



Acoustic Report

Montague Quarter Shopping Centre, Worthing Residential Development Noise Impact Assessment

Final Report v3
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Project **Montague Quarter Shopping Centre, Worthing,
Noise Impact Assessment: Residential Development**

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1 INTRODUCTION

7th Wave Acoustics has been appointed to prepare a noise assessment to support a Section 73 application to Worthing Borough Council for the proposed residential development at the Montague Quarter Shopping Centre, Worthing, BN11 1YJ.

In summary, a new Full Planning Application is being submitted for the:

“Conversion of first floor retail space at the Montague Quarter Shopping Centre to provide nine residential units (in addition to previously approved development for the provision of three additional floors containing residential units under planning references AWDM/1624/22 and AWDM/1194/24)” at The Montague Centre, Liverpool Road, Worthing, West Sussex.

The proposed development forms part of the wider Montague Quarter site, which benefits from planning permission for the provision of residential accommodation above the existing shopping centre. The original scheme was approved under reference AWDM/1624/22 on 6 October 2023 for:

“Full planning permission for a maximum of three additional floors above the Montague Quarter Shopping Centre to provide 42 residential units.”

The application consolidates previously approved planning permissions AWDM/1624/22 and AWDM/1194/24 and incorporates the proposed conversion of the existing first floor retail space to provide 9 additional residential units.

Upon completion, the building will comprise ground floor commercial accommodation and 54 residential units across first floor and above.

This report should be read in conjunction with the previously submitted acoustic reports by 7th Wave Acoustics (as referenced below). It specifically considers the noise assessment in respect of the proposed additional nine residential units only and should not be taken as a reassessment of the wider development.

- Noise Impact Assessment for 42 Flats. 1173.001R.2.0.JP 8th September 2022
- Addendum to Noise Report for an additional 3 flats. 1173.001Add.2.0.JP 3rd October 2024

To support this application, a noise impact assessment has been carried out, using noise criteria contained within the Sussex Planning Noise Advice Document, along with criteria contained in British Standards BS 8233:2014 and World Health Organisation guidelines on noise.

The findings of this noise assessment are presented in this report.



2 SITE AND DEVELOPMENT DESCRIPTION

Site Description

The development site is located within Worthing town centre, BN11 1YJ. The location of the site is shown in Figure A1 of Appendix A.

The Montague Quarter Shopping Centre currently comprises ground floor retail accommodation with residential development approved above. A public car park lies to the north of the site, with Alexander Terrace (residential dwellings) to the west. Retail premises adjoin the site to the east and south.

The first floor was formerly used as retail delivery and staff access space associated with the commercial units. This area is now vacant.

Consented Residential Development

Planning permission has previously been granted for residential accommodation above the shopping centre, comprising three additional floors. That consent (as subsequently varied) provides for 45 residential units above ground floor commercial space.

The previously approved scheme remains unchanged.

Noise assessments supporting the earlier consents were undertaken by 7th Wave Acoustics and are referenced in Section 1.

Proposed Development

The current application seeks to convert the vacant first floor retail space to residential use, providing 9 additional flats.

The commercial premises at ground floor level will remain in operation.

The proposed first floor plan and elevations are presented in Figures A2 and A3 of Appendix A.

3 PLANNING POLICY CONTEXT

3.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)^[3] sets out the Government's planning policies for England and how these are expected to be applied. It does not present specific noise criteria to be applied but does provide the following statements regarding noise impacts:

"15. Conserving and enhancing the natural environment

187. Planning policies and decisions should contribute to and enhance the natural and local environment by: [bullet point points reduced to those regarding noise only]

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

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

(a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and quality of life; and

(b) Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

200. Planning policies and decisions should ensure that 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.

201. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

The NPPF refers to the Noise Policy Statement for England^[4] for the derivation of significant adverse impacts.



3.2 Noise Policy Statement for England

This document^[4], which has been approved at Government level sets out 3 aims for noise control.

First aim

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

Second aim

Mitigate and minimise adverse impacts on health and quality of life from environment, neighbourhood noise within the context of Government policy on sustainable development.

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

LOAEL – Lowest Observed 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.

Third aim

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy of sustainable development.

This aim seeks, where possible, positively to improve health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

3.3 Local Authority Requirements

Worthing Borough Council advised in the pre-application (ref: PREAPP/24/0015) response that a noise impact assessment should accompany the planning application, however, specific details were not included.

Local Authorities in Sussex have produced a planning guidance document 'Planning Noise Advice Document – Sussex^[5] which sets out the required approach for undertaking a noise assessment, for certain types of development.

For new residential dwellings, including conversions that require planning permission, the guidance refers to BS8233:2014, WHO (2009) and ProPG (2017).

Reference to the rating of commercial noise sources, in line with British Standard 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Noise is also provided.



4 NOISE UNITS, METHODOLOGY & ASSESSMENT CRITERIA

4.1 Noise Units

There is a million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Noise is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB). Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz; however, its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure noise is, therefore, weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A).

It is generally accepted that a change in noise level of 1 dB is not perceptible by the normal ear under normal conditions, a 3 dB change is just perceptible, whilst a change of 10 dB is perceived as a doubling or halving of the noise level.

An indication of the range of noise levels commonly found in the environment is given below in Table 4.1.

Table 4.1: Typical Noise Levels

Typical Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night
40	Residential area at night
60	Conversation
80	Inside general factory premises
100	Near to pneumatic hammer
120	Near to speaker at rock concert
140	Threshold of pain

A number of different indices are used to describe the fluctuations in noise level over certain time periods. The main indices include:

- L_{A90,T}** This is the noise level exceeded for 90% of the measurement period and provides a measurement of the quieter 'lull' periods in between noise events. It is often referred to as the background noise level.
- L_{Aeq,T}** This is the equivalent continuous A-weighted sound pressure level and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period, T. It is often used for measuring all sources of noise in the environment, which can be referred to as the ambient noise.
- L_{Amax,F}** This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response.

4.2 British Standard 8233:2014

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*^[6] gives recommendations for the control of noise in and around buildings. The Standard suggests appropriate criteria and limits for different situations to guide the design of new or refurbished buildings undergoing a change of use.

Desirable upper noise levels inside residential habitable rooms are specified in the Standard and are reproduced below in Table 4.2.

Table 4.2: BS 8233 Indoor Ambient Noise Levels for Dwellings

Activity	Room	Ambient Indoor Noise Level 07:00 to 23:00 hrs, dB $L_{Aeq,16\text{ hr}}$	Ambient Indoor Noise Level 23:00 to 07:00 hrs, dB $L_{Aeq,8\text{ hr}}$
Resting	Living Room	35	-
Dining	Dining room/ area	40	-
Sleeping (daytime resting)	Bedroom	35	30

For regular individual noise events, such as aircraft, BS 8233 indicates a guideline night-time level in terms of Sound Exposure (L_{AE}) or $L_{Amax,F}$ may be set depending on the character and number of noise events per night.

In external amenity spaces, such as private gardens and patios, BS 8233 indicates that it is desirable that the external noise level in these areas does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ in noisier environments.

The standard does recognise that these guideline values for outdoor noise levels are not achievable in all circumstances where development might be desirable. In higher noise areas, such as in city centres or urban areas adjoining a strategic transport network a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.

4.3 World Health Organisation

The most recent WHO guidelines '*Environmental Noise Guidelines for the European Region*'^[7] acknowledge that 'single event noise indicators such as the maximum sound pressure level are warranted in specific situations such as night time railway or aircraft noise events that can clearly elicit awakenings', however, the guidance indicates that 'the relationship between different types of single-event noise indicators and long-term health outcomes at the population level remains tentative' and therefore does not make any recommendations for single event noise indicators.

However, guideline values for community noise in specific environments are presented in the WHO's '*Guidelines for Community Noise*'^[8] document. The guideline values are presented in Table 4.3.

Table 4.3: WHO Guideline Values

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB $L_{Amax,F}$
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

Note 1: For a good sleep, the WHO states that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10–15 times per night.

The Night Noise Guidelines (NNG) for Europe ^[9] is described as an extension of the WHO Guidelines for Community Noise publication. The threshold levels of noise exposure presented in the document are described as milestones in the process of evaluating the health consequences of environmental exposure. The health based guideline values for the assessment and control of night noise exposure were derived from a review of available scientific evidence on the health effects of night noise. These include the effects and threshold levels for night time $L_{Amax,F}$, which are lower than those presented in the WHO community noise guidelines. These revised levels are presented in Table 4.4 below.

Table 4.4 WHO Night-Time Noise Guidelines

Effect	Description	Indicator	NOEL Threshold
Sleep Quality	Waking up in night and/or too early in the morning	dB $L_{Amax,F}$	42

4.4 Criteria Summary for the Noise Assessment

Taking into account the standard and guideline criteria discussed above, the noise impact assessment in this report will be undertaken in accordance with BS 8233:2014 to achieve internal noise levels which meet the desirable guideline values set out in Table 4.2 above.

The night-time internal criteria of 42 dB $L_{Amax,F}$ specified by the WHO Night Noise Guidelines will be used for the assessment of regular (more than 10 times per night) individual night-time noise events.

5 NOISE SURVEY AND ANALYSIS

5.1 Overview

To support the planning application for the recently consented residential development at the site, an environmental noise survey comprising of unattended and attended noise monitoring was undertaken between Thursday 14th July 2022 and Wednesday 20th July 2022 to evaluate the existing noise climate.

The measurement data remains valid and where appropriate, has been used for this new application.

Details of the surveys are provided in the following sub-sections.

5.2 Unattended Survey Details

Continuous unattended monitoring of ambient and background noise levels was undertaken between 08:45hrs on Thursday 14th July 2022 and 10:15hrs on Wednesday 20th July 2022, as detailed in Table 5.1 below.

Table 5.1: Summary of Noise Monitoring Locations

Location	Height*	Freefield / Façade	From	To
LT1	1.8 m	Free-field	08:45 hrs Thursday 14 th July 2022	10:15hrs Wednesday 20 th July 2022

Note: [1] Approximate height above roof level.

A sound level meter was installed above roof level of the first floor retail units, in free-field conditions, towards the northwest site boundary, where safe access was available. The unattended noise monitoring location is labelled as LT1 on Figure A4 of Appendix A.

This monitoring location is representative of the west facing façade of the proposed flats.

Noise measurements were made using the equipment presented in Table 5.2 below.

Table 5.2: Noise Monitoring Equipment

Noise Monitoring Location	Manufacturer	Model No.	Description	Serial No.	Calibration Due Date ^[1]
LT1	Larson Davis	LxT	Sound Level Meter	0004968	April 2024
-	Larson Davis	CAL200	Calibrator	12981	April 2023

Note [1]: Calibration due date at the time of the survey

The sound level meters were powered by dry cell batteries and stored inside a weatherproof security box.

Measurements were obtained using the 'F' time weighting and A-weighting frequency network. The equipment was calibrated before and after the survey to generate a calibration level of 114.0 dB at 1 kHz, with the noted drift falling within acceptable tolerances.

The unattended noise monitoring locations were considered representative of the prevailing noise environment at the proposed west façade of the development site.

Fifteen-minute consecutive measurements of $L_{Amax,F}$, $L_{Aeq,15min}$, and $L_{A90,15min}$ noise levels were obtained over the duration of the survey.

5.2 Attended Noise Monitoring

Attended short-term noise measurements were also obtained at monitoring locations ST1 and ST2 as shown on Figure A4 of Appendix A, to understand the variation in noise levels between the unattended noise monitoring locations and the north and east facing façades of the proposed development.

The attended measurements were undertaken between 09:19hrs and 09:50hrs on Thursday 14th July 2022. All measurements were obtained in free-field conditions. The microphone was approximately 1.5 m above local ground. The sound level meter was configured to measure A-weighted noise indices, which included $L_{Amax,F}$, $L_{Aeq,15min}$ and $L_{A90,15min}$ levels.

The attended noise monitoring was undertaken using the equipment presented below in Table 5.3.

The clocks on the attended and unattended sound level meters were synchronised.

Table 5.3: Attended Noise Monitoring Equipment

Manufacturer	Model No.	Description	Serial No.	Calibration Due Date
Larson Davis	LxT	Sound Level Meter	0006489	June 2023

5.3 Weather Conditions

Weather conditions during the site visits are presented below in Table 5.4.

Table 5.4: Weather Conditions during Site Visits

Site Visit	Date and Time	Noted Weather
Setup/attended	14/07/2022 07:15	Dry and clear; 18°C; 86% humidity; average windspeeds <0.8m/s.
Collection	20/07/2022 10:30	Dry and clear; 20°C; 90% humidity; average windspeeds <0.7m/s.

A history of the weather conditions during the continuous noise survey period has been obtained from an internet source (www.wunderground.com). Analysis of the weather data indicates a period of dry and calm weather.

The weather conditions obtained for the noise survey period is summarised in Figure A5 of Appendix A.

5.4 Unattended Survey Analysis

The full results of the unattended noise monitoring survey at LT1 are presented in graphical form in Figures A6 of Appendix A and are tabulated in Tables B1 in Appendix B.

The measured daily ambient $L_{Aeq,T}$ and background $L_{A90,T}$ noise levels at LT1 during daytime and night-time hours, are summarised below in Table 5.5. The values presented in parentheses show the range of individual 15-minute $L_{Amax,F}$ measurements which occurred during each period.

Table 5.5: Summary of Measured Noise Levels at Unattended Monitoring Location LT1

Date	Measured Free-field Noise Levels, dB					
	Daytime (07:00 - 23:00)			Night-time (23:00 - 07:00)		
	L _{Amax,F}	L _{Aeq,16hr}	L _{A90,16hr}	L _{Amax,F}	L _{Aeq,8hr}	L _{A90,8hr}
Thu 14/07/22 ^[1]	72(64-80)	54	44	68(54-80)	50	39
Fri 15/07/22	74(59-96)	55	45	70(53-87)	54	40
Sat 16/07/22	72(60-92)	55	45	71(61-84)	54	42
Sun 17/07/22	71(55-82)	52	45	68(51-84)	51	41
Mon 18/07/22	73(62-80)	54	45	69(52-93)	56	43
Tue 19/07/22	74(61-91)	55	45	69(51-89)	56	41
Wed 20/07/22 ^[1]	73(67-80)	54	45	-	-	-
Average	73(71-74)	54	45	69(68-71)	54	41

Notes:

[1] incomplete daytime periods due to equipment installation and collection.

The results of the unattended monitoring at LT1 show that ambient daytime L_{Aeq,16hr} sound levels ranged from 52 to 55 dB with a mean average of 54 dB L_{Aeq,16hr}. The night-time L_{Aeq,8hr} sound levels ranged from 50 to 56 dB with a mean average of 54 dB L_{Aeq,8hr}.

The results show the mean average L_{Aeq,T} values during the daytime and night-time periods are equal. The reason for the elevated L_{Aeq,T} noise levels during the night-time periods was due to early morning deliveries to TK Maxx in the delivery area closest to the LT1 monitor. As described in Section 2, following the planning consent for construction of three additional floors above the Montague Quarter, the first-floor area will no longer be used by the commercial premises. The measured noise levels at LT1 therefore provided a worst-case measure of the noise levels at the site.

Mean maximum sound levels ranged from 68 to 71 dB L_{Amax,F} with a mean average of 69 dB during the night-time period.

5.5 Attended Noise Survey Results

The results of the attended noise measurements obtained on Thursday 14th July 2022 are summarised below in Table 5.6.

Table 5.6: Summary of Attended Noise Monitoring Results

Monitoring Location	Date	Start Time	Duration (mins)	Measured Free-field Noise Levels, dB			Observations
				L _{Amax,F}	L _{Aeq,T}	L _{A90,T}	
ST1	14/07/2022	09:19	15	79.2	55.6	49.2	Distant road traffic; occasional local car passes in car park; pedestrians walking past talking
ST2		09:35	15	72.0	56.1	51.6	pedestrians walking past meter and talking close to meter; road traffic.

5.6 Derivation of Representative Ambient Noise Levels

The results from the unattended noise measurements obtained at LT1 provides an indication of the typical diurnal variation in noise levels at the development site, whilst the short term attended noise



measurements obtained at ST1 and ST2 provides an indication of the variation in noise levels across the development site at the north and east facing façades, respectively.

The attended short-term measurements have been compared with the levels at the corresponding unattended monitoring location at a given time, with the difference used to provide a correction factor to extrapolate the mean 16-hour L_{Aeq} and 8-hour L_{Aeq} noise levels for the attended (ST) monitoring location.

Following comparison of the measured unattended and attended data, a difference of +5dB is observed between LT1 and ST1 and also between LT1 and ST2. The resulting free-field ambient noise levels at the ST2 monitoring location, derived for the purpose of the noise assessment, are presented below in Table 5.1.

For assessment purposes the north, east and west facing façades have been assigned a receptor I.D. of R1, R2 and R3, respectively, as displayed in Figure A7 of Appendix A. It should be noted that no habitable rooms with windows are proposed on the south facing façade.

As described in Section 5.4 above, the mean average $L_{Aeq,T}$ values during the night-time period are elevated due to the deliveries to the TK Maxx retail store, and the measured noise during this period therefore provide a worst-case measure of the noise levels at the site.

Table 5.7 : Derived Free-Field Daytime and Night-Time Ambient Noise Levels

Façade	Receptor ID	Representative Monitoring Location	Derived Free-field Ambient Noise Levels, $L_{Aeq,T}^{[1]}$	
			$L_{Aeq,16hr}$	$L_{Aeq,8hr}$
North	R1	ST1	59	59
East	R2	ST2	59	59
West	R3	LT1	54	54

6 NOISE ASSESSMENT

6.1 Assessment of Internal Ambient Noise Levels

BS 8233:2014 contains recommended guideline levels of 35 dB $L_{Aeq,T}$ for resting inside bedrooms and living rooms during the daytime, 40 dB $L_{Aeq,T}$ for dining areas and 30 dB $L_{Aeq,T}$ for sleeping inside bedrooms at night.

The approximate sound reduction value provided in Annex G of BS 8233 for a closed insulating glass window unit is 30 dB R_w .

Taking the typical sound reduction performances into consideration, internal noise levels have been predicted inside the dwellings, assuming windows are fully closed.

Internal noise levels have been calculated and are summarised below in Table 6.1.

Table 6.1: Assessment of Estimated Internal Noise Levels

Receptor	Measured Daytime Free-Field Noise Level $L_{Aeq,16hr}$	Estimated Daytime Internal Noise Level, dB $L_{Aeq,16hr}$	Measured Night-Time Free-Field Noise Level $L_{Aeq,8hr}$	Estimated Night-Time Internal Noise Level, dB $L_{Aeq,8hr}$
		Windows Closed ^[1]		Windows Closed ^[1]
R1	59	29	59	29
R2	59	29	59	29
R3	54	24	54	24

Notes:

[1] internal levels based on a sound reduction of 30 dB with windows closed.

Based on the assumed facade reductions described above, the noise predictions show that at the receptors, the internal noise levels remain below the BS8233:2014 daytime and night-time criterion values, with closed insulating windows, assuming a sound reduction of 30dB R_w .

6.2 Assessment of Internal Single Event $L_{Amax,F}$ Noise Levels

Single event noise indicators such as maximum $L_{Amax,F}$ noise levels generated at night have also been considered.

The WHO 2009 guidance sets an internal sleep disturbance noise limit of 42 dB $L_{Amax,F}$ for the onset of critical health effects, which is a level which should not be exceeded on a regular basis. Based on an interpretation that for a noise to be regular, it needs to occur several (i.e. more than two) times per hour, the $L_{Amax,F}$ noise needs to be based upon an average of at least 10-15 events that are typical in nature.

Analysis of the 1-minute $L_{Amax,F}$ data obtained from the unattended noise monitoring locations LT1, the measurement location representative of R3, indicates that during the night-time period, the 90th percentile of the $L_{Amax,F}$ values is 71 dB.

71 dB has therefore been taken as the representative $L_{Amax,F}$ value for assessment purposes at the R3 receptor.

Removing the influence of pedestrians talking close to the sound level meter, comparison of the measured 1-minute $L_{Amax,F}$ values obtained at the unattended (LT1) and attended (ST1) measurement locations indicate a difference of +4dB. The same level difference is seen when comparing the $L_{Amax,F}$ values at ST2 and LT1 during the same period.



The adopted free-field $L_{Amax,F}$, derived for the purpose of the noise assessment at the R1 and R2 receptors is 75 dB.

The typical facade reduction described above is then used to estimate internal $L_{Amax,F}$ noise levels and is presented in Table 6.2 below.

Table 6.2: Assessment on Estimated $L_{Amax,F}$ Levels Based on Typical Maximum Events

Location	Calculated External Noise Levels, dB $L_{Amax,F}$	Estimated Typical Internal Noise Level, dB $L_{Amax,F}$ Windows Closed ^[1]
R1	75	45
R2	75	45
R3	71	41

Note:

[1] Internal levels based on a sound reduction of 30dB with windows closed.

The assessment shows that the WHO internal sleep disturbance noise limit is exceeded by 3 dB at R1 and R2, assuming a sound reduction of 30dB R_w .

The WHO internal sleep disturbance noise limit is met at the R3 receptor.

The requirement for the provision of an enhanced glazing is considered further in the following chapter.

6.3 External Amenity Area Noise Assessment

Review of the architectural plans indicates that there is no external amenity areas proposed.

7 NOISE MITIGATION

7.1 Glazing Strategy

Based on the noise assessment it is considered that:

- Enhanced double glazing which can achieve a minimum sound level difference of 33dB should be considered for all bedrooms on the development, to ensure the night-time $L_{Amax,F}$ criteria can be achieved; and
- Standard double glazing which can achieve a minimum sound level difference of 30dB should be considered for all habitable rooms on the development, to ensure the daytime and night-time criteria is achieved.

Examples of suitable glazing product are presented in Table 7.1 below. The glazing requirements are also shown visually on Figure A8 of Appendix A.

Table 7.1: Appropriate Glazing Specification for the Development

Room	Minimum Sound Insulation Requirements	Typical Glazing Specification ^[1]
Bedrooms on the North and East Facing Façades	33 dB	4mm glass / 20mm air cavity / 6mm glass
Other habitable rooms	30 dB	4mm glass / 16mm air cavity / 4mm glass

Note: [1] Based on Saint Gobain glazing specification

The information provided in Table 7.1 is based on a broad assessment to provide an early indication of glazing requirements for the residential development site and does not account for the volume of glazing required for each facade. It is possible that a more enhanced glazing product will be required, depending on the quantity of glazing and the final ventilation strategy selected. Detailed internal calculations should be undertaken for the worst affected facades once final façade information has been determined to ensure the glazing and ventilation selection is suitable.

7.2 Ventilation Strategy

The ventilation requirements set out in Approved Document F^[10] can be delivered by a natural ventilation system or a mechanical ventilation system or a combination of both.

Continuous mechanical supply and extract with heat recovery (MHRV re. Approved Document F, system 4) could be used to provide background ventilation across the proposed building. The ventilation system can be used to supply and extract air from all rooms of the houses via ductwork venting to atmosphere.

The MVHR system alleviates the need for additional trickle ventilation to be built into the apartment facades, however, the following should be considered to ensure that internal noise levels are not compromised:

- operating noise from the ventilation unit;
- vibration isolation to ensure the mechanical system does not transmit vibration into building elements; and
- inlet/outlet attenuators should be incorporated.

Alternatively, adequate ventilation can also be provided with the implementation of mechanical ventilation to wet rooms and the provision of trickle vents to the glazing units.



This direct air path trickle ventilation can be fitted into the windows to provide a means of passive ventilation to allow windows to be kept closed if required.

Examples of trickle ventilation and in-wall ventilator manufacturers include Passivent, Greenwood, Glidevale and Timloc. Other manufacturers are also available.

7.3 Overheating

A separate overheating assessment has been undertaken as part of the planning submission [14]. The glazing and ventilation strategy outlined within this report is compatible with the ventilation approach adopted within that assessment.

The use of mechanical ventilation enables windows to remain closed to achieve the internal noise standards identified in this report, without conflicting with thermal comfort requirements.

7.4 Internal Sound Insulation

There will be a separating floor/ceiling between the ground floor commercial space and the flats at first floor level.

The proposed floor/ceiling construction will need to adequately protect the future residents from the internal transfer of noise from the future commercial operations.

The minimum requirements set out in Approved Document E ^[12] are designed to offer a reasonable resistance to the passage of sound between residential dwellings. For floors that separate spaces used for normal domestic and non-domestic purposes, the regulation states that 'a higher standard of sound insulation may be required'. In these situations, the appropriate level of sound insulation will depend on the noise generated in the communal and non-domestic spaces.

It is recommended that the party floor/ceiling between commercial and residential space is designed to ensure that noise due to the commercial premises does not exceed NR20 inside the residential accommodation. A condition requesting a review of the proposed design could be attached to the planning approval should the application be successful.

7.5 Other Considerations

No other noise source such as fixed plant such as air source heat pumps is proposed at this stage, however, Figure A4 indicates that plant serving the proposed dwellings is likely to be located at roof level. The potential impact could cause disturbance when in operation. This will require consideration and will likely be subject to Local Authority requirements.

The Local Authority criteria for external plant is usually a rating noise level to be no greater than the existing background sound level when assessed in accordance with BS 4142:2014+A1:2019 ^[13].

Modal statistical analysis of the background $L_{A90,T}$ sound levels are presented in Figure A9 of Appendix A for the daytime and night-time periods.

Using this modal analysis, the following plant rating noise levels should be considered a maximum, when measured at the nearest noise sensitive receptors.

- Daytime (07:00 – 23:00) – 45 dB $L_{Ar, Tr}$; and
- Night-time (23:00 – 07:00) – 40 dB $L_{Ar, Tr}$

8 SUMMARY AND CONCLUSIONS

7th Wave Acoustics was commissioned to undertake a noise impact assessment in support of a full planning application for the proposed conversion of the first floor retail space to provide nine residential units at the Montague Quarter Shopping Centre, Worthing, BN11 1YJ. The proposal forms part of the wider residential development previously approved at the site.

The existing noise environment has been established through unattended and attended noise monitoring previously undertaken in 2022 to support the approved residential scheme. The survey data remains representative of the prevailing town centre noise climate and has been supplemented by attended short-term measurements to understand spatial variation across the site.

An assessment of external and internal noise levels has been undertaken using the recommended guideline levels prescribed in BS8233:2014 and WHO $L_{Amax, F}$ guidance for night-time noise events.

The assessment demonstrates that, with windows closed and assuming a minimum glazing performance of 30 dB R_w , the BS 8233:2014 internal ambient noise criteria can be achieved within the proposed residential units.

Typical night-time $L_{Amax, F}$ noise levels are predicted to exceed the WHO guideline value of 42 dB internally at bedrooms on the north and east façades if standard glazing is adopted. Enhanced glazing, as outlined in Section 7, is therefore required to ensure the WHO night-time criterion can be achieved.

To protect the future residents from the potential impact from the internal transfer of noise from any non-domestic activities at the ground floor of the development, it is recommended that a review and an assessment of the proposed floor/ceiling construction is undertaken to ensure an appropriate level of sound insulation is provided between the spaces. It could be conditioned as part of any planning approval, to request a scheme of design to demonstrate a suitable level of sound insulation can be achieved.

External plant rating noise limits have been derived based on the established background ($LA_{90, T}$) sound levels to inform the final selection and design of any fixed plant associated with the development.

Subject to implementation of the glazing and sound insulation measures outlined in this report, the proposed development is considered acceptable in acoustic terms.



9 REFERENCES

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2. Worthing Borough Council. Planning Permission. AWDM/1624/22. 20th October 2022.
3. Department for Levelling Up, Housing and Communities (DLUHC). National Planning Policy Framework. Published 12 December 2024; amended 7 February 2025.
4. Department for Environment, Food and Rural Affairs (DEFRA). Noise Policy Statement for England (NPSE), 2010.
5. The Planning Noise Advice Document: Sussex. November 2023.
6. British Standard BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings.
7. World Health Organisation. 2018. Environmental Noise Guidelines for the European Region.
8. World Health Organisation. 1999. Guidelines for Community Noise.
9. World Health Organisation. Night Noise Guidelines for Europe. 2009.
10. The Building Regulations. Approved Document F.
11. Approved Document O - Overheating (2021). HM Stationary Office. 2021.
12. The Building Regulations 2010. Approved Document E – Resistance to the passage of sound.
13. British Standard BS4142:2014+A1:2019. Methods for rating and assessing industrial and commercial sound.
14. PJR Building Services Design Engineers. Energy Statement (Planning) for Montague Quarter, Worthing, West Sussex. July 2025 ref 38/01/ENS Ver 03



APPENDIX A: FIGURES

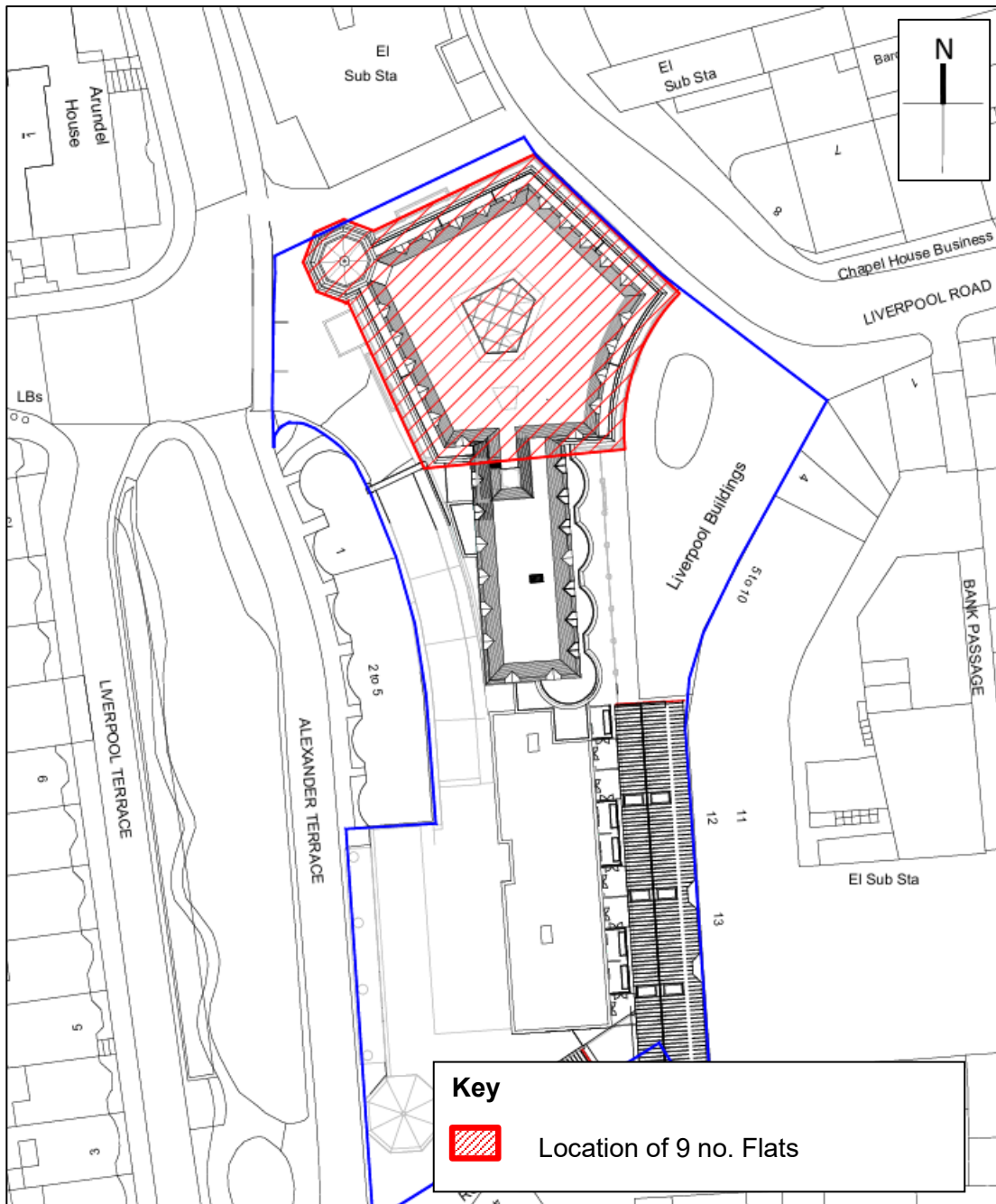


Figure A1: Site Location Plan



Figure A2: First Floor Plan

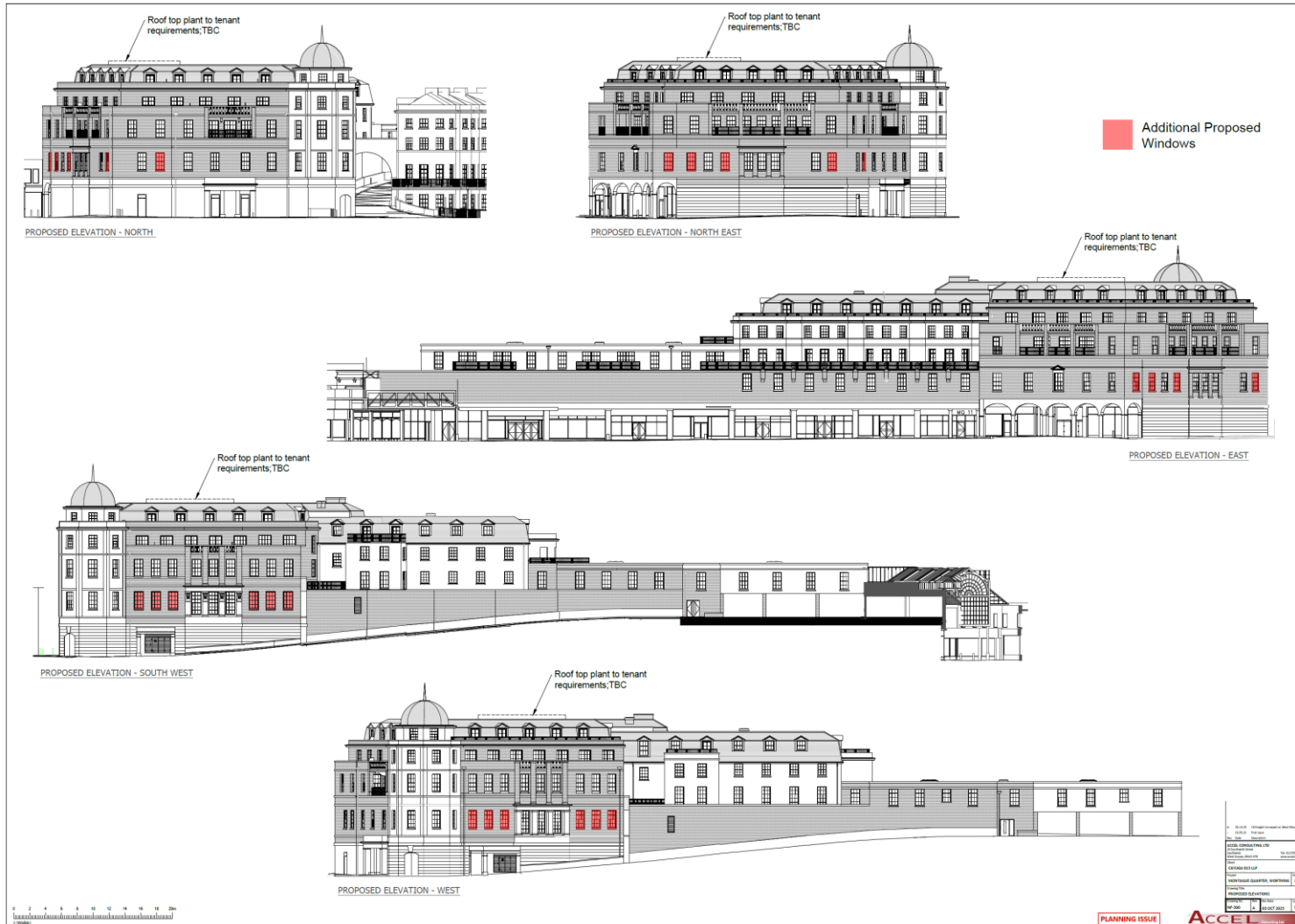


Figure A3: Proposed Elevations

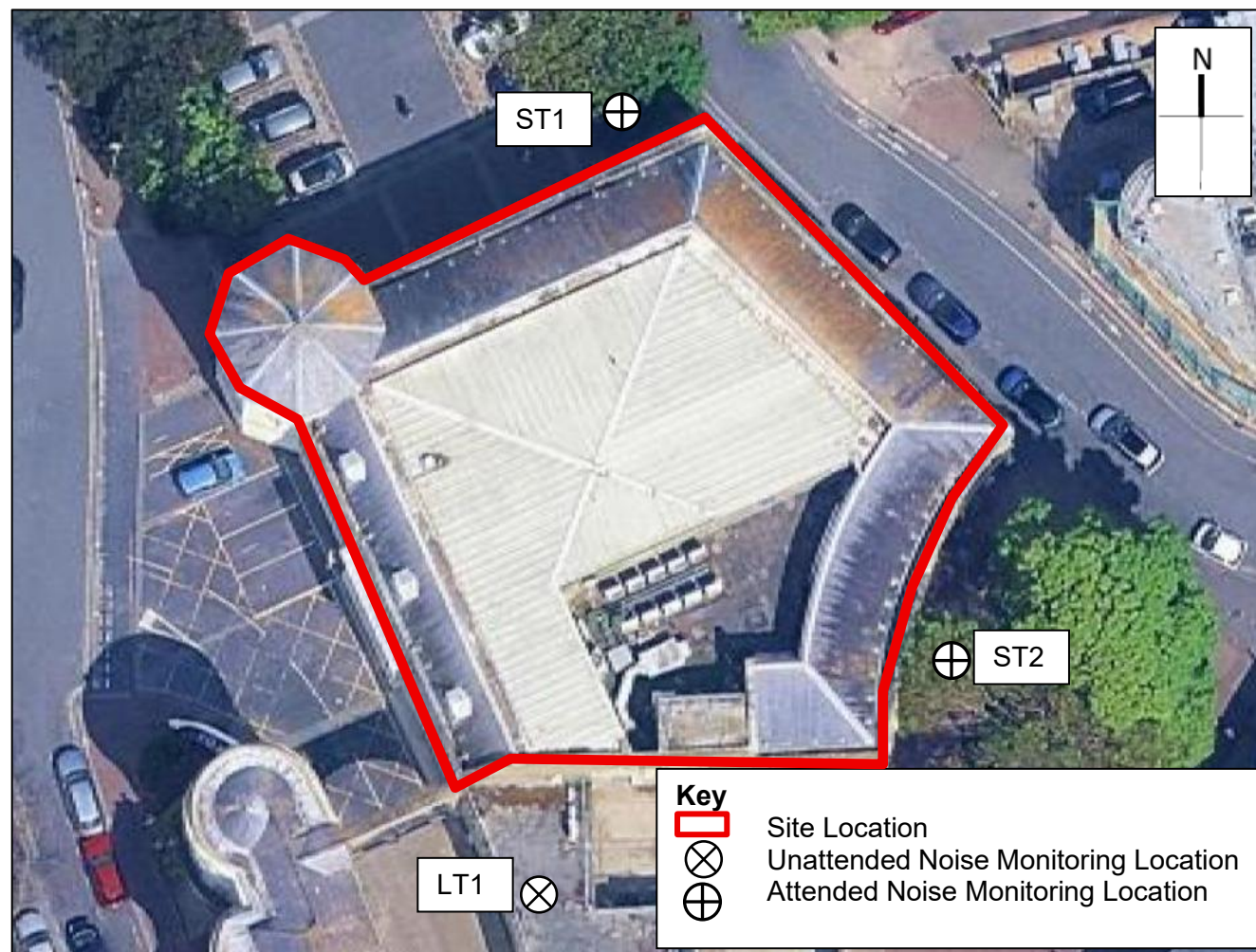


Figure A4: Noise Measurement Locations

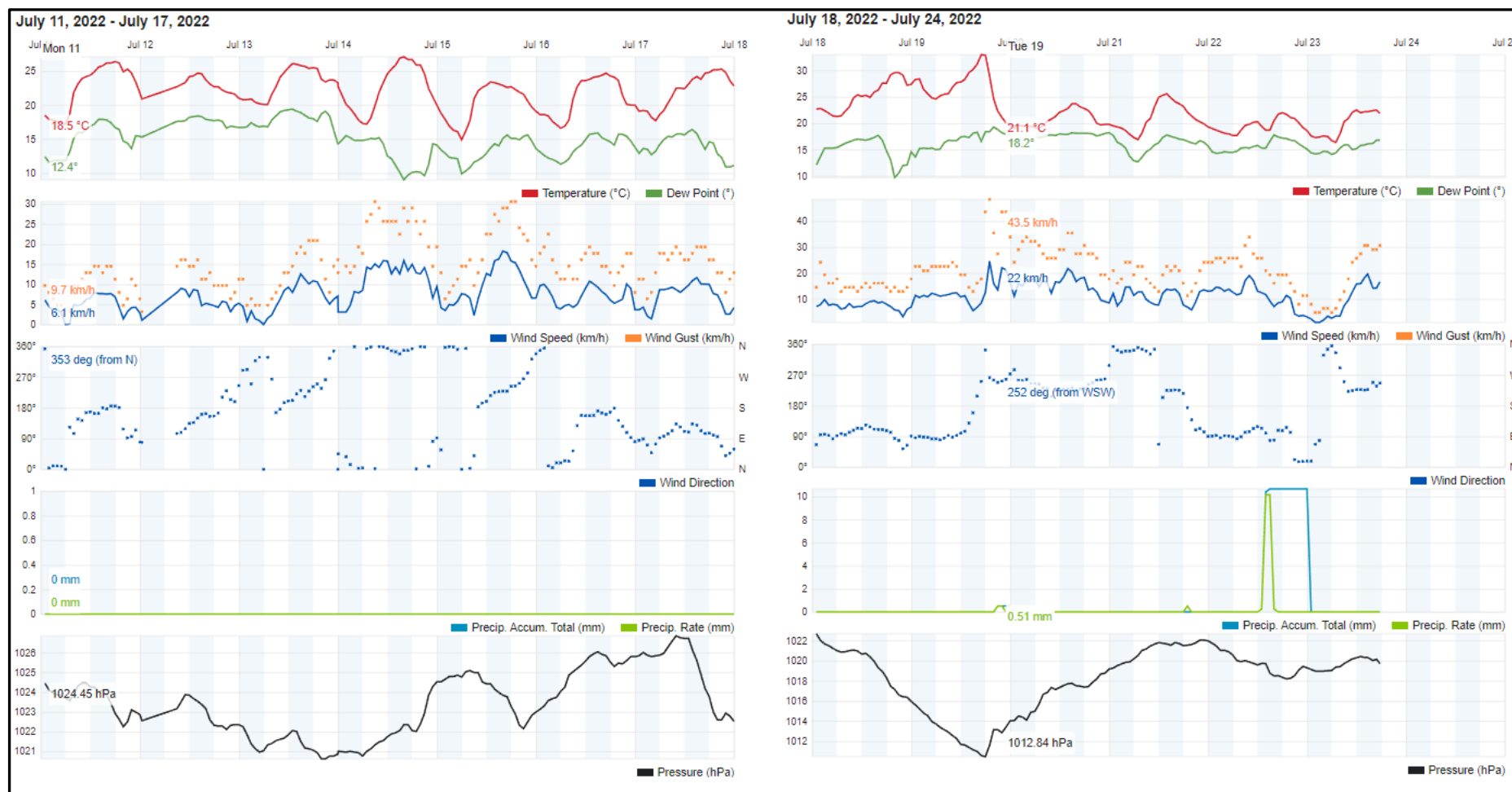


Figure A5: Weather Data for Unattended Noise Measurement Period

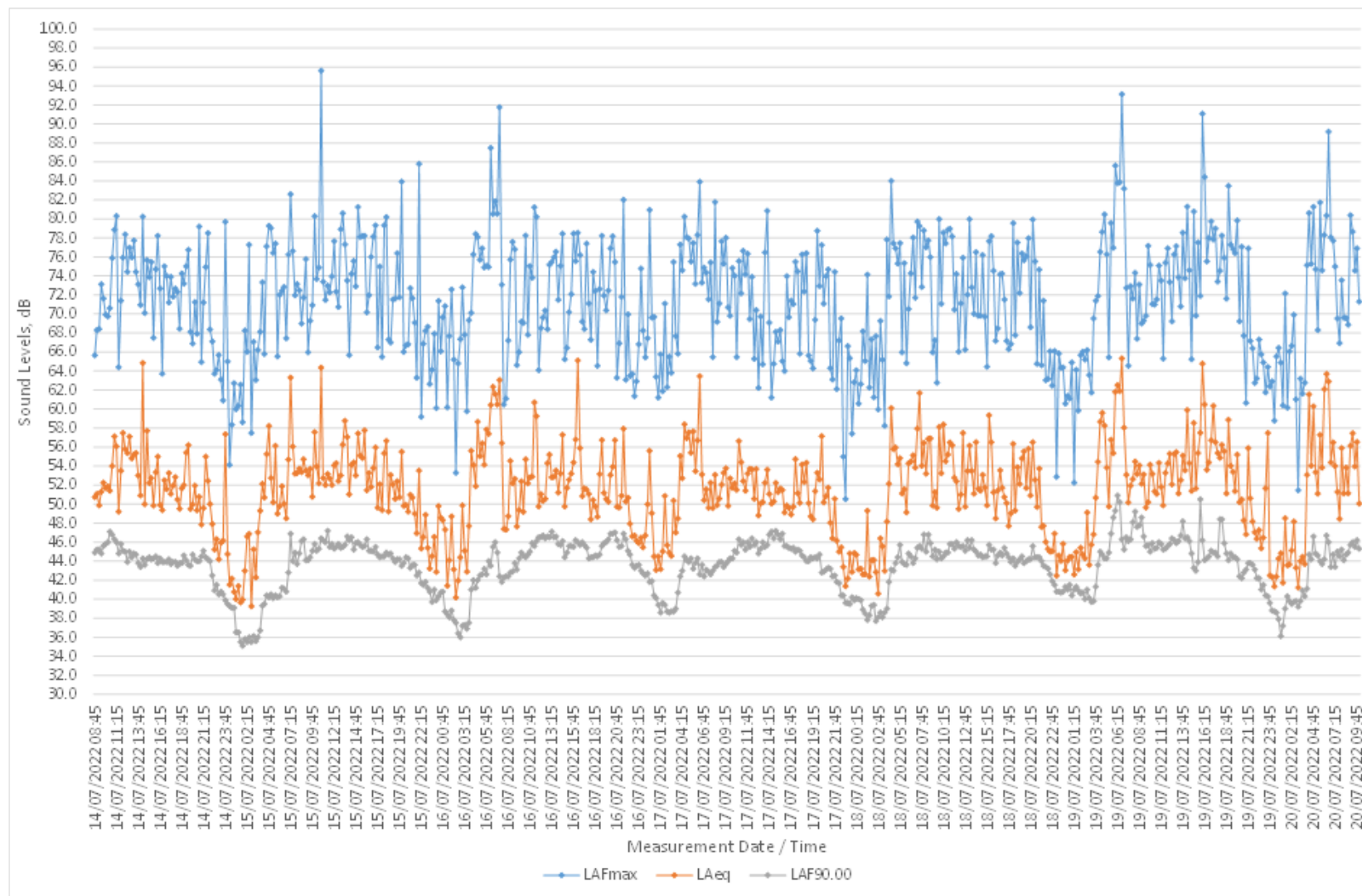


Figure A6: Time History of Unattended Noise Monitoring at LT1

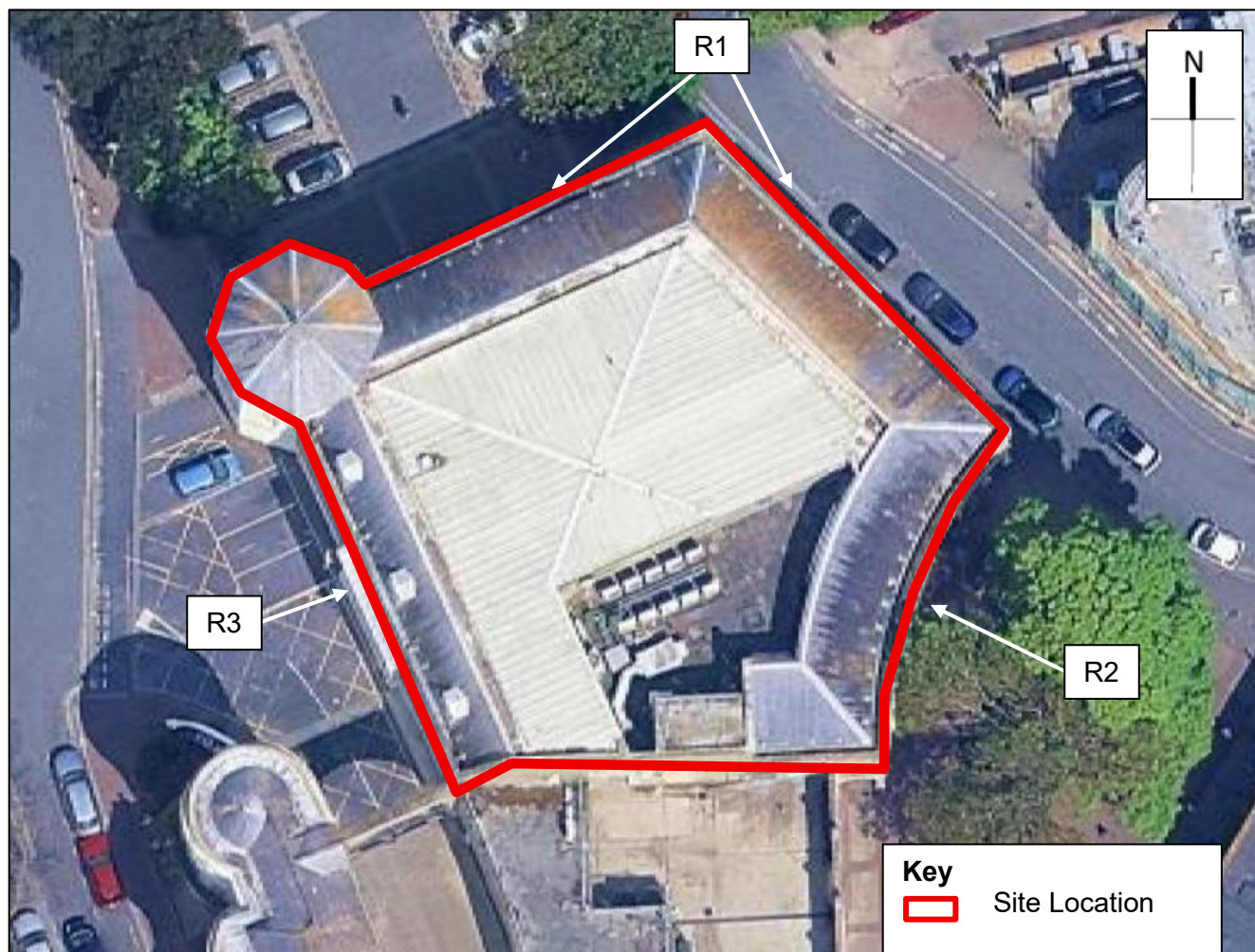


Figure A7: Assessment Receptor Locations



Figure A8 : Locations of Enhanced Glazing System

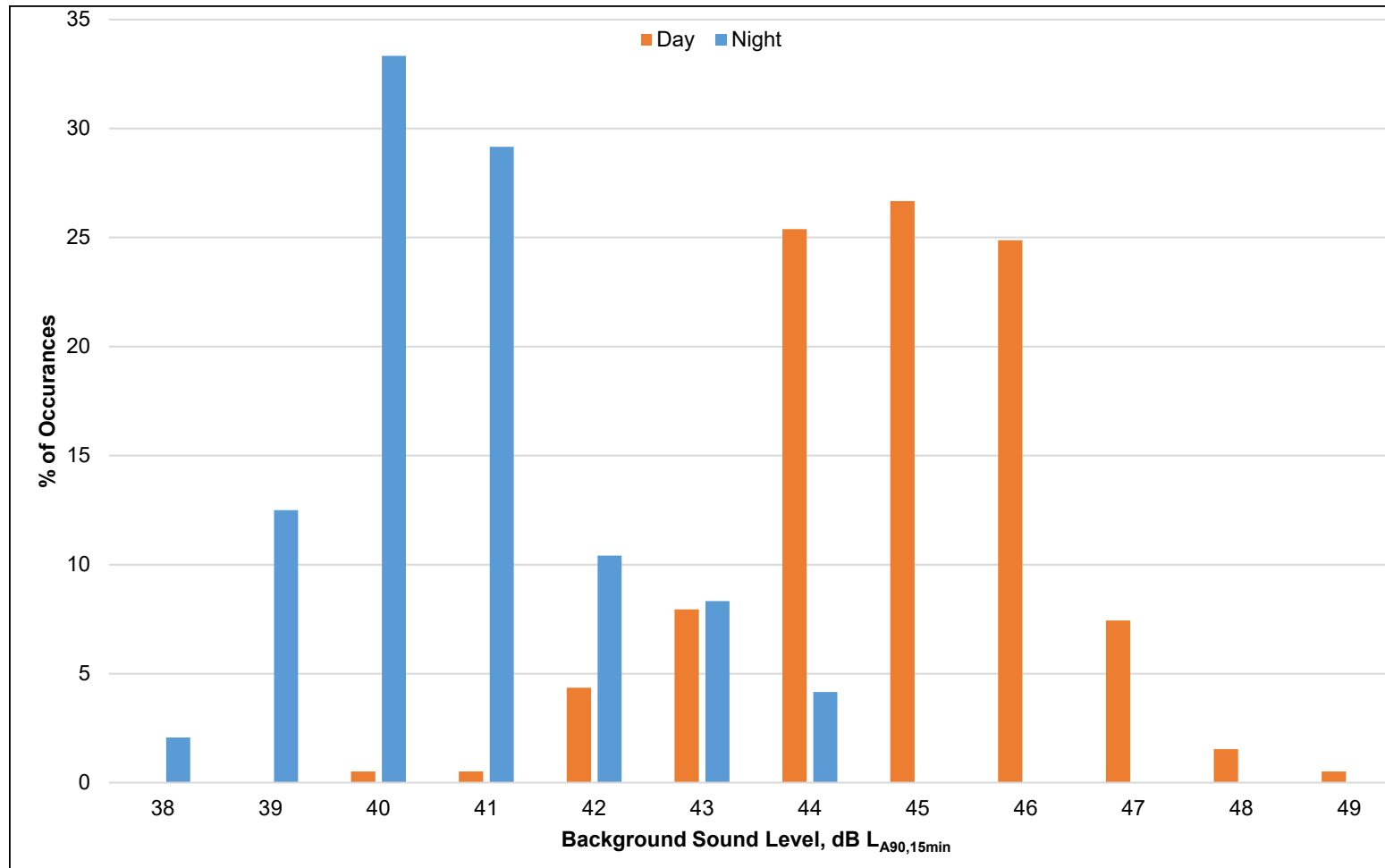


Figure A9: Derivation of Background Sound Assessment Levels for Plant Rating Limits

APPENDIX B: TABLES

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Thursday 14 th July 2022	08:45	65.7	50.7	44.9
	09:00	68.3	51.1	45.2
	09:15	68.4	49.9	45.2
	09:30	73.1	51.3	44.8
	09:45	71.6	52.2	45.6
	10:00	70.0	51.7	45.8
	10:15	69.8	51.9	46.0
	10:30	70.6	51.4	47.1
	10:45	75.9	54.0	46.8
	11:00	78.9	57.1	46.3
	11:15	80.3	56.1	46.0
	11:30	64.4	49.2	44.8
	11:45	71.4	53.5	45.8
	12:00	75.9	57.5	45.1
	12:15	78.4	55.8	45.0
	12:30	74.4	55.4	43.9
	12:45	77.0	57.1	45.0
	13:00	76.0	54.8	44.4
	13:15	77.7	55.2	44.8
	13:30	74.4	55.4	44.7
	13:45	73.1	53.0	43.8
	14:00	71.0	50.9	43.4
	14:15	80.3	64.9	44.3
	14:30	70.1	50.0	43.6
	14:45	75.7	57.7	44.2
	15:00	73.9	52.2	44.4
	15:15	75.5	52.8	44.2
	15:30	67.5	49.8	44.3
	15:45	74.7	53.4	44.5
	16:00	78.2	55.0	43.8
	16:15	72.7	49.9	44.3
	16:30	63.7	49.4	43.9
	16:45	75.0	52.5	43.9
	17:00	74.0	51.6	43.9
	17:15	71.2	53.3	44.2
	17:30	73.9	51.1	43.7
	17:45	71.8	52.0	43.9
	18:00	72.7	52.8	43.9
	18:15	72.3	50.5	43.5
	18:30	68.4	49.5	43.8
	18:45	74.3	51.7	43.8
	19:00	73.2	52.0	44.6
	19:15	75.0	55.4	44.1

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Thursday 14 th July 2022	19:30	76.8	56.2	43.6
	19:45	68.1	49.5	43.5
	20:00	66.9	50.0	44.7
	20:15	71.3	51.9	44.2
	20:30	67.9	49.4	44.0
	20:45	79.2	50.8	44.0
	21:00	65.0	47.8	44.5
	21:15	71.2	49.6	45.1
	21:30	75.0	55.0	44.4
	21:45	78.5	52.4	44.2
	22:00	68.4	50.0	44.0
	22:15	67.1	47.9	42.5
	22:30	63.7	45.2	40.9
	22:45	64.1	46.3	41.5
	23:00	65.7	44.2	40.5
	23:15	63.1	45.9	40.8
	23:30	60.9	46.2	40.5
	23:45	79.7	57.4	39.9
Friday 15 th July 2022	00:00	65.0	44.7	39.5
	00:15	54.1	41.5	39.3
	00:30	58.4	42.2	39.1
	00:45	62.7	40.8	39.1
	01:00	60.0	40.0	36.5
	01:15	60.3	41.4	36.5
	01:30	62.6	39.6	35.5
	01:45	58.6	40.0	35.1
	02:00	68.3	43.0	35.8
	02:15	66.0	46.6	35.5
	02:30	77.3	46.9	36.0
	02:45	57.5	39.3	35.5
	03:00	67.1	45.2	36.1
	03:15	63.1	42.3	35.6
	03:30	66.2	47.0	36.0
	03:45	68.1	49.3	36.7
	04:00	73.4	52.1	39.3
	04:15	65.8	50.7	39.5
	04:30	77.1	55.3	40.4
	04:45	79.3	58.2	40.2
	05:00	79.0	52.7	40.5
	05:15	76.4	50.2	40.1
	05:30	77.4	56.1	40.4
	05:45	65.5	49.0	40.2
	06:00	72.0	49.8	40.3
	06:15	72.4	51.9	41.2
	06:30	72.8	50.0	41.1
	06:45	67.5	48.5	40.8

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Friday 15 th July 2022	07:00	76.2	54.7	42.8
	07:15	82.6	63.3	46.9
	07:30	76.6	56.1	44.0
	07:45	72.0	53.2	44.9
	08:00	73.2	53.3	43.7
	08:15	72.5	53.7	44.8
	08:30	69.0	53.4	46.1
	08:45	71.7	54.7	46.3
	09:00	75.8	53.5	44.1
	09:15	66.0	53.0	44.1
	09:30	69.3	53.7	44.4
	09:45	70.9	50.8	45.1
	10:00	80.3	57.6	45.8
	10:15	73.7	54.0	45.1
	10:30	74.9	52.2	45.3
	10:45	95.6	64.4	46.4
	11:00	73.4	52.7	46.2
	11:15	71.5	52.0	46.0
	11:30	73.0	53.2	47.2
	11:45	72.3	52.7	45.5
	12:00	73.9	52.0	45.8
	12:15	77.7	54.1	45.3
	12:30	72.4	54.3	45.5
	12:45	70.8	52.4	45.8
	13:00	78.9	53.0	45.4
	13:15	80.6	56.3	45.5
	13:30	77.3	58.8	45.7
	13:45	73.5	57.1	46.6
	14:00	65.7	51.0	46.2
	14:15	74.2	54.1	46.5
	14:30	75.6	54.4	45.2
	14:45	72.9	53.0	45.9
	15:00	81.3	57.4	46.0
	15:15	78.1	55.1	45.7
	15:30	78.2	54.9	45.5
	15:45	78.2	57.8	45.6
	16:00	70.2	51.4	46.3
	16:15	72.0	53.3	45.1
	16:30	76.0	51.8	45.1
	16:45	78.1	53.8	45.0
	17:00	79.3	56.0	45.5
	17:15	66.5	49.6	44.7
	17:30	75.0	52.1	44.4
	17:45	65.5	49.4	44.5
	18:00	79.3	55.4	44.5
	18:15	80.2	56.7	44.9

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Friday 15 th July 2022	18:30	67.3	49.2	44.7
	18:45	67.0	53.1	44.8
	19:00	71.5	52.1	44.3
	19:15	71.6	50.5	43.9
	19:30	76.4	52.4	44.2
	19:45	71.8	50.7	44.2
	20:00	83.9	55.5	43.5
	20:15	66.0	49.8	43.8
	20:30	66.7	49.9	44.4
	20:45	66.8	49.2	44.3
	21:00	72.7	51.0	43.3
	21:15	71.7	50.7	43.6
	21:30	69.1	49.0	43.6
	21:45	63.3	46.9	42.5
	22:00	85.8	53.5	42.8
	22:15	59.2	45.3	41.7
	22:30	66.9	46.5	41.5
	22:45	68.2	48.9	41.8
	23:00	68.7	45.4	41.2
	23:15	62.6	43.2	40.8
	23:30	64.1	44.5	39.7
	23:45	67.9	46.6	41.0
Saturday 16 th July 2022	00:00	60.1	42.9	39.9
	00:15	71.4	49.8	40.3
	00:30	66.1	48.6	40.7
	00:45	69.7	48.3	40.8
	01:00	70.8	47.3	38.7
	01:15	60.2	41.4	38.4
	01:30	67.7	44.1	38.1
	01:45	72.6	48.7	38.8
	02:00	65.2	43.1	37.8
	02:15	53.3	40.2	37.5
	02:30	64.8	42.0	36.4
	02:45	67.4	44.4	36.0
	03:00	72.8	49.9	37.2
	03:15	67.8	45.1	37.3
	03:30	59.8	42.9	36.9
	03:45	69.3	47.7	37.5
	04:00	70.1	55.6	41.0
	04:15	76.3	54.1	42.0
	04:30	78.4	51.9	41.2
	04:45	78.1	58.7	42.0
	05:00	75.7	55.1	42.5
	05:15	76.9	56.4	42.6
	05:30	74.9	54.1	43.2
	05:45	75.1	57.9	42.6

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Saturday 16 th July 2022	06:00	75.0	57.4	44.0
	06:15	87.5	60.4	43.5
	06:30	80.5	62.4	45.5
	06:45	81.9	61.6	46.0
	07:00	80.6	60.5	44.9
	07:15	91.8	63.1	42.4
	07:30	73.1	56.4	41.8
	07:45	60.5	47.4	42.3
	08:00	61.1	47.3	42.4
	08:15	67.2	48.7	42.4
	08:30	75.7	54.6	42.8
	08:45	77.6	52.2	42.9
	09:00	76.8	52.7	43.8
	09:15	64.6	47.6	43.1
	09:30	66.0	49.4	44.3
	09:45	69.2	52.4	44.9
	10:00	69.1	49.2	44.6
	10:15	78.3	54.7	44.4
	10:30	67.8	52.2	44.7
	10:45	75.0	52.8	45.0
	11:00	73.8	52.9	45.9
	11:15	81.2	60.7	45.6
	11:30	80.2	59.2	46.1
	11:45	64.1	49.7	46.5
	12:00	68.5	51.0	46.5
	12:15	69.6	50.3	46.7
	12:30	70.4	50.6	46.4
	12:45	68.4	54.3	46.6
	13:00	75.2	55.2	46.5
	13:15	75.5	52.8	47.1
	13:30	76.0	52.9	46.5
	13:45	76.6	53.5	46.6
	14:00	71.5	51.2	45.8
	14:15	75.1	53.2	45.7
	14:30	78.5	57.3	46.1
	14:45	65.2	49.8	44.4
	15:00	66.5	51.7	44.9
	15:15	70.2	52.6	45.6
	15:30	72.1	53.2	45.6
	15:45	78.5	54.4	45.5
	16:00	75.6	56.8	46.2
	16:15	78.6	65.1	46.0
	16:30	76.2	55.9	45.7
	16:45	69.2	50.8	46.0
	17:00	68.4	51.7	45.7
	17:15	77.4	51.5	45.4

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Saturday 16 th July 2022	17:30	71.1	51.1	44.3
	17:45	67.3	48.4	44.4
	18:00	74.4	50.4	44.4
	18:15	72.4	49.8	44.6
	18:30	64.5	48.7	44.5
	18:45	72.6	53.2	44.7
	19:00	78.2	56.7	45.6
	19:15	72.0	51.2	45.9
	19:30	70.4	50.5	46.0
	19:45	72.5	50.3	46.3
	20:00	76.9	53.0	46.9
	20:15	78.2	53.9	46.9
	20:30	75.5	56.7	47.0
	20:45	63.3	49.7	46.2
	21:00	66.9	49.7	45.5
	21:15	71.8	50.9	45.6
	21:30	82.0	57.9	46.9
	21:45	63.1	50.3	46.3
	22:00	70.0	50.7	45.1
	22:15	63.5	47.9	44.7
	22:30	63.7	46.6	43.6
	22:45	61.4	46.7	43.3
	23:00	62.9	46.2	43.5
	23:15	66.8	45.9	43.6
	23:30	74.8	46.5	43.0
	23:45	68.3	45.4	42.7
Sunday 17 th July 2022	00:00	65.4	46.7	42.5
	00:15	67.5	50.0	42.7
	00:30	81.0	55.6	41.8
	00:45	69.6	49.1	41.9
	01:00	69.7	44.5	40.4
	01:15	63.4	43.1	40.1
	01:30	61.2	44.5	39.4
	01:45	65.7	43.1	38.6
	02:00	61.9	45.0	39.6
	02:15	71.1	50.9	39.4
	02:30	62.3	45.7	38.7
	02:45	65.5	44.9	38.6
	03:00	63.8	44.6	38.7
	03:15	75.5	50.4	38.7
	03:30	67.7	47.0	39.0
	03:45	65.8	48.5	40.7
	04:00	77.3	55.1	42.4
	04:15	74.6	52.7	43.0
	04:30	80.2	58.4	44.5
	04:45	78.1	56.9	44.1

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Sunday 17 th July 2022	05:00	78.0	57.6	43.9
	05:15	75.5	55.4	44.3
	05:30	77.5	57.7	43.2
	05:45	73.2	53.5	43.8
	06:00	78.3	56.7	44.3
	06:15	83.9	63.5	42.6
	06:30	73.3	53.1	43.6
	06:45	74.9	50.4	42.4
	07:00	74.4	51.6	43.1
	07:15	71.6	49.6	42.9
	07:30	75.4	52.2	42.6
	07:45	65.5	49.6	43.0
	08:00	81.8	53.1	43.4
	08:15	69.2	49.9	43.5
	08:30	71.1	50.6	43.9
	08:45	77.7	52.0	43.9
	09:00	75.3	53.3	43.4
	09:15	78.0	53.8	43.7
	09:30	70.7	49.8	44.0
	09:45	69.8	52.7	44.3
	10:00	74.8	51.7	44.3
	10:15	74.0	52.2	45.1
	10:30	65.5	51.5	44.9
	10:45	75.6	56.6	46.3
	11:00	72.2	54.4	45.7
	11:15	76.6	52.4	46.0
	11:30	74.2	51.4	45.2
	11:45	76.4	53.2	46.0
	12:00	69.5	53.7	45.5
	12:15	73.9	53.6	46.4
	12:30	65.3	50.5	45.7
	12:45	70.4	53.7	46.0
	13:00	62.2	48.8	44.8
	13:15	69.7	50.1	45.3
	13:30	64.7	50.2	46.0
	13:45	76.5	52.2	45.5
	14:00	80.9	53.6	45.7
	14:15	69.1	51.1	46.8
	14:30	61.2	50.1	47.1
	14:45	64.8	50.3	46.4
	15:00	68.1	52.2	47.2
	15:15	67.1	51.3	46.8
	15:30	68.3	51.6	46.3
	15:45	65.0	51.5	46.9
	16:00	64.0	49.1	45.6
	16:15	74.0	49.8	45.6

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Sunday 17 th July 2022	16:30	69.7	49.6	45.4
	16:45	71.4	48.9	45.3
	17:00	71.1	49.7	45.4
	17:15	75.5	54.7	45.0
	17:30	74.5	51.1	45.2
	17:45	65.8	50.1	45.1
	18:00	76.3	54.2	44.6
	18:15	72.4	52.3	44.4
	18:30	76.4	54.4	44.0
	18:45	65.6	50.1	44.0
	19:00	65.1	48.7	44.4
	19:15	64.3	48.4	44.3
	19:30	69.4	51.4	44.4
	19:45	78.8	53.3	44.3
	20:00	72.9	52.6	44.7
	20:15	77.3	57.1	42.8
	20:30	71.1	50.2	42.9
	20:45	74.0	50.8	43.1
	21:00	74.7	51.7	43.3
	21:15	64.3	48.0	43.2
	21:30	63.1	46.4	42.4
	21:45	74.4	50.6	42.5
	22:00	62.1	46.2	41.8
	22:15	67.2	45.0	41.7
	22:30	69.5	45.4	40.4
	22:45	55.0	43.4	40.4
	23:00	50.5	41.4	39.6
	23:15	66.6	42.2	39.6
	23:30	65.3	44.8	39.5
	23:45	57.4	42.9	40.2
Monday 18 th July 2022	00:00	62.8	44.9	39.9
	00:15	64.1	44.7	40.1
	00:30	60.6	43.1	40.0
	00:45	62.6	43.2	39.9
	01:00	68.2	42.6	38.9
	01:15	65.1	42.6	38.5
	01:30	74.1	49.3	37.8
	01:45	62.2	42.4	38.3
	02:00	67.3	44.1	39.3
	02:15	61.2	44.1	39.4
	02:30	67.7	42.8	37.7
	02:45	60.0	40.6	38.1
	03:00	69.3	46.4	38.6
	03:15	65.2	45.6	38.1
	03:30	58.2	43.0	38.6
	03:45	77.8	48.2	39.0

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Monday 18 th July 2022	04:00	71.9	52.1	41.8
	04:15	84.0	60.1	43.1
	04:30	77.4	55.8	43.0
	04:45	76.9	56.0	43.8
	05:00	75.3	54.2	44.4
	05:15	77.5	54.8	45.7
	05:30	66.0	51.1	43.9
	05:45	75.4	51.6	43.7
	06:00	64.8	49.1	43.6
	06:15	70.5	54.3	44.8
	06:30	74.3	54.5	44.5
	06:45	78.1	55.1	43.8
	07:00	71.7	53.8	44.3
	07:15	79.7	58.0	45.4
	07:30	79.2	61.7	45.6
	07:45	72.9	54.0	45.3
	08:00	78.8	56.4	46.8
	08:15	77.0	53.2	45.0
	08:30	77.7	56.9	46.8
	08:45	76.0	56.9	45.9
	09:00	66.0	49.8	44.5
	09:15	67.2	51.3	45.2
	09:30	62.8	49.6	44.2
	09:45	80.0	58.1	45.0
	10:00	71.1	53.2	44.3
	10:15	78.6	58.4	44.5
	10:30	77.4	54.5	44.9
	10:45	78.9	55.2	44.9
	11:00	79.0	56.5	45.8
	11:15	78.2	56.2	45.8
	11:30	70.5	52.8	45.3
	11:45	74.2	52.4	46.0
	12:00	66.0	49.5	45.6
	12:15	71.1	51.0	45.5
	12:30	75.9	57.5	45.6
	12:45	66.3	49.7	45.1
	13:00	72.0	53.5	46.2
	13:15	80.0	56.2	45.4
	13:30	72.8	53.5	46.2
	13:45	70.0	51.1	45.2
	14:00	76.5	56.5	45.0
	14:15	69.8	51.6	44.6
	14:30	69.8	51.4	44.7
	14:45	76.2	53.1	44.4
	15:00	69.7	51.7	44.5
	15:15	64.4	49.9	44.5

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Monday 18 th July 2022	15:30	77.7	59.4	45.7
	15:45	78.2	56.5	45.2
	16:00	74.5	51.2	45.2
	16:15	67.2	48.5	43.8
	16:30	68.5	51.4	44.6
	16:45	74.2	53.6	44.9
	17:00	74.2	51.7	44.6
	17:15	71.5	50.7	45.4
	17:30	67.2	50.1	44.8
	17:45	66.3	47.7	44.4
	18:00	66.8	49.0	43.9
	18:15	79.6	56.3	44.3
	18:30	67.8	49.3	43.5
	18:45	77.5	53.9	43.9
	19:00	72.2	52.1	44.2
	19:15	76.4	54.8	44.5
	19:30	75.7	55.6	43.8
	19:45	76.1	51.7	44.0
	20:00	78.0	55.8	44.2
	20:15	68.6	50.9	44.2
	20:30	79.9	56.5	45.6
	20:45	75.5	52.6	44.4
	21:00	64.8	49.7	44.4
	21:15	74.7	53.8	44.4
	21:30	64.6	47.6	44.0
	21:45	71.4	47.7	43.5
	22:00	63.0	46.0	43.4
	22:15	63.2	45.3	43.2
	22:30	66.1	45.0	42.6
	22:45	62.5	45.0	41.9
	23:00	66.1	46.9	41.5
	23:15	52.9	42.5	40.8
	23:30	65.9	44.6	40.8
	23:45	64.3	44.0	40.7
Tuesday 19 th July 2022	00:00	64.4	45.8	40.8
	00:15	60.6	43.0	41.3
	00:30	61.4	44.1	41.0
	00:45	61.1	44.4	41.5
	01:00	64.9	44.5	40.4
	01:15	52.3	42.6	41.0
	01:30	64.1	45.0	41.3
	01:45	59.8	43.1	40.9
	02:00	65.7	45.4	40.6
	02:15	66.0	44.7	40.7
	02:30	65.2	44.3	40.0
	02:45	66.2	49.1	41.0

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Tuesday 19 th July 2022	03:00	63.6	43.6	40.1
	03:15	61.7	45.7	39.7
	03:30	69.5	46.8	39.8
	03:45	71.4	50.7	41.3
	04:00	71.9	54.5	43.6
	04:15	76.5	58.7	45.0
	04:30	78.6	59.6	44.7
	04:45	80.5	58.3	44.3
	05:00	76.3	53.8	44.3
	05:15	65.4	49.7	44.9
	05:30	79.6	56.8	46.9
	05:45	77.0	55.3	48.6
	06:00	85.6	61.8	49.3
	06:15	83.8	62.5	50.9
	06:30	83.9	61.9	50.2
	06:45	93.1	65.3	46.3
	07:00	83.2	58.1	45.2
	07:15	72.8	53.1	46.5
	07:30	64.6	50.2	46.1
	07:45	72.9	51.9	46.3
	08:00	71.6	52.6	48.1
	08:15	74.3	54.5	49.2
	08:30	67.4	53.2	47.6
	08:45	73.1	54.1	47.8
	09:00	69.0	52.1	48.6
	09:15	69.3	53.1	46.6
	09:30	69.8	49.6	45.6
	09:45	77.2	50.2	45.7
	10:00	75.2	54.2	45.0
	10:15	71.1	53.2	45.9
	10:30	71.0	51.3	45.3
	10:45	71.6	51.1	45.4
	11:00	75.1	54.3	46.0
	11:15	73.5	51.8	45.8
	11:30	65.3	49.9	45.2
	11:45	75.4	53.3	45.3
	12:00	76.9	54.3	45.6
	12:15	73.4	55.3	45.8
	12:30	69.2	52.1	46.4
	12:45	76.3	55.3	46.2
	13:00	77.2	55.5	45.9
	13:15	73.9	51.1	46.1
	13:30	70.8	52.5	46.7
	13:45	78.6	55.1	48.2
	14:00	73.8	53.5	46.4
	14:15	81.3	59.9	46.5

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Tuesday 19 th July 2022	14:30	74.6	54.3	46.1
	14:45	65.2	51.4	44.8
	15:00	80.8	58.5	43.3
	15:15	69.8	51.7	43.0
	15:30	77.5	55.4	43.9
	15:45	71.9	57.5	50.5
	16:00	91.1	64.8	46.2
	16:15	84.4	60.5	44.1
	16:30	75.5	53.6	44.3
	16:45	78.0	54.4	44.5
	17:00	79.8	56.7	45.1
	17:15	77.8	60.3	44.9
	17:30	79.0	56.5	44.9
	17:45	73.4	55.4	44.5
	18:00	74.6	54.9	48.4
	18:15	78.3	56.2	48.4
	18:30	75.9	55.6	45.9
	18:45	71.6	51.1	44.8
	19:00	83.5	58.9	44.1
	19:15	77.3	54.0	44.8
	19:30	76.8	53.4	44.4
	19:45	76.4	51.4	44.4
	20:00	79.8	55.2	44.2
	20:15	69.2	50.2	42.4
	20:30	77.1	50.5	42.2
	20:45	67.7	48.3	42.8
	21:00	60.6	46.8	43.1
	21:15	76.9	55.9	43.8
	21:30	67.2	50.6	43.8
	21:45	66.4	48.2	43.6
	22:00	62.8	47.0	43.1
	22:15	63.2	46.3	42.2
	22:30	67.3	47.3	42.2
	22:45	65.8	45.3	41.0
	23:00	64.9	46.5	41.5
	23:15	61.8	51.7	40.4
	23:30	64.4	57.5	40.3
	23:45	62.4	42.5	39.6
Wednesday 20 th July 2022	00:00	62.9	42.3	38.8
	00:15	58.8	41.3	38.7
	00:30	65.5	42.4	38.6
	00:45	66.4	44.3	37.9
	01:00	64.9	44.8	36.1
	01:15	60.4	41.7	37.2
	01:30	72.2	48.5	39.0
	01:45	60.2	43.6	40.3

Table B1: Noise Monitoring Data at LT1

Date of Meas.	Start Time	Measured Noise Levels, dB		
		L _{Amax,F}	L _{Aeq,15min}	L _{A90,15min}
Wednesday 20 th July 2022	02:00	66.1	43.7	39.8
	02:15	66.7	45.1	39.5
	02:30	69.9	48.2	39.7
	02:45	61.0	43.3	39.8
	03:00	51.5	41.2	39.2
	03:15	63.2	44.0	39.8
	03:30	61.6	44.4	40.9
	03:45	62.8	43.7	40.3
	04:00	75.1	53.1	41.1
	04:15	80.6	61.6	44.7
	04:30	75.3	54.0	44.2
	04:45	81.3	60.3	46.6
	05:00	74.7	53.4	44.8
	05:15	68.3	51.1	44.6
	05:30	81.7	57.3	44.0
	05:45	74.6	53.8	43.7
	06:00	78.3	62.1	44.2
	06:15	80.4	63.7	46.7
	06:30	89.2	62.9	46.0
	06:45	78.1	54.4	43.4
	07:00	77.7	56.5	44.7
	07:15	75.0	54.0	43.4
	07:30	69.5	51.3	45.0
	07:45	66.9	48.4	44.5
	08:00	73.6	55.9	45.2
	08:15	69.6	51.1	44.1
	08:30	69.6	53.8	44.7
	08:45	68.9	51.2	44.9
	09:00	80.4	56.1	45.7
	09:15	78.7	57.5	46.0
	09:30	74.6	54.0	45.5
	09:45	76.9	56.5	46.2
	10:00	71.3	50.1	45.3