devices should be capable of controlling octave band noise levels as shown in the following table.

Sound Source	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Internal Function Room Amplified Music Limit Level	91	92	92	93	90	86	83	95
External Area Music Limit Level at 1m from Speaker	71	67	63	60	58	54	52	63

Table 9 – Music Limit Levels

Zonal P.A. Systems

To retain a feeling of subjective loudness and achieve a uniform distribution of sound within the spaces, it is recommended that distributed and zonal PA systems are installed. This involves installing a higher quantity of speakers all emitting at a lower level, which takes advantage of the proximity of the listener to the speaker, thus reducing the overall noise emissions in the space. The speakers should be focused on the main operational area and not located near entrances and exits.

5.1 Further Noise Control Measures

In order to effectively manage noise at the venue, the following noise control measures are also recommended.

a) Premises Management Responsibility

The designated premises supervisor 'DPS' will have the responsibility for ensuring that nuisances and hazards arising from the premises due to noise are minimised.

b) Management Control Measures

The following range of management control methods should be implemented at the premises, including but not limited to:

- The operational hours should not exceed the hours shown in the report.
- Where possible, doors and windows should be kept closed during functions with significantly amplified music except when access is required, therefore, mechanical door closers should be installed and an alternative means of ventilation during hot days may be required.
- Site staff should be made aware that they are working in the vicinity of Noise Sensitive Receptors and avoid all unnecessary noise due to elevated music levels, the opening of doors/windows or excessive noise from patrons. The DPS will be required to implement strict staff rules to ensure that the staff immediately respond to unnecessary elevated noise levels.
- Staff training should involve reviewing the Noise Management Plan and Operational Noise Management Guide.

- All operational staff will be responsible for reporting any noise problems immediately to the DPS.
- A class 2 sound level meter should be purchased by the venue and noise monitoring should be undertaken during events to ensure the background noise levels shown above are not being exceeded. If it is found that noise emissions from the venue are too high, then the limit levels inside the venue should be adjusted accordingly.
- It is also recommended that subjective monitoring is undertaken by the venue staff. An example monitoring form is included in Appendix E.

6. External Patron Noise Assessment

In the following section, the noise emissions from people congregating in the external areas of the site are assessed.

6.1 Specific Patron Noise

In order to present a worst-case scenario, it is assumed that up to 100 guests could be using the ground floor external area at any one time.

It is likely that no more than half of these people would be talking simultaneously (one person talking with one person listening). The values that will be used in the sound model are shown in the following table.

Patron Noise levels			
Description	$L_{Aeq,t}$ (dB)	Sound Power (L_{WA} , dB)	No. of Emitters in Model
Sound Level of Normal Voice at 1m	61	69	50

Table 10 – Patron Noise Levels

The sound model showing the predicted worst-case noise levels is shown in the figure below.

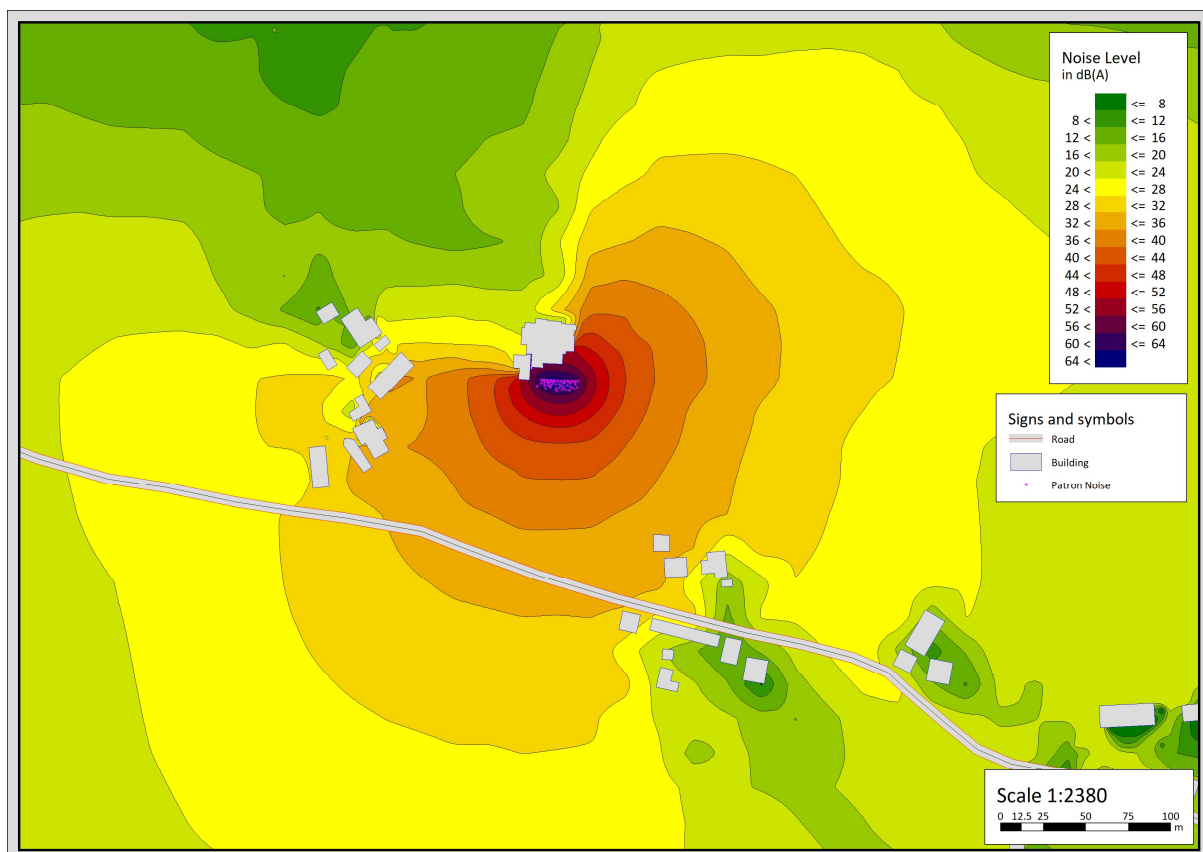


Figure 3 – Patron Noise Map – 1.5m Grid Map Height

The predicted noise levels at the NSRs are shown in the table below.

Patron Noise levels at NSRs	
NSR	Predicted L _{Aeq} (dB)
1	32
2	32
3	25

Table 11 – Patron Noise at NSRs Summary

6.2 Increase in Ambient Noise Level Assessment

In the following section, the expected increase in ambient noise levels of the area due to patron noise is assessed.

The specific noise levels at the most affected NSRs are logarithmically added to the measured ambient noise level presented in Table 3. The higher the increase in noise level, the higher the expected impact.

Patron Noise Assessment			
Description	NSR1 (dBA)	NSR2 (dBA)	NSR3 (dBA)
Specific Noise Level at NSR1	32	32	25
Ambient Noise Level	49	49	49
Resulting Noise Level	49.1	49.1	49.0
Increase in Noise Level	0.1	0.1	0.0
IEMA Effect Descriptor	'Not Significant'	'Not Significant'	'None'

Table 12 – Increase in Ambient Noise Level Assessment

Discussion

As can be seen in the assessment above, the ambient noise levels at the most affected NSRs are predicted to increase by a maximum of approximately 0.1 dB due to patrons talking in the external areas. This is classed as a 'Not Significant' increase when assessed with IEMA guidelines and 'No Observed Effect Level' (NOEL) when assessed with the NPPF and NPSE. Considering this is a worst-case scenario, it is thought that patron noise is unlikely to have a negative impact on residential amenity.

7. Plant Noise Assessment

In the event that external plant units are required for the development (kitchen extraction, ventilation, etc.), the cumulative noise emissions from all plant must be of a low enough level as not to cause impact at the most affected NSRs. Consequently, a plant noise limit level has been defined in the table below which must not be exceeded. The plant noise limit level is inclusive of any rating penalties that should be applied to account for audible characteristics of the sound that may be perceived to cause increased annoyance, such as tonality or intermittency, in line with BS4142:214 recommendations.

Description	Operational Hours (dBA)
Background Sound Level	34
Maximum Rating Plant Noise Level Limit at the Façade of the Closest NSR	24
Exceedance of Background Sound Level	-10

Table 13 – Plant Noise Level Limit Summary

Discussion:

As can be seen in the assessment above, provided the cumulative plant limit level is adhered to all plant noise emissions are predicted to fall a minimum of 10 dB below the prevailing background sound level. When assessed in accordance with BS4142:2014 this indicates 'Low Impact' and achieves 'No Observed Effect Level' (NOEL) when assessed with the NPSE and NPPF.

Recommendations

The following section outlines the mitigation measures that are necessary to reduce the impact of any proposed plant.

- The cumulative sound level of all plant should not exceed the plant noise rating Level of **24 dBA** at the façade of the nearest NSR.
- The plant should be installed on appropriate anti vibrational mounts.
- Once the plant has been specified, a suitably qualified person should assess whether the plant noise limit level can be achieved. Further acoustic design and mitigation may be required once specified.

8. Conclusion & Action Plan

The noise emissions from the Proposed Development have been assessed against the specified acoustic design criteria and a noise mitigation scheme has been provided to ensure the criteria will be achieved.

In order to achieve 'Lowest Observed Adverse Effect Level' ('LOAEL) when assessed with the NPPF and NPSE, the following 'Action Plan' should be implemented:

- Limiting devices should be installed which are capable of limiting noise levels in the specific octave band frequencies shown in Table 9. The limiters must be calibrated by a competent person during commissioning to ensure noise breakout is inaudible at the NSRs. Due to the inherent uncertainty in the noise modelling software, this may mean that the limit levels need to be reduced.
- All windows and external doors to the function rooms must remain closed during entertainment events involving amplified music within the function room.
- It is recommended that all external doors have automatic door closers installed.
- In order to ensure low impact, it is recommended that subjective monitoring is undertaken by the venue staff. An example monitoring form is included in Appendix E.

The findings of this report will require written approval from the Local Authority and licensor prior to work commencing.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Background Sound	Underlying level of sound over a period, T , which might in part be an indication of relative quietness at a given location
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
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
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
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
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
Rating Level, $L_{Ar, Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
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 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), given by the formula: $L_p = 10 \log_{10} (p/p_0)^2$. Where: p is the root-mean-square sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy and Guidance

This report is to be primarily based on the following standards, legislation, policy and guidance.

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 185 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

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

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

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

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

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – British Standard BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound**Overview**

BS4142 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ ‘specific sound level’, immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the

specific sound level to obtain the $L_{A_{r,Tr}}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

Rating Penalty

Section 9 of BS4142 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

- a) subjective method;*
- b) objective method for tonality;*
- c) reference method."*

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) Tonality

A rating penalty of +2 dB is applicable for a tone which is "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

b) Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".

c) Other Sound Characteristics

BS4142 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."

d) Intermittency

BS4142 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which

contains the greatest total amount of on time ... if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.”

Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a ‘typical’ background sound level for a given period. The purpose has not been to simply select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

BS4142 states: *“The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs”*. An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

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

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound 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 sound level does not exceed the background sound level, this is an indication of the specific sound source having a negligible impact and would therefore be classified as No Observed Effect Level.

- During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

B.4 – Entertainment & Leisure Noise Legislation

Noise from entertainment and leisure venues, e.g., noise from recorded music, live bands, gyms or karaoke, can be particularly annoying for residents and business if it is not adequately contained within the venue. When considering the potential impact of a proposal for an entertainment premises or residential near to entertainment premises a consideration for the overall noise level (L_{Aeq}) and the 63Hz and 125Hz octave band noise levels. Music noise in the 63Hz and 125Hz octave bands, which is described as 'bass noise' is particularly difficult to contain and the impulsive and non-steady character of low frequency music noise is particularly disturbing for residents exposed to it.

A lively city centre bar can operate around 95 dB L_{Aeq} and nightclubs can be even higher at 105 dB L_{Aeq} . The range of level of 63Hz and 125Hz octave bands is wider than the A-weighted levels and can be up to 115 dB L_{eq} and 110 dB L_{eq} respectively (Davies et al 2005).

There is a lack of consensus on an assessment method for noise levels within habitable rooms regarding entertainment noise. The design aim should be to design to 'inaudible'*. The building structure is therefore key and will usually involve a high performing solution in either the music venue or residential premises. Existing noise standards/criteria are not appropriate for evaluating low frequency noise; in almost all other situations the established noise descriptors are based on the A-weighted sound level (dBA) which effectively filters out low frequency sound (Moorhouse et al 2011).

**Noise is considered to be inaudible when it is at a sufficiently low level such that it is not recognisable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question. The DEFRA report 'Noise from Pubs and Clubs – Phase 1', which, on page 17 reproduces the Institute of Acoustics (IOA) working group guidance to achieve music noise levels which are 'virtually inaudible' inside a residential property.*

When dealing with noise control, especially at the lower frequencies it is usual to look at the octave band data as a Z-weighting (linear) and not the A-weighting, due in main to the amount you have to 'take off', resulting in meaningless data (-26.2dB at 63Hz) and also with respect to the sound insulation performance of various construction materials. Rather than just A-weighted levels being assessed e.g. internal noise levels as per BS8233; a low frequency band analysis should be carried out (McCullough et al 2004).

In the 'Procedure for the assessment of low frequency noise complaints – Revision 1', Moorhouse et al (2011) use limits for low frequency noise levels in 1/3 octave bands between 10Hz and 160Hz. For the assessment of low frequency music noise, it is more practical to consider the 63Hz and 125 Hz octave bands. The Noise Council's Code of Practice on 'Environmental Noise Control at Concerts' suggests limits on both these octave bands. The DEFRA report 'Noise from Pubs and Clubs – Phase 1' suggests limits on 1/3 octave bands. However, the problem with this suggestion, and one of the reasons it is not widely used, is due to the difficulty in obtaining 1/3 octave band sound insulation performance data for various

construction materials. With regards to assessing music noise at the 63 Hz and 125 Hz octave band levels a good correlation is shown between the NR 15 curve and Moorhouse curve at low frequencies, shown below.

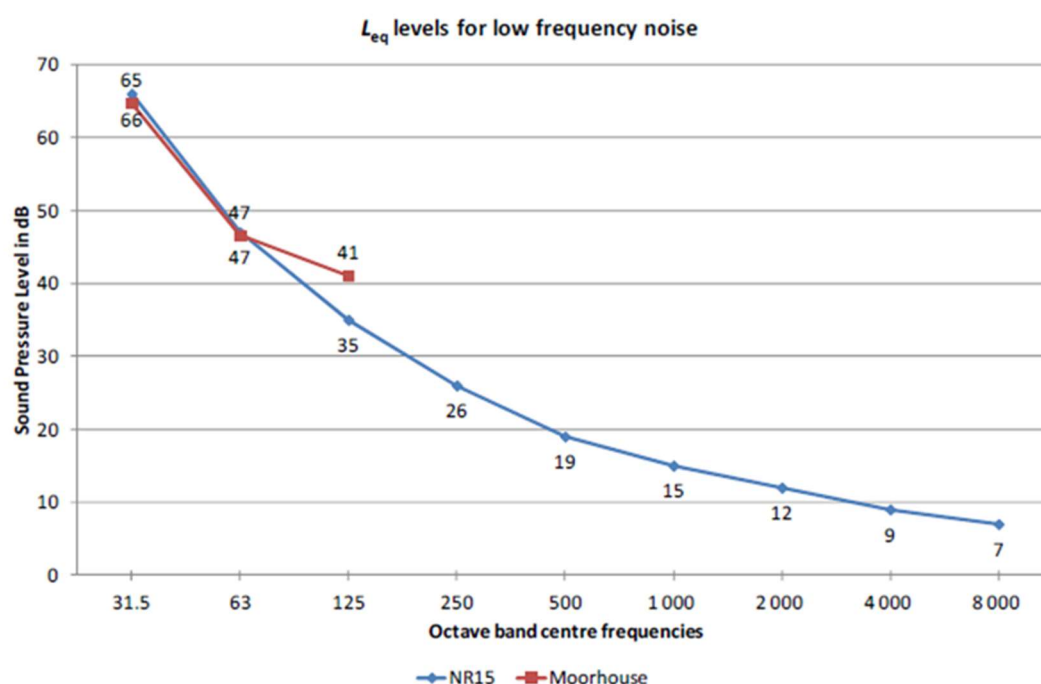
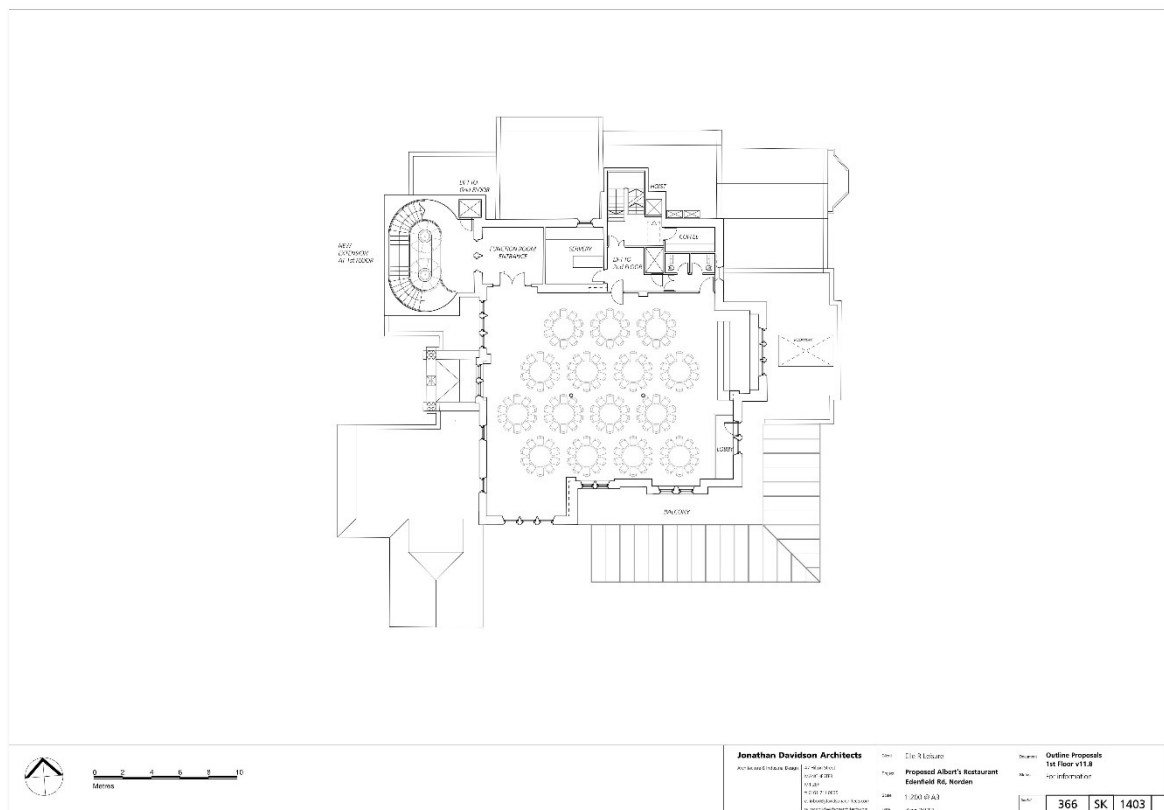


Figure 4 – Moorhouse Low Frequency Noise Rating Curve

However, The NR curve may be too stringent at mid and higher frequencies and may be lower than background noise levels in habitable spaces. Further, the NR curve is most commonly used to set limits for mechanical services noise in buildings i.e., steady, continuous noise sources. Music noise has distinctive characteristics and as such can be described as unsteady and non-continuous in comparison. Even though the Moorhouse curve does not specifically relate to entertainment noise (as per the caveat in the revised edition) these levels provide a good practical basis to assess low frequency music noise. They also provide a workable prediction for planning applications and a measurement method and assessment for in-situ low frequency issues in existing habitable spaces. Therefore, a criterion that would achieve a condition of 'inaudible' / 'virtually inaudible' which is applicable for new residential developments that are structurally connected to entertainment venues (or vice versa) would be: 'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}), respectively'. This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue.

References:

- i) Institute of Acoustics (2002) – Good practice guide on the control of noise from pubs and clubs – Draft Annex 2.
- ii) McCullough et al (2004) A practical evaluation of objective noise criteria used for the assessment of disturbance due to entertainment music
- iii) Moorhouse et al (2005) Proposed criteria for the assessment of low frequency noise disturbance, Defra (updated in 2008 and 2011).



Appendix D – Environmental Survey

Background Sound Level Summary – Night-time Operational Periods							
Measurement Period ('t')	Octave Band L _{90,t} (Hz, dB)						
	63	125	250	500	1k	2k	4k
Night 1: 11/03/22 – 23:00 – 01:00	45	41	38	34	32	29	25
Night 2: 12/03/22 – 23:00 – 01:00	51	48	46	43	40	35	30
Night 3: 13/03/22 – 23:00 – 00:00	42	38	34	31	29	25	23
Measurement Period ('t')	LA _{90,15min}	SMR LA _{90,15min}	Min LA _{90,15min}	Max LA _{90,15min}			
Night 1: 11/03/22 – 23:00 – 01:00	37	36	35	39			
Night 2: 12/03/22 – 23:00 – 01:00	45	45	40	47			
Night 3: 13/03/22 – 23:00 – 00:00	34	34	33	34			
Background Sound Level Summary – Full Measurement Period							
Measurement Period ('t')	Octave Band L _{90,t} (Hz, dB)						
	63	125	250	500	1k	2k	4k
Day 1 – 11/03/22 – 13:00 – 23:00	54	50	47	49	52	48	37
Night 1 – 11/03/22 – 23:00 – 07:00	46	43	40	39	41	36	30
Day 2 – 12/03/22 – 07:00 – 23:00	56	52	49	50	51	46	36
Night 2 – 12/03/22 – 23:00 – 07:00	49	45	42	41	41	37	35
Day 3 – 13/03/22 – 07:00 – 23:00	53	50	46	48	50	45	34
Night 3 – 13/03/22 – 23:00 – 07:00	43	40	36	37	39	34	25
Day 4 – 14/03/22 – 07:00 – 11:00	60	55	52	53	55	50	42
Measurement Time Period ('t')	LA _{90,15min}	SMR LA _{90,15min}	Min LA _{90,15min}	Max LA _{90,15min}			
Day 1 – 11/03/22 – 13:00 – 23:00	55	53	38	56			
Night 1 – 11/03/22 – 23:00 – 07:00	44	36	35	45			
Day 2 – 12/03/22 – 07:00 – 23:00	53	50	42	53			
Night 2 – 12/03/22 – 23:00 – 07:00	46	40	38	47			
Day 3 – 13/03/22 – 07:00 – 23:00	53	50	34	54			
Night 3 – 13/03/22 – 23:00 – 07:00	42	32	30	49			
Day 4 – 14/03/22 – 07:00 – 11:00	53	49	46	57			

Table 14 – Sound Survey Summary Results

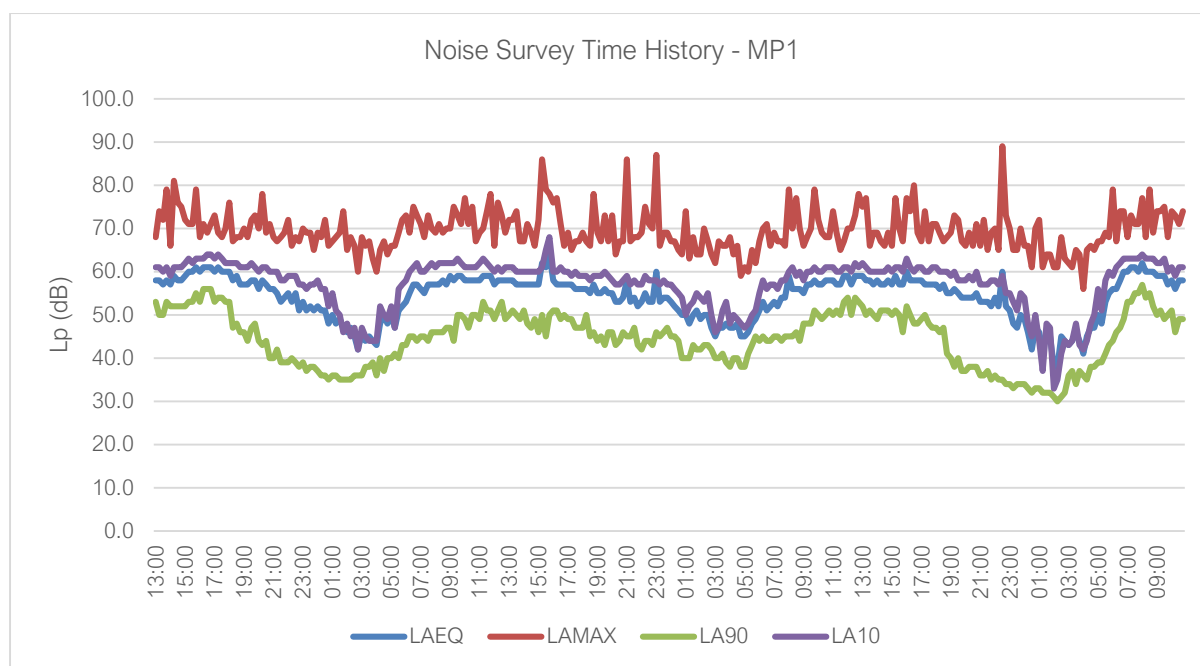


Figure 5 – Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek SV307 Class 1 Sound Level Meter	87871	≤0.5
Svantek SV36 Class 1 Calibrator	106876	

Table 15 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Edgworth (12km Southeast of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
11/03/22: 00:00 – 23:59	6.9 – 11.3	0.0 – 4.8	NNW	0.2 – 5.3
12/03/22: 00:00 – 23:59	5.5 – 11.6	0.0 – 1.8	NE	0.7 – 4.9
13/03/22: 00:00 – 23:59	2.2 – 10.4	0.0 – 4.8	SSE	0.0 – 5.2
14/03/22: 00:00 – 23:59	1.5 – 9.8	0.0 – 1.8	SSE	0.0 – 5.0

Table 16 – Weather Summary

Appendix E – Subjective Noise Monitoring Forms

Premises: _____ Event: _____

Date: _____ Event start time: ____:____ Event End time: ____:____

Pre-start checklist:

- Windows & doors closed: Y/N
- Sound check and volume set: Y/N
- Agree who will complete objective noise monitoring & when: Y/N
- Check sound limiter is fully operational: Y/N
- Set end-time with performer(s): Y/N
- Complete monitoring form: Y/N

Subjective Noise Monitoring Guide			
Assessment		Description	Guide / Action
A	Not audible at NSR & below Table 2 noise levels at MP1 & MP2	No Entertainment Sound audible.	Okay
B	Just audible at NSR & above Table 2 noise levels at MP1 & MP2	Muffled sound, vocals/music not clear, easily masked by other ambient noise in area.	Okay, but adjust noise level to A.
C	Clearly audible at NSR & above Table 2 noise levels at MP1 & MP2	Clear vocals/music and likely to be heard by neighbours.	Reduce to B immediately, and aim to reduce to A.
D	Loud at NSR & above Table 2 noise levels at MP1 & MP2	Vocals/music are dominant and would be clearly heard by neighbours.	Not acceptable.

Table 17 – Subjective Noise Monitoring Guide

Location	Date & Time	Assessment				Observation & Corrective Action Taken	Initials
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		
NSR1		A	B	C	D		
NSR2		A	B	C	D		

Table 18 – Example Subjective Noise Monitoring Form



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