

58 Mosley Street Manchester

Noise Impact Assessment Report

30387/NIA1

14 July 2023

For:

NJL Consulting
Northspring, 6th Floor
70 Spring Gardens
Manchester
M2 2BQ



Hann Tucker Associates

Consultants in Acoustics Noise & Vibration

Head Office: Duke House, 1-2 Duke Street, Woking, Surrey, GU21 5BA (t) +44 (0) 1483 770 595

Manchester Office: First Floor, 346 Deansgate, Manchester, M3 4LY (t) +44 (0) 161 832 7041

(w) hanntucker.co.uk (e) enquiries@hanntucker.co.uk



Noise Impact Assessment Report 30387/NIA1

Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	14/07/2023	Update to Roof Terrace Occupancy		
			Alex Jang Assistant Consultant BEng(Hons), AMIOA	Joe Sinker Associate BEng(Hons), MSc(Res), MIOA
0	21/12/2022			
			Alex Jang Assistant Consultant BEng(Hons)	Tom Bonnert Senior Associate BEng(Hons) MIOA



Noise Impact Assessment Report 30387/NIA1

Contents	Page
1.0 Introduction	1
2.0 Objectives	1
3.0 Acoustic Terminology	2
4.0 Site Description	2
5.0 Proposed Development	3
6.0 Planning Policy, Standards & Guidance	4
7.0 Baseline Noise Survey	6
8.0 Noise Emission Limits	9
9.0 External Amenity Space	10
10.0 Music Noise Breakout	11
11.0 Conclusions	12

Attachments

Appendix A – Acoustic Terminology

Appendix B – National Planning Policies

Time History Graph 30387/TH1



1.0 Introduction

Hann Tucker Associates Limited (Hann Tucker) has been commissioned by NJL Consulting to undertake a noise impact assessment for a site in Manchester. The site, which is located on Mosley Street, is understood to undergo the following:

- Alterations to the façade to include landscaping works to create level access to the building.
- Provision of new accessible entrance way on Booth Street and movement of existing entranceway.
- Erection of a lightweight, glazed roof extension at the eight level.

As part of the above, baseline noise conditions have been established by means of a detailed noise survey, presented herein. The findings have subsequently been used to assess the suitability of the proposed works regarding noise.

Measures required to mitigate noise impacts for the proposed development (when operational) have been discussed in context with relevant national & local planning policies, design standards and good practice guides.

2.0 Objectives

To establish by means of an unattended noise survey the existing L_{Amax} , L_{Aeq} and L_{A90} environmental noise levels at secure and accessible on-site positions, using fully computerised noise monitoring equipment.

Measurement procedures shall be in general accordance with British Standard BS 7445 “Description and measurement of environmental noise”.

The survey will enable noise emission limits applicable to the proposed development to be identified with reference to the requirements of the Local Authority and/or the application of BS 4142: 2014 and to minimise the possibility of noise nuisance to neighbours.

To also assess noise emissions from the operation of the proposed roof extension and associated external terrace and quantify the potential for noise impact on nearby noise sensitive receptors.

If required, preliminary guidance for mitigation measures to suitably control operational noise breakout from the proposed development will be provided.



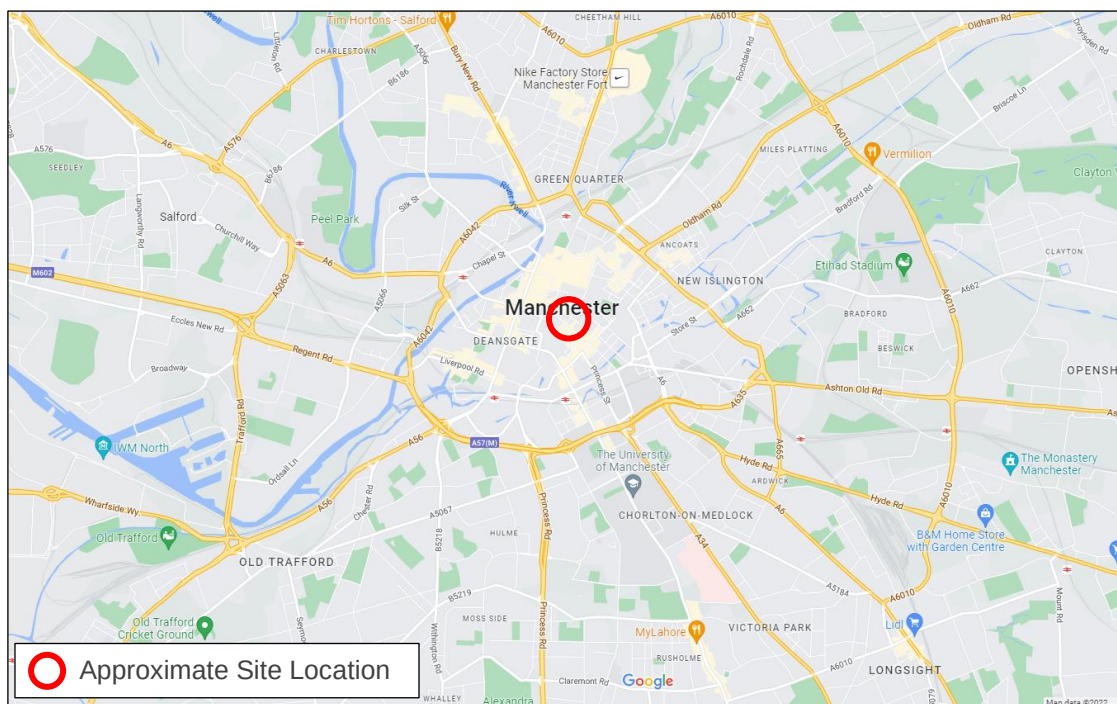
3.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

4.0 Site Description

4.1 Location

The site is located in Manchester and falls within the jurisdiction of Manchester City Council. See Location Map below.



Location Map (© Google Maps)

4.2 Description

The site is highlighted in red in the figure below and is bound by Mosley Street, Booth Street, and West Mosley Street. There is also a set of tram tracks that run along Mosley Street.

The surrounding buildings primarily consist of commercial and entertainment buildings, with the nearest commercial building approximately 15m southeast of the site. There is also noted to be an art gallery, approximately 25m south of the site. The nearest residential building is approximately 130m away to the northwest, and is well screened from the site.

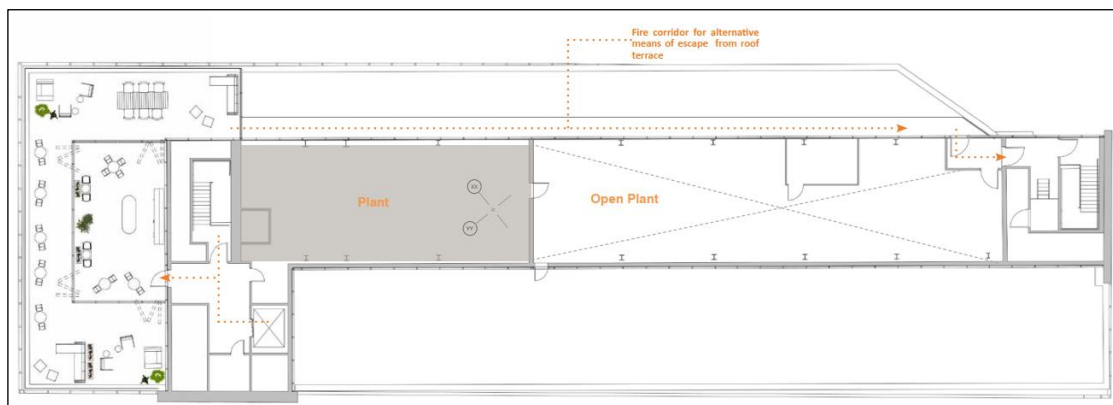
See Site Plan below.



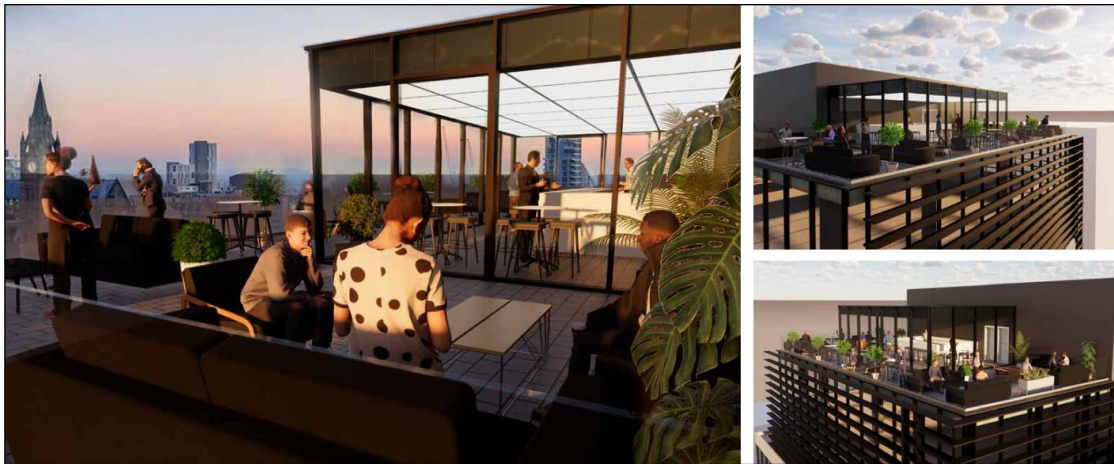
Site Plan (© Google Maps)

5.0 Proposed Development

Proposed building plans and a CGI are provided in the figures below for context.



Proposed Plan of Roof Terrace Development



Indicative 3D View of Proposed Roof Terrace

6.0 Planning Policy, Standards & Guidance

6.1 National Planning Policies

In order to provide a suitable assessment a number of national planning policies have been considered, including:

- The National Planning Policy Framework (NPPF), 2021
- The Noise Policy Statement for England (NPSE), 2010
- Planning Practice Guidance – Noise (PPGN), 2019

The above documents highlight the importance of considering the potential noise effects on any new residential development and provide a qualitative approach to assessment. However, each of the above does not provide any quantitative guidance. As such, all quantitative guidance used to form a noise impact assessment is taken from various other standards and guidance as detailed in the following sections.

A detailed summary of each of the above National Planning Policies is provided in Appendix B for reference.

6.2 Standards & Guides

6.2.1 BS 4142:2014

BS 4142: 2014 describes methods for rating and assessing the effects of outdoor sound levels, of an industrial and/or a commercial nature, *“on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident”*.



The impact of a specific sound is indicated by subtracting the existing background noise level from the rating level (i.e. noise level from the proposed items of plant/machinery/etc plus any acoustic feature corrections). The standard states that:

- “a difference of around +10dB or more is likely to be an indication of a significant adverse impact”;
- “a difference of around +5dB is of marginal significance is likely to be an indication of an adverse impact”;
- “where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact”.

The noise from the new development is expressed in terms of a rating level and given as a $L_{Aeq, T}$ noise level. The existing background noise level is expressed in terms of a $L_{A90, T}$ noise level. T is the assessment time interval, which is 1-hour for operations during daytime hours (07:00 to 23:00) and 15-minutes for operations during night-time hours (23:00 to 07:00).

BS 4142:2014 states that if a noise source contains an ‘acoustic feature’, such as tonality, intermittency or impulsiveness, an appropriate penalty should be applied.

6.3 Local Planning Guidance

Manchester City Council requirements are outlined in Manchester City Council’s Planning & Noise Technical Guidance document (October 2022).

The document aims to provide help and advice in relation to noise in a planning context to encourage good acoustic design. It outlines what is expected in relation to current guidance and policy with the aspiration that new developments achieve the highest possible standards without compromising the health and wellbeing of people that live and work within the City of Manchester.

The following sections summarise the relevant sections of the above document that relate to this site.

6.3.1 Entertainment Venues

Section 3.7.1.2 discusses the potential impact of introducing a new entertainment-based venue. The document states that *“A planning application for a new entertainment venue that is structurally detached from other building uses should demonstrate that music noise from the proposal will not be ‘audible’ in nearby residential properties, assuming that the residential properties in question have their windows open. The criterion here is:*



'Entertainment noise (LAeq,5min) should be controlled to 5dB below the typical background noise level (LA90) in each octave band at the nearest noise sensitive location'.

The above is also the criterion for any commercial developments.

Furthermore MCC guidance on controlling music noise states that it may also be important to design such that *"music noise levels in the 63Hz and 125Hz octave centre frequency bands (Leq) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (Leq,5min), respectively"*.

MCC stipulate amplified noise egress criteria for residential receptors should not exceed 5 dB below the background noise level, however, there is no specific requirements to control noise egress to office developments. As such, to minimise the risk of disturbance to adjacent office developments we propose that the cumulative noise level as a result of noise egress from the development not exceed 5 dB below the internal noise level within the office assuming a sealed façade.

6.3.2 Noise and vibration from fixed plant / equipment

Section 3.7.1.5 states that *"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location"*.

7.0 Baseline Noise Survey

7.1 Procedure

Unattended noise monitoring was undertaken on site over a 5-day period to establish full daytime and night-time noise levels over a typical weekday and weekend period. The monitoring was carried out between 15:00 on Wednesday 7 December 2022 and 14:30 on Monday 12 December 2022, with equipment set up to record broadband and spectral (octave band) sound pressure levels over discrete 2 and 15-minute periods.

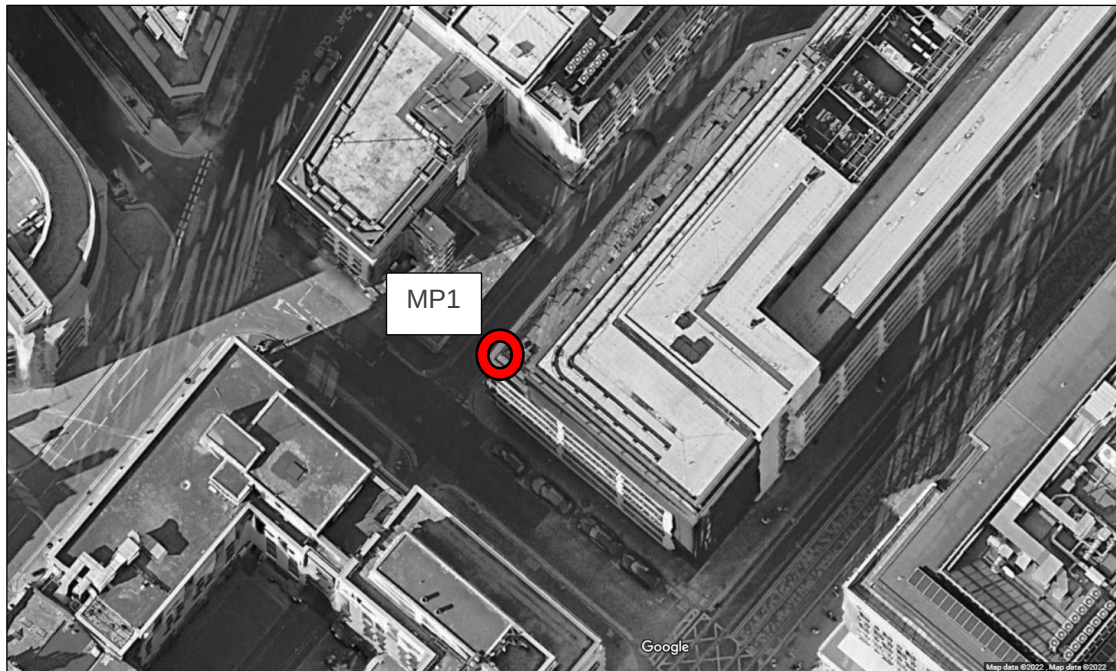
The surveys were performed by Alex Jang BEng(Hons). All measurements were collated in general accordance with BS 7445-1:2003 *Description and Measurement of Environmental Noise*.



7.2 Measurement Positions

The measurement positions were as described and illustrated below.

Position	Type	Description
1	Unattended	To the east side of the site, on the existing 6 th floor terrace space, approximately 25m above ground level. Attached to a pole on the terrace railing, approximately 4m away from the façade. This is considered to be a free-field level.



Measurement Position (© Google Maps)

7.3 Weather Conditions

For the unattended survey between 15:00 on Wednesday 7 December 2022 and 14:30 on Monday 12 December 2022, local weather reports indicated no periods of prolonged and/or heavy rainfall. Temperatures ranged from -6°C (night) to 3°C (day) and wind speeds generally less than 5 m/s. During our time on site, skies were clear, wind conditions were calm and from a northerly direction and road surfaces were dry.

Weather conditions were deemed suitable for obtaining representative noise readings.

7.4 Instrumentation

The instrumentation used during the survey is presented in the table below.



Position	Description	Manufacturer	Type	Serial Number	Last Calibration
1	Type 1 Data Logging Sound Level Meter	Larson Davis	824	4047	22/05/2022
1	Type 1 Calibrator	Larson Davis	Call200	3083	06/05/2021

The sound level meter was housed in a weatherproof case with the microphone connected via an extension cable. The sound level meter was fitted with a windshield.

The sound level meter was calibrated prior to and on completion of the surveys. No significant deviations occurred (not more than 0.3 dB).

7.5 Measurement Results

7.5.1 Unattended Survey

The results of the unattended survey have been plotted on Time History Graph 30387/TH1 enclosed. This graph presents the 15-minute A-weighted (dBA) L_{90} , L_{eq} and L_{max} free-field sound pressure levels at Position MP1 throughout the duration of the survey.

A summary of the results, as used to inform subsequent assessments against current guidelines, is presented in the table below. The L_{A90} values presented are the 'representative lowest' sound levels determined through statistical analysis of the 15-minute readings, in line with BS 4142. L_{Amax} values are the '15th highest' 2-minute value. All results are presented as free-field levels.

Position	Daytime (07:00 – 23:00 hrs)		Night-time (23:00 – 07:00 hrs)		
	$L_{Aeq,16hr}$	L_{A90}	$L_{Aeq,8hr}$	L_{A90}	Typical Highest L_{Amax}
MP1	60	54	59	53	78

1 External L_{Amax} noise level not normally exceeded more than 10 times a night. This is considered to be the ventilation design case.

7.6 Discussion of Noise Climate

Due to the nature of the survey, i.e., unattended, it is not possible to accurately describe the dominant noise sources, or specific noise events throughout the entire survey period. However, at the beginning and end of the survey period the noise climate was noted to be dominated by road traffic noise, primarily from Mosley Street and Booth Street.



8.0 Noise Emission Limits

8.1 Entertainment Noise Limits

On the basis of Manchester City Council's guidance, and the results of the environmental noise survey, we propose that the following noise emission criteria be achieved at 1 metre from the nearest noise residential sensitive receptor, presented as façade limits.

Noise Emission Limits (dBA)	
Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
49	48

	Music Noise Emission Limits (dBA) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Daytime (07:00 – 23:00)	47 ^[1]	41 ^[1]	37	36	35	31	21	5
Night-time (23:00 – 07:00)	47 ^[1]	41 ^[1]	35	35	35	30	20	5

Note 1 Increased based on the threshold of inaudibility at these frequencies

At low frequencies, achieving 5 dB below the minimum background levels at this particular site is unnecessarily onerous, the breakout noise limits have therefore been increased to 47 dB and 41 dB at 63 Hz and 125 Hz, respectively. These limits are based upon the MCC criterion for entertainment noise intrusion to bedrooms, which itself is based upon the threshold of audibility at low frequencies. It is expected, therefore, that relaxing the limits in this way will have no effect on the impact to nearby sensitive receptors.

8.2 Plant Noise Emission Limits

On the basis of Manchester City Council's guidance and the results of the environmental noise survey, we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive receptor, presented as façade limits

Plant Noise Emission Limits (dBA)	
Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
49	48



Noise shall be assessed in accordance with BS 4142:2014 with corrections applied for any plant emitting noise of a tonal or irregular quality.

It should be noted that the above are subject to the final approval of Manchester City Council.

9.0 External Amenity Space

The proposed development is for a new external roof terrace on the eighth floor, on the south side of the site, which is accessed from a new Level 8 extension. Given the nature of the probable use of these areas, the main consideration is regarding outgoing noise from the use of the terraces to adjacent office receptors as the nearest residential receptor is over 125m away.

We have calculated the outgoing noise from the terrace based on a total occupancy of 50No. individuals. From this, we have assumed 50% of people would be speaking at any one time (i.e., 25 people), with a further 50% split of people talking with a raised voice vs. talking with a normal voice.

From calculating the worst-case outgoing noise level from the external terrace, assuming 25% shouting (83dB SWL) and 25% talking with raised voices (78dB SWL), the noise levels at the nearest receptor, which is located on 32 Booth Street, are likely to be 57dB L_{Aeq} , which can be compared to an existing daytime ambient noise level of 60 dB L_{Aeq} .

Based on this, it would likely be appropriate to use the roof terrace during the daytime as the levels of noise break-in to the office spaces would be 3 dB below the ambient noise break-in. Also, the facades to the adjacent office receptors are likely sealed and internal noise might consist of mechanical ventilation.

Night-time use of the terrace should also be acceptable as the nearby receptors are office and are unlikely to be occupied during the night.



10.0 Music Noise Breakout

10.1 Expected Internal Noise Levels

To inform our assessment of the spaces, we have drawn upon typical noise levels within similar spaces that incorporate music. These typical highest 1-hour noise levels are presented below.

Description	Reverberant Noise Level (dB L _{eq,1hr}) at Octave Band Centre Frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
Typical internal noise levels in a bar with background music playing:	71	74	75	75	72	68	63	77

10.2 Window Glazing Calculation

We understand the bar will be located internally with glazing that has yet to be determined. We have performed our calculations using the minimum required performance glass to demonstrate the ability to comply with the criteria, and our assessment is therefore considered to be worst-case and robust given that glazing will likely be thicker for safety/security reasons, thus increasing any acoustic performance achieved.

10.3 Assessment

We have assessed noise breakout to the nearest receptors based on standard calculation procedures for reverberant noise breakout and source noise levels in Section 10.1. The resultant external noise level has been calculated using the following equation.

$$SPL_{out} = SPL_{in} - SRI + 10 \log_{10} \left(\frac{S}{r^2} \right) - 14$$

Where:

SRI estimated sound reduction performance of façade element

r distance from radiating element to receptors

S approximate area of radiating element

The tables presented below outline summary calculations for the different operational noise levels assumed. Night-time criterion has been used to ensure a worst-case assessment of minimum glazing performances required given that there is only 1-2dB difference in each octave between daytime and night-time criteria.

**Typical internal noise levels in a bar with background music playing**

Assessment to Residential Receptor	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Internal noise level (dB L _{eq}) <i>SPL_{in}</i>	71	74	75	75	72	68	63
Distance & radiating area propagation correction (dB) $10\log_{10}\left(\frac{S}{r^2}\right)$	-13	-13	-13	-13	-13	-13	-13
Internal diffuse field to external free-field hemispherical radiation correction (dB) -14	-14	-14	-14	-14	-14	-14	-14
External noise level at nearest receptor (dB L _{eq}) <i>SPL_{out}</i>	44	47	48	48	45	41	36
Criteria at nearest receptor (dB L _{eq})	47 ^[1]	41 ^[1]	35	35	35	30	20
Minimum required glazing sound reduction (dB R) <i>SRI</i>	0	6	13	13	10	11	16

The above minimum glazing performances can typically be achieved with double glazing. Notwithstanding, other configurations will likely be available, though it is important any system satisfies the above performances.

It should be noted that our assessment presented above has been undertaken with consideration to daytime and night-time operation. Should the desired operational hours of the external amenity space be reduced, this would reduce the reliance on glazing performance to control noise break-out.

Ultimately, the above demonstrates systems are readily available to control noise break-out from the external amenity space.

11.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate around the site.

Music and plant noise emission criteria have been recommended based on the results of the noise survey and with reference to the Local Authority's requirements.

Noise egress limits have been proposed in line with the Local Authority's requirements. A pessimistic assessment has shown that the noise egress limits are unlikely to be exceeded (with proper façade design and management of outdoor spaces).

Appendix A – Acoustic Terminology

The acoustic terms used in this report are defined as follows:

dB	Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).
dBA	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The _A subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.
L _{90,T}	L ₉₀ is the noise level exceeded for 90% of the period <i>T</i> (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
L _{eq,T}	L _{eq,T} is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, <i>T</i> .
L _{max}	L _{max} is the maximum sound pressure level recorded over the period stated. L _{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L _{eq} noise level.
L _p	Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).
L _w	Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

Appendix B –National Planning Policies

National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) was first published in 2012, replacing the existing Planning Policy Guidance Note 24 (PPG24) “Planning and Noise”, and sets out the government’s planning policies for England and how these are expected to be applied.

The latest revision of the NPPF (July 2021) states that planning system should contribute to, and enhance, the natural and local environment by (amongst others) *“preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability.”*

NPPF advises that planning policies and decisions should ensure:

“...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] *“mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life”* and *“identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”*

“...new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.”

The NPPF makes reference to the Noise Policy Statement for England.

Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is 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.”

That vision is supported by the following NPSE noise policy aims which are reflected in three of the four aims of planning policies and decisions in the NPPF as below:

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

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.”*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level

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

LOAEL – Lowest Observable Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *“all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development.”* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

Planning Practice Guidance on Noise (PPG)

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource. This includes specific guidance on Noise although, like the NPPF and NPSE, the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

58 Mosley Street

Position 1

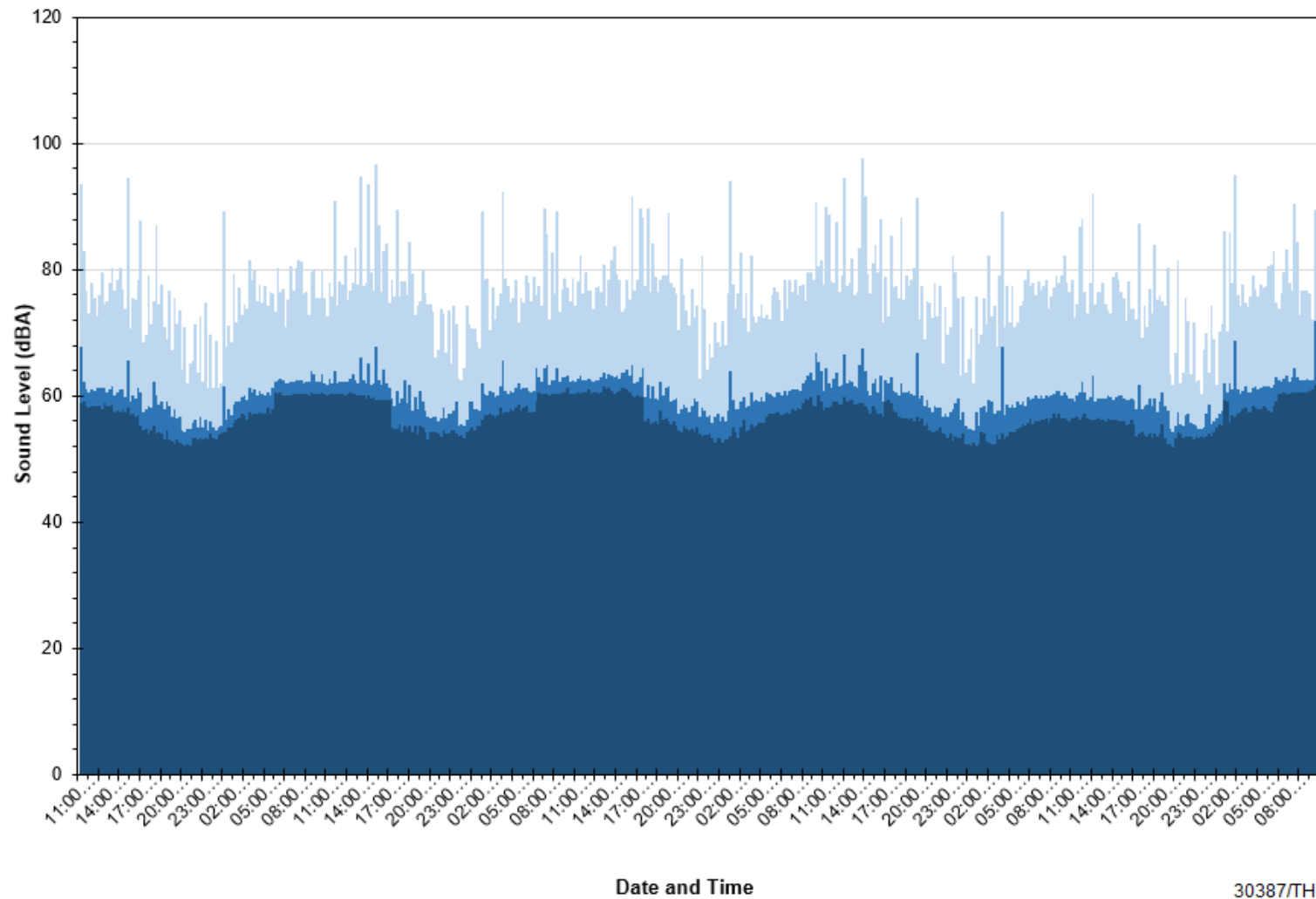
L_{eq} , L_{max} and L_{90} Noise Levels

Wednesday 7 December 2022 to Monday 12 December 2022

■ L_{Amax}

■ L_{Aeq}

■ L_{A90}



30387/TH1