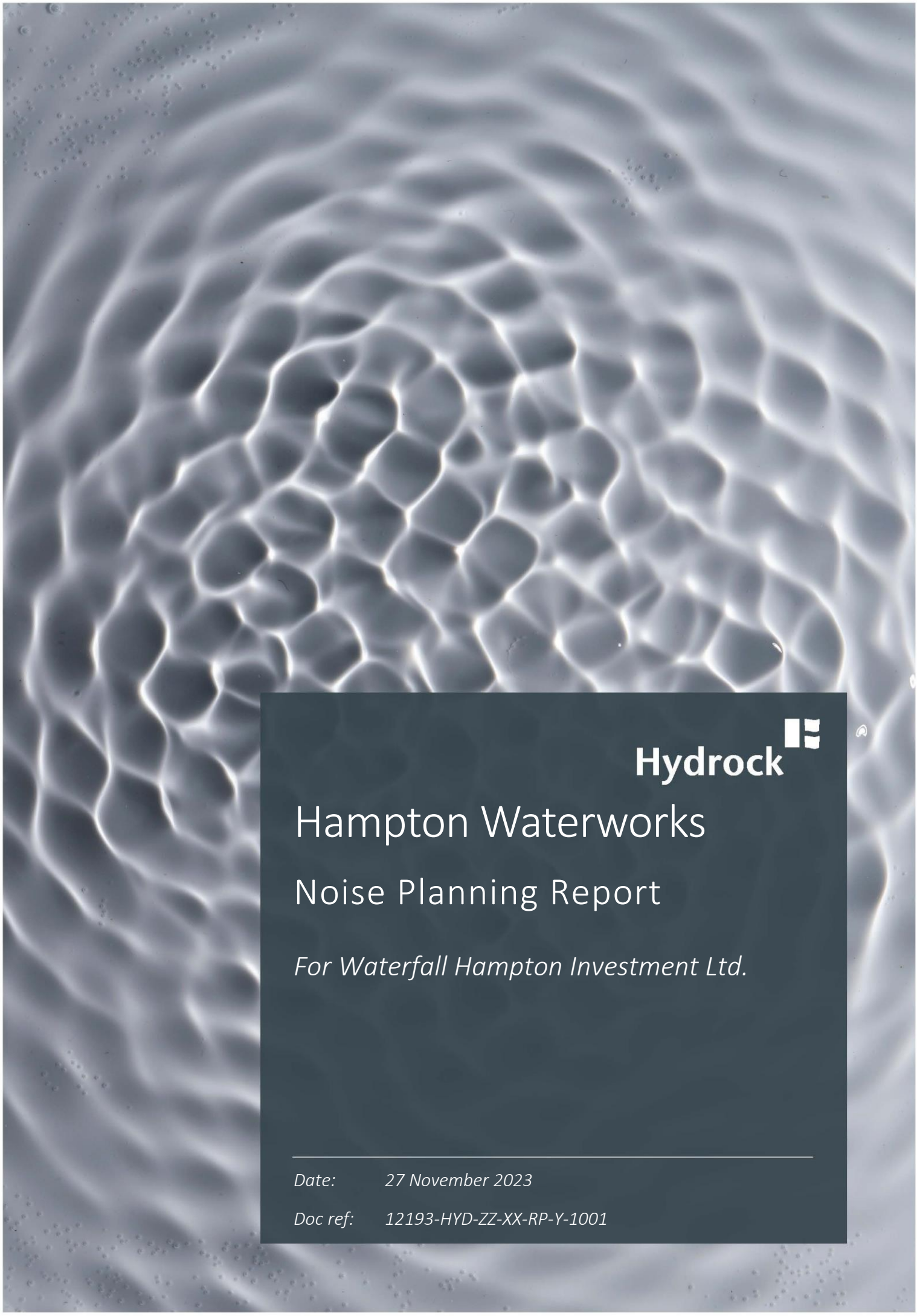

Hydrock

Hampton Waterworks

Noise Planning Report

For Waterfall Hampton Investment Ltd.

Date: *27 November 2023*

Doc ref: *12193-HYD-ZZ-XX-RP-Y-1001*

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Hampton Waterworks

1. INTRODUCTION

Hydrock Consultants have been appointed by Waterfall Hampton Investment Ltd. to provide acoustic consultancy services in relation to the proposed mixed residential and commercial development at the former Hampton Waterworks.

A noise survey on and around the proposed development site was carried out over the period 21st to 24th June 2019. This report presents details of the noise survey and an assessment of the suitability of the site for residential development. Although the survey is now over 3 years old there have been no changes in policy or standards in regards to the survey methodology and there is no reason to believe that there have been significant changes to environmental noise conditions (predominantly road traffic) this long after the covid-19 pandemic compared to pre covid-19 pandemic.

Limits for plant noise emissions from the building are also provided.

An earlier version of this report was previously provided for a previous iteration of the scheme.

Hydrock received details of a revised scheme. The changes have been reviewed and advised upon as well as capturing changes to national and local planning policy in relation to noise and captures newly published amendments or entirely new building regulations published in the interim.

Therefore, this assessment is now applicable to the scheme as proposed.

2. OUTLINE DESCRIPTION OF THE DEVELOPMENT

The site is on the corner of Lower Sunbury Road and Upper Sunbury Road. The area to the south is retained by Thames Water and contains two settling lakes which are regularly dredged by Thames Water. The site and surroundings are shown in Figure 1.

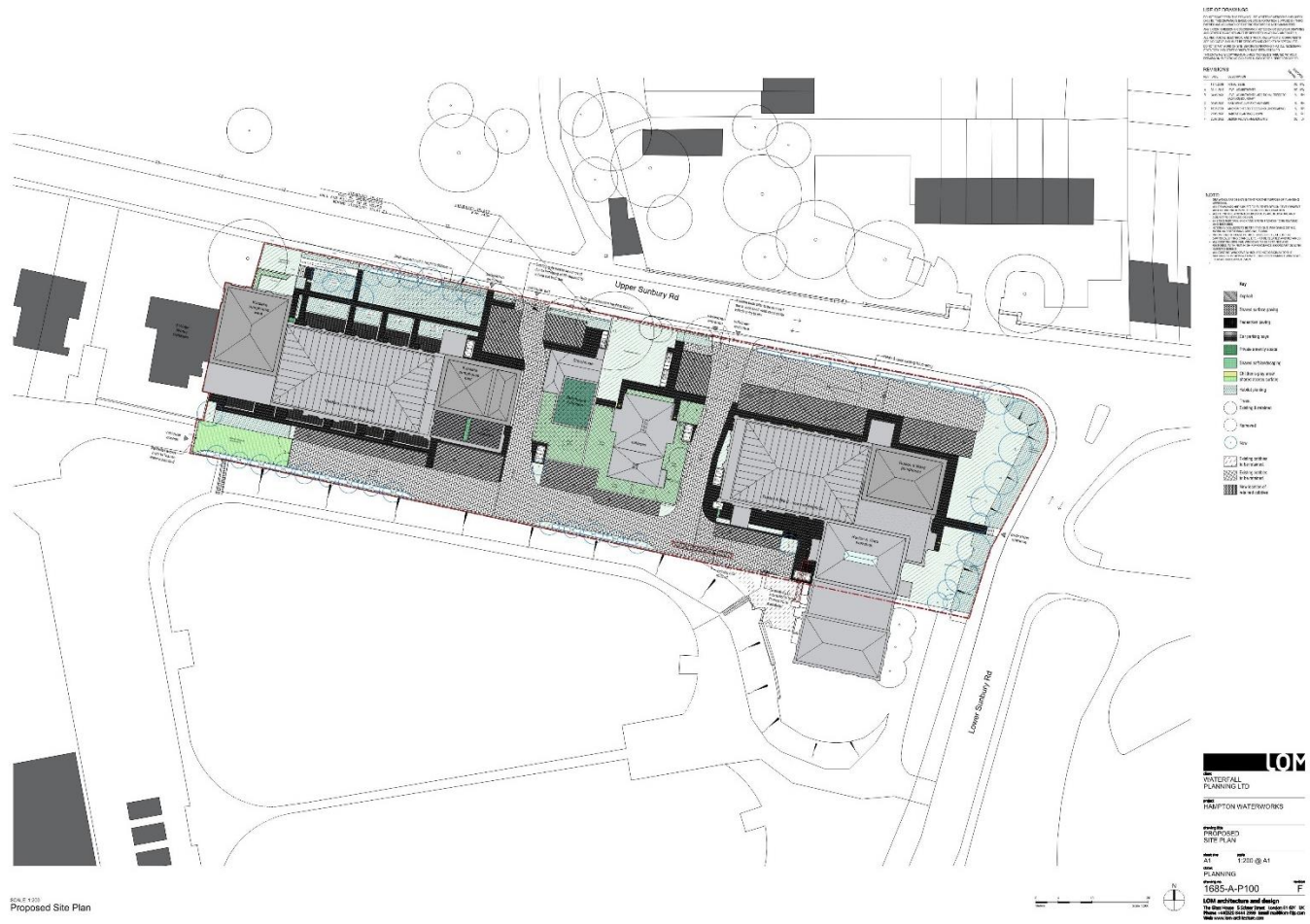

Figure 1: Development site plan

3. ASSESSMENT METHODOLOGY

3.1 Policy and Guidance

The assessment methodology is based on the following policy and guidance documents:

- National Planning Policy Framework (NPPF);
- Noise Policy Statement for England (NPSE);
- World Health Organisation "Guidelines for Community Noise", Berglund et. al., 1999 (WHO Guidelines);
- BS 8233:2014 – "Guidance on sound insulation and noise reduction for buildings"; and
- BS 4142:2014 + A1 2019 – "Methods for rating and assessing commercial and industrial sound".

A review of the relevant planning policy and acoustics guidance is provided in Appendix A.

3.2 Local Policy

The development is located within the administrative boundary of the London Borough of Richmond upon Thames (Richmond). The Richmond Local Plan, adopted July 2018, recognises that noise "can have a significant effect on health, quality of life, amenity, living conditions and the environment in general" and should be considered at an early stage during the planning process for both noise generating and noise sensitive developments.

With regards to the potential impact on existing business of a new noise sensitive development, The Richmond Local Plan paraphrases the NPPF "agent of change" principal as follows:

> *"Businesses should not have unreasonable restrictions put on them because future noise sensitive uses are subsequently permitted adjacent to the business or within the surrounding area; this also includes changes of use. Therefore, proposed new noise sensitive developments should follow good acoustic design principles and incorporate adequate mitigation measures to ensure appropriate acoustic conditions in new developments."*

Policy LP 8 "Amenity and Living Conditions" requires all new developments to "ensure balconies do not raise unacceptable overlooking or noise or disturbance to nearby occupiers" and "ensure there is no harm to the reasonable enjoyment of the use of buildings, gardens and other spaces due to increases in traffic, servicing, parking, noise, light, disturbance, air pollution, odours or vibration or local micro-climatic effects".

The Richmond Local Plan in supplemented by the Supplementary Planning Document (SPD) "Development Control for Noise Generating and Noise Sensitive Developments", adopted September 2018. The SPD states that:

> *"Where it has been demonstrated that the SPD guidance has been followed and where a potential residential development site poses a negligible risk from a noise perspective, the Borough will typically not require any specific measures and it should be possible to expedite consideration of the planning application on noise grounds and to make a recommendation that planning consent may be granted without the need for noise conditions requiring further assessment."*

For Noise Sensitive Developments the SPD describes an assessment process which is essentially the same as the method described in ProPG: Planning & Noise and specifically references internal noise limits for habitable rooms from BS8233:2014 and World Health Organisation Guidelines . For noise generating developments the SPD cites BS4142:2014 "Methods for rating and assessing industrial and commercial sound".:

Two legal challenges were made regarding the adoption of the Local Plan. On 3 March 2020, the Council adopted the two matters related to the legal challenges within the Local Plan. Neither challenge relates materially to acoustics and noise or the propsoed development. It is understood a new Local Plan is in preparation and that the draft Local Plan 'Pre-Publication' Draft (December 2021) has been consulted.

4. NOISE SURVEY

4.1 Methodology

A noise survey was carried out over the period Friday 21st to Monday 24th June 2019 to measure background sound levels in the area and noise levels effecting the proposed dwellings. The noise measurement locations are shown in Figure 2.

Figure 2: Measurement Positions

Measurements were undertaken in accordance with the guidance outlined in BS 4142:2014 and BS 7445-1:2003. Measurement positions were in free field, i.e. at least 3.5m from building facades and 1.5m above ground. A wind shield was fitted to the monitoring equipment at all times. Details of the monitoring locations and equipment used are provided in Table 2.

Although the survey is now over 3 years old there have been no changes in policy or standards in regards to the survey methodology and there is no reason to believe that there have been significant changes to environmental noise conditions (predominantly road traffic) this long after the covid-19 pandemic compared to pre covid-19 pandemic.

Table 1: Survey Equipment

Monitoring Location	Equipment Used				Type of Measurement	Time Interval	Description of Noise Climate
	Manufacturer	Instrument	Type	Serial No. / Version			
Position 1	Rion	Sound Level Meter	NL52	775959	Long term unattended	5 min	Road traffic noise from A308 (Upper Sunbury Road)
		Pre-Amplifier	NH25	54394			
		Microphone	UC59	11689			
Position 2	Rion	Sound Level Meter	NL52	775960	Long term unattended	5 min	Road traffic noise and noise from the Thames Water site.
		Pre-Amplifier	NH25	76077			
		Microphone	UC59	11690			
Position 3	Bruel & Kjaer	Sound Level Meter	2250	3009207	Manual Short term attended	15m55s	Road traffic noise and moving plant from the Thames Water site.
		Pre-Amplifier	ZC 0032	23772			
		Microphone	4189	3005149			
Position 1 & 2	Rion	Acoustic Calibrator	NC74	35157401	Calibration	N/A	94.0 dB @ 1kHz, drift within normal tolerances
Position 3	Bruel & Kjaer	Acoustic Calibrator	4231	3015450	Calibration	N/A	94.0 dB @ 1kHz, drift within normal tolerances

A record of the weather conditions as published by www.timeanddate.com is presented in Table 3.

Table 2: Weather Data

Period	Mean Temperature Degrees Celsius	Events	Wind Speed m/s	Prominent Wind Direction
Friday, 21 June 2019	20	Clear	4	E
Saturday, 22 June 2019	23	Clear	4	S
Sunday, 23 June 2019	24	Passing Clouds	5	E
Monday, 24 June 2019	23	Passing Cloud	2	S

Average recorded wind speeds during the survey did not exceed 5 m/s and therefore wind noise would not have significantly affected measurements. There was no rainfall recorded during the survey.

4.2 Results

Three main acoustic parameters were measured using a time interval of 5 minutes for Position 1 and Position 2 as described below.

- $L_{Aeq,T}$ dB, defined as the 'A' weighted equivalent continuous sound pressure level. Over a defined time period 'T', it is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal. It is often referred to as the 'ambient noise level'.
- $L_{Amax,F,T}$ dB, defined as the 'A' weighted maximum sound pressure level that occurred during the time period 'T' acquired using a 'fast' time weighting (i.e. a sample every 125ms). It is commonly used to describe the highest noise level that occurred during an event such as a vehicle pass-by.
- $L_{A90,T}$ dB, defined as the 'A' weighted sound pressure level exceeded for 90% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined with other acoustic parameters. It is generally used to describe the prevailing background noise level.

A summary of the 16-hour daytime (0700hrs to 2300hrs) and 8-hour night time (2300hrs to 0700hrs) $L_{Aeq,T}$ for both positions are presented in Table 4. The L_{Aeq} levels presented are the logarithmic average of the measured $L_{Aeq\ 5\ minute}$ values for the period.

Full measurement time histories for position 1 and 2 are available in Appendix B

Table 3: Summary of Long term Unattended L_{Aeq} Measured Noise Levels

Measurement position	Period	Friday, 21 March 2019	Saturday, 22 March 2019	Sunday, 23 March 2019	Monday, 24 March 2019	Overall
Position 1	Daytime $L_{Aeq\ (16hour)}$ dB	61	62	61	63	62
	Night time $L_{Aeq\ (8hour)}$ dB	57	56	57	-	57
Position 2	Daytime $L_{Aeq\ (16hour)}$ dB	55	57	55	57	56
	Night time $L_{Aeq\ (8hour)}$ dB	50	49	48	-	49

A summary of the 16-hour daytime (0700hrs to 2300hrs) and 8-hour night time (2300hrs to 0700hrs) $L_{Amax,T}$ for both positions are presented in Table 5. The L_{Amax} levels presented are the tenth highest measured $L_{Amax\ 5\ minute}$ values.

Table 4: Summary of L_{Amax} Measured Noise Levels

Measurement position	Period	Friday, 21 March 2019	Saturday, 22 March 2019	Sunday, 23 March 2019	Monday, 24 March 2019	Overall
Position 1	Daytime L_{Amax} dB	79	81	79	76	81
	Night time L_{Amax} dB	74	73	73	-	74
Position 2	Daytime L_{Amax} dB	77	78	76	72	78
	Night time L_{Amax} dB	64	63	62	-	64

The lowest typical day (07:00 - 23:00 hours) and night-time (23:00 - 07:00 hours) background sound levels during week-days (including Friday night) and weekends (including Sunday night) are presented in Table 4. The full background sound measurement results are presented in Appendix B in the form of distribution plots showing the number of 15-minute background sound level measurements at each integer for each period.

Table 5: Lowest Typical Measured Background Sound Levels

Period	Position 1		Position 2	
	Weekday - Typical L_{A90}, dB	Weekend - Typical L_{A90}, dB	Weekday - Typical L_{A90}, dB	Weekend - Typical L_{A90}, dB
Day (07:00-23:00hrs)	50	55	47	47
Night-time (23:00-07:00hrs)	37	33	45	42

A short-term measurement was carried out to help calibrate the computer model and assess what noise was arising from Lower Sunbury Road at Position 3 as per Figure 2. A summary of the results can be found in the table below.

Table 6: Short term Attended Measurements (Position 3) Results

Measurement Position	Start Time	Elapsed Time	L_{Aeq} [dB]	L_{AF10}[dB]	L_{AF90} [dB]	L_{AFmax} [dB]
Position 3	21/06/2019 11:20	00:15:55	68	71	55	86

5. NOISE MODELLING

5.1 Noise Mapping

In order to determine the noise levels on the proposed development site, a noise model has been created using DataKustik CadnaA environmental noise prediction and mapping software.

The noise map includes data from the long-term noise monitoring measurements.

The modelling was carried out on the basis of:

- Ground absorption set to 0.5
- Order of reflection set to 1
- Reflection loss from buildings set to 0 dB
- Noise levels shown at the receptors are the highest at each point of the façade

Figures 3 and 4 display the noise level maps of the proposed site during daytime (0700-2300hrs) and night-time hours (2300-0700hrs).

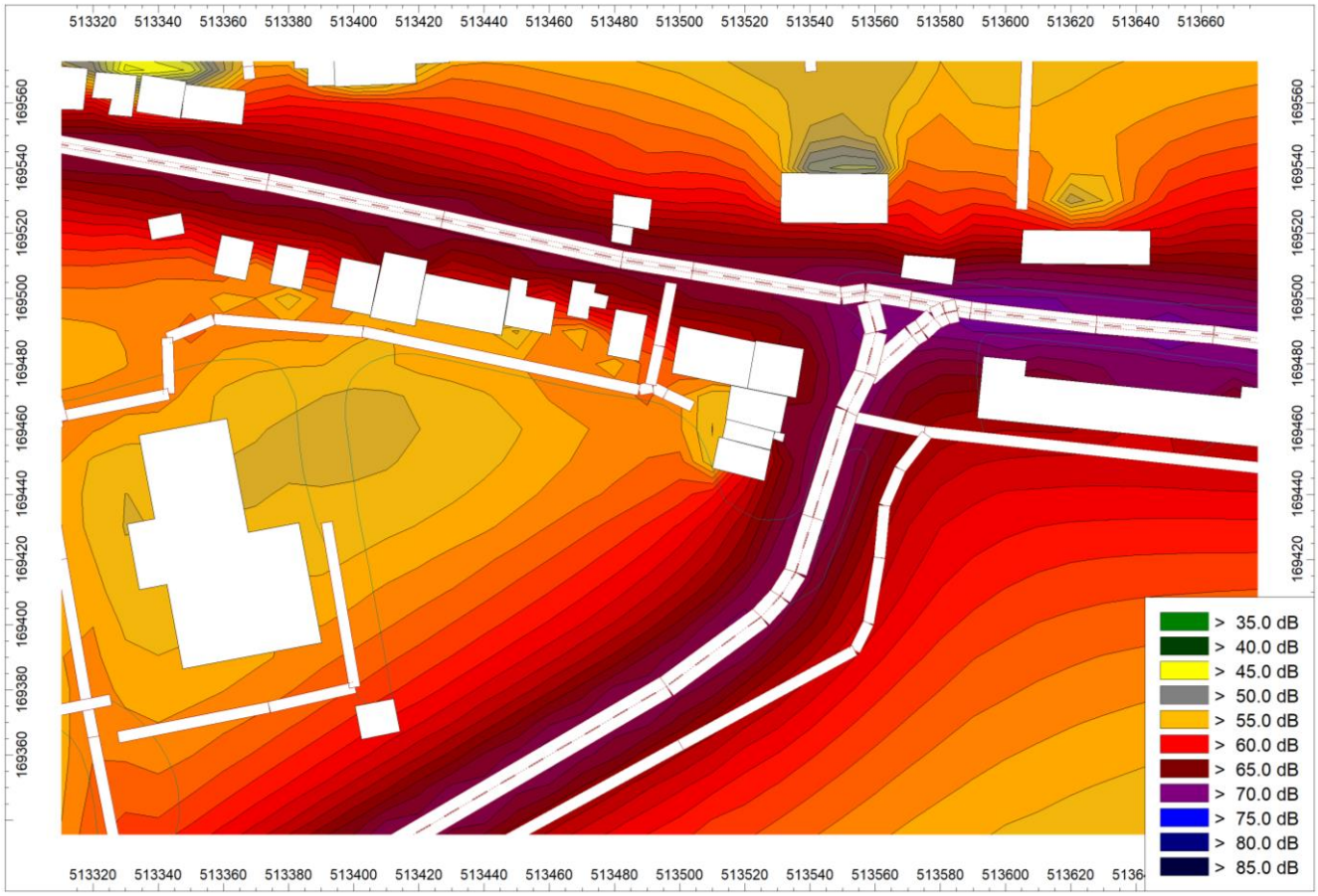

Figure 3: Baseline Noise Map (Daytime: 0700-2300)

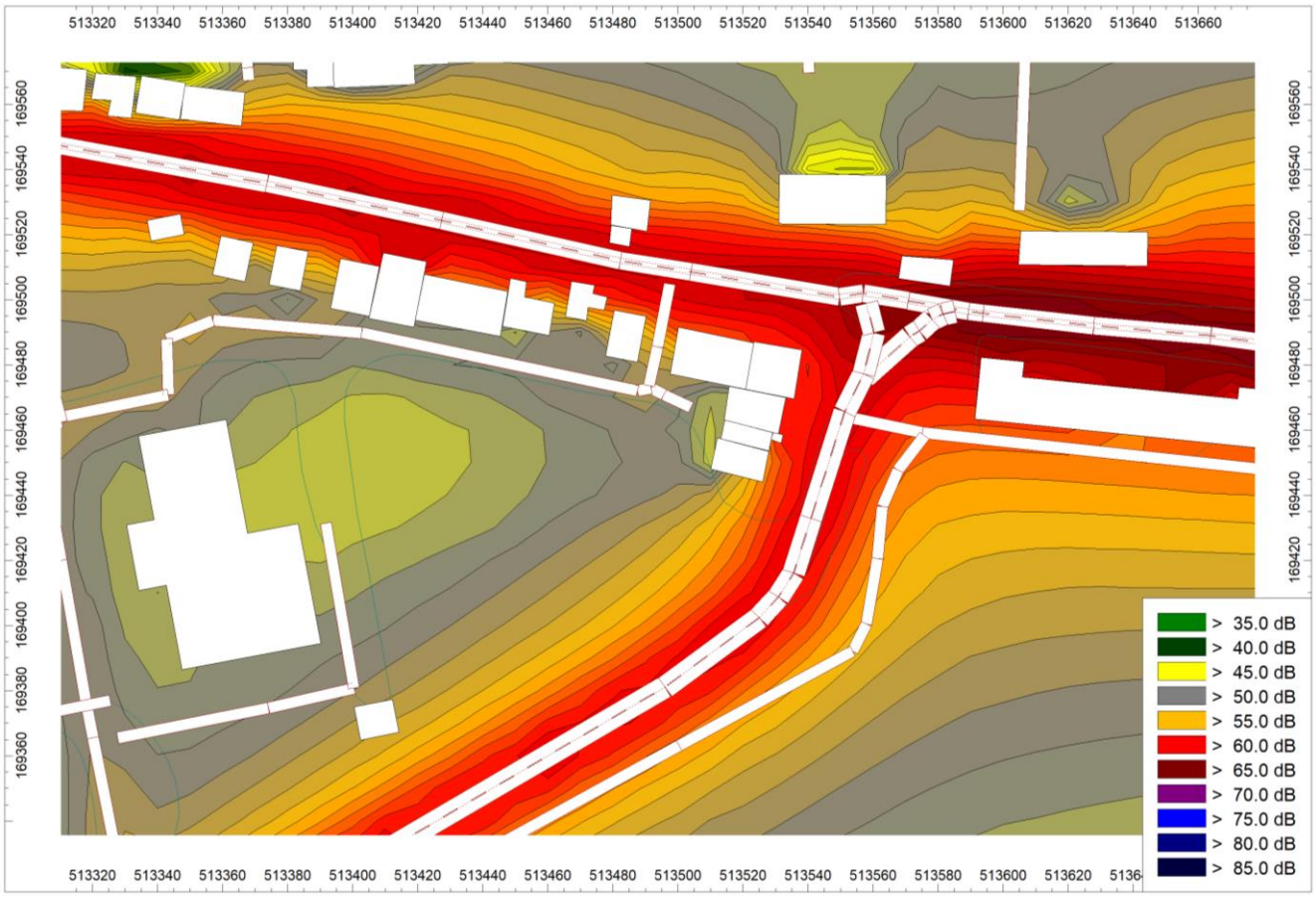

Figure 4: Baseline Noise Map (Night Time 2300-0700)

5.2 Assessment

A description of the impact of predicted facade noise levels is provided in Table 7 with reference to Figures 5 and 6 and the following guidance:

- BS8233:2014;
- World Health Organisation (WHO) Guidelines for Community Noise, 1999;
- Professional Practice Guidance – Planning and Noise (ProPG), ANC, IOA and CIEH, May 2017;
- Acoustics, Ventilation and Overheating – Residential Design Guide ANC, IOA, Jan 2020.
- Approved Document O

Table 7: Significance Criteria for Road Traffic and other Anonymous Noise affecting Dwellings

Magnitude of Impact	Daytime External Noise Level, dB $L_{Aeq\ 16\ hour}$ (07:00 - 23:00 hours)	Night-time External Noise Level, dB $L_{Aeq\ 8\ hour}$ (23:00 - 07:00hours)	External Amenity (Gardens and Balconies) Without Design Mitigation	Description of Effect Without Design Mitigation
Medium high	≥57 - ≤70	≥53 - ≤60	Significant Observed Adverse Effect. Sleeping with windows open may impact quality sleep and, particularly at the upper end of this range, daytime noise in external areas and inside with windows open will impact amenity. Windows being open to cool an overheating room should be avoided, conditions will need additional control measures particularly in high risk areas such as London.	Consideration of the acoustic performance of façade elements is required to ensure reasonable internal noise levels with windows closed. Mechanical cooling or other means of maintaining thermal comfort may be necessary to ensure windows can remain closed. Acoustic barriers should be considered to provide reasonable conditions in external amenity areas.
Medium Low	>50 - ≤56	>44-≤52	Lowest Observed Adverse Effect. Good internal conditions will be achieved with windows closed and ventilation provided by a trickle vent. Windows being open to cool an overheating room should be avoided, conditions will need additional control measures particularly in high risk areas such as London.	Consideration of the acoustic performance of façade elements is required to ensure reasonable internal noise levels with windows closed. Mechanical cooling or other means of maintaining thermal comfort may be necessary to ensure windows can remain closed. Acoustic barriers should be considered to provide reasonable conditions in external amenity areas.
Negliable	<50	≤44	No observed adverse effect. Good internal conditions, as defined in BS8233:2014 and WHO Guidelines, can generally be achieved, even with windows open for background ventilation and under the overheating condition.	None specific required

The extent of each of the defined exposure levels as defined in Table 7 is set out in Figures 5 and 6.

Figure 5: Noise at Façades and amenity spaces - Daytime

Figure 6 Noise at the Façades - Night-time

6. FAÇADE SOUND INSULATION REQUIREMENTS

6.1.1 Proposed Accommodation Mitigation

Sound insulation calculations for habitable rooms within the proposed development have been prepared in accordance with BS EN 12354-3 to determine the extent of the sound insulation required to control noise levels and achieve internal noise limits recommended in BS 8233:2014.

For refurbished buildings and the rear Karslake extension calculations have been undertaken on the basis of the following build of the facade:

- Brickwork exterior finish
- Rockwool insulation (50mm 10kg/m^3)
- Lightweight Independent internal plasterboard linings (1x12.5mm wallboard or equivalent).
- Calculated to provide the minimum sound insulation of 55 dB R_w.

For the roof extension accommodation for Karslake:

- Pine exterior
- Cement Board
- 100mm SFS construction
- Internal acoustic plasterboard linings (2x12.5mm Soundblock or equivalent)
- Calculated to provide a minimum sound insulation of 50dB R_w

Alternative façade constructions and sound insulation values maybe suitable. Suitability would be subject to detailed assessment and further calculations at the appropriate design stage.

The required window and ventilation sound insulation performances are set out in Tables 7 and 8 with a view to meeting the internal requirements of BS8233:2014.

On the basis that some glazing will be retained and therefore require secondary acoustic glazing, and other areas will receive new glazed units.

Table 7: Required Glazing Acoustic Performance Refurbished façade

Façade	Living Room	Bedroom
	dB R_w	dB R_w
Medium High Noise Exposure	38	32
Medium Low Noise Exposure	31	31
Negligible Noise Exposure	31	31

**Additional to Existing where retained.*

Table 8: Required Window/Glazing Acoustic Roof Extension

Façade	Living Room	Bedroom
	dB R_w	dB R_w
Medium High Noise Exposure	38	37
Medium Low Noise Exposure	31	31
Negligible Noise Exposure*	31	31

**Also applicable to the Medium low exposure Karslake rear extension and Storehouse extension*

The overheating strategy states that the scheme requires MVHR with individual air source heat pumps, the above glazing specification acoustic performance should be demonstrated to be achieved for framed new

glazed units as well as for framed secondary glazed new units to the rear of existing retained listed sash window units.

As the design progresses, qualified comment should be sought on acoustic suitability and evidence of lab performance values should be made available by manufacturers. If glazing areas/sizes change, then the assessment should be revisited.

7. RESIDENTIAL VENTILATION ADDITIONAL CONSIDERATIONS

7.1 Purge Ventilation Requirements

The use of opening windows for rapid purge ventilation (i.e. to expel paint fumes or burnt toast odours as per Approved Document F) is acceptable at all facade. This is on the basis that windows will be opened for short periods and may be closed as occupant discretion once odours are purged.

7.2 Relief of Summertime Overheating

Windows may require opening to cool overheating rooms on hot summer days even where suitable background ventilation is provided by trickle vents or MVHR. Approved Document O to the Building Regulations 2010 (ADO), which came into force June 2022, provides advice on providing sufficient control of overheating in new residential buildings. ADO also precludes the use of open windows for control of overheating in bedrooms at night if this will result in internal noise levels above specified limits. ADO is not applicable to this scheme.

However, it is recommended that some consideration is given to reducing the need to open windows for overheating in bedrooms at night where façade noise levels exceed 53 dB L_{Aeq} (i.e. high and medium high noise exposure facades). At these facades, it should be considered acceptable to open windows but only if it is necessary rarely (e.g. for the hottest week or two of the design year). This approach is based on the guidance contained in Acoustics, Ventilation and Overheating – Residential Design Guide ANC, IOA, Jan 2020.

8. EXTERNAL AMENITY AREAS

The development is proposed to include external amenity areas, such as gardens and balconies.

BS 8233:2014 provides guidance on external noise levels for the protection of private amenity spaces of residential properties and states that:

'It is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, 55 dB $L_{Aeq,T}$ should be regarded as the upper guideline value.'

BS8233:2014 states that "the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$".

The standard continues… *"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited."*

PPG-Noise states: *"If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended"* .

As noted in ProPg:

"It is notable that both documents require a decision to be made regarding whether or not an external amenity area (or amenity space) is intrinsic to the required design for acoustic, or for other, reasons. However, the advice in BS8233:2014 states that the resulting noise levels outside are never a reason for refusal as long as levels are designed to be as low as practicable. Whereas, to comply with policy guidance any amenity space must have an acoustic environment so that it can be enjoyed as intended"

The private garden amenity space to the south for the cottages and storehouse dwellings achieve the ideal values below 50 dB.

The upper stories of the scheme offer some mitigation via glazed barrier screens overlooking Upper Sunbury Road. In a relaxed sitting position this is likely to offer some acoustic screening although levels are likely to still exceed 55dB $L_{Aeq,T}$ depending on seating position this expected to be 1-4dB below the façade levels shown on figure 5

In addition, all dwellings will have access to communal amenity land with an on-site children play site on the south of the development which will be well screened from road traffic, adjacent to the reservoir, with noise levels in this area in compliance with the requirements of BS8233:32014 at 50dB as per figure 5 at 1.5m

The gardens facing upper Sunbury road will not be able to achieve noise levels at <55dB however figure 5 shows noise levels at 1.5m at 56dB. 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.

Based on guidance in ProPG it is worth noting that in heavily built up cities there are often parks and other recreational areas that are more suited for amenity space than what is provided by the dwelling. There is amenity green space that can be found 0.3miles and 5 minutes walk north from the development in the form of Hampton Village green where subjective noise levels were "pleasant" in the opinion of the noise survey engineer.

9. DESIGN GUIDANCE – INTERNAL SEPARATION

9.1 Building Regulations Part E

During application Historic England have requested further information regarding the scheme's potential compliance with Part E of The Building Regulations 2010.

The normal way of complying with Part E is to achieve the numerical performance standard from Approved Document E. The most onerous of these performance standards and the most likely to be constrained by the existing structure is for sound insulation between proposed dwellings and between proposed dwelling and other parts of the building.

Approved Document E accepts that sometimes the constraints of heritage or listed historic buildings will prevent developers from achieving the numerical performance standards and provides specific further guidance on this (see below). Therefore, there is a mechanism within the Building Regulations to allow for the development of historic buildings where the normal performance standards are unachievable.

Hydrock are in the process of reviewing existing building fabric and are reviewing the potential constraints to achieving the normal Approved Document E requirements at this stage.

Building Control and Historic England will be further consulted at the relevant design stage as proposals emerge with regards to Part E compliance should significant constraints be identified.

9.1.1 Part E Section 4.13:

Excerpt as reproduced below:

"For some historic buildings undergoing a material change of use, it may not be practical to improve the sound insulation of the performance standards set out in Section 0: Performance Table 1a. In such cases refer to Section 0: Performance, paragraph 0.7."

9.1.2 Part E Section 0.7:

Excerpt as reproduced below:

"In the case of some historic buildings undergoing material chance of use, it may not be practical to improve the sound insulation to the standards set out in Tables 1a and 1b.
The need to consider special characterises of such historic buildings needs to be recognised, and in such work, the aim should be to improve sound insulation to the extent that is practically possible, always provided that the work does not prejudice the character of the historic building or increase the risk of long-term deterioration to the building fabric or fittings.

In arriving at an appropriate balance between historic building conservation and improving sound insulation it would be appropriate to take into account the advice of the local authority conservation office. In such cases it will be reasonable to improve the sound insulation as much as practical, and to affix a notice showing the sound insulation value(s) obtained by testing in accordance with regulation 41 or 20(1) and (5) in a conspicuous place inside the building."

9.2 Special Considerations

For sound insulation between the basement cinema/gym space and dwellings an enhancement to the basic Building Regulations requirements will be necessary. It is proposed that noise from music and sound tracks should not exceed NR20 in the dwellings. Noise from activity in the gym will be controlled to 25 dB L_{Aeq} and 45 dB L_{Amax}.

Achieving these requirements will require careful consideration of: sound insulation, gym noise control, sound system design and noise limits as the design develop. However, as a minimum, sound insulation of 5-10dB better than the basic Building Regulation requirements is likely to be necessary. It is not likely that adequate sound insulation between the gym/cinema and the flats above can be achieved without a resiliently hung 2x15mm 12.5kg/m^2 surface mass per layer plasterboard ceiling is installed in the gym/cinema.

To control impact sound in the gym, a roll out or tiled rubber flooring solution of ≈> 70mm is likely to provide adequate control of impact sound transmitted vertically, through the building structure, to the flats above.

Suitable flooring solutions are available from TVS Gym Flooring and Pliteq (e.g. Pliteq GenieMat Fit). These manufacturers can also provide solutions such as platforms, plinths, and shock absorbing pads to individually dampen noise from weights machines, treadmills, and other potential source of rhythmic or reciprocal impact noise. Ultimately the specialist should be approached to devise a specific solution at the appropriate design stage.

Sound insulation between the workshop and plant rooms and flats must also be considered and again an enhancement to the basic Building Regulations requirements will be necessary.

As with the cinema/gym area a plasterboard ceiling is likely to be required in these spaces. Noise from the plant room will be designed to be controlled to NR25 in flats.

Noise from the workshops is advised to be controlled to 25 dB L_{Aeq} and 45 dB L_{Amax} during normal activity.

10. OUTLINE DESIGN GUIDANCE – EXTERNAL PLANT

The proposed development may incorporate building services plant which can potentially vent to external locations or have externally located plant items. These are capable of producing audible noise and may require noise control measures (and potentially vibration control dependent on location).

The nearest noise sensitive properties have been identified as:

- Proposed receptors of the development.
- Existing Receptors on the Upper Sunbury road

A statistical assessment of background noise levels has been undertaken in accordance with BS 4142:2014.

The typical background daytime and night-time noise levels at each of the long-term monitoring locations are shown below:

Typical background noise levels at Position 1:

- L_{A90} 53 dB daytime (0700hrs to 2300hrs)
- L_{A90} 37 dB night time (2300hrs to 0700hrs)

Typical background noise levels at Position 2:

- L_{A90} 47 dB daytime (0700hrs to 2300hrs)
- L_{A90} 42 dB night time (2300hrs to 0700hrs)

Typically, a proposed noise limit of prevailing background noise (as above) minus 5 dB(A) is advised for design purposes in accordance with the procedures of BS 4142:2014. The proposed limits are shown below.

Table 9: Proposed Plant Limits

Parameter	Period	Noise Levels, dB
$L_{Ar,1hour}$	Daytime (0700hrs to 2300hrs)	42
$L_{Ar,15mins}$	Night Time (2300hrs to 0700hrs)	32

The noise limits above are 'free-field' levels at any height above ground and 1.0m from the nearest noise sensitive property façade. It applies to the overall combined operation of building services plant without any specific tone or character.

If the plant noise will contain specific tones or intermittent character, then further penalties devised in accordance with BS4142:2014+2019 A should be applied.

11. SUMMARY AND CONCLUSIONS

Hydrock Consultants are appointed to provide acoustic consultancy services in relation to the proposed development Hampton Waterworks.

Planning legislation and guidance documents have been consulted in order to undertake an assessment of the site suitability for residential use in terms of environmental noise. A noise survey of the site was undertaken over the period of 21st to 24th June 2019.

Although the survey is now over 3 years old there have been no changes in policy or standards in regards to the survey methodology and there is no reason to believe that there have been significant changes to environmental noise conditions (predominantly road traffic) this long after the covid-19 pandemic compared to pre covid-19 pandemic.

Noise models have been generated in order to determine the likely prevailing noise levels of the development site during both daytime and night-time hours. This has been used to provide preliminary advice on the sound insulation and ventilation design of the façades.

External amenity areas (private gardens or balconies) are proposed in the development, best practical means mitigation has been provided.

In conclusion, assuming the mitigation measures and design requirements outlined in this report are implemented, the development will meet the requirements of National and Local Policy and guidance.

Appendix A Guidance Documents

Noise Policy Statement for England (NPSE)

The NPSE is intended to apply to environmental noise and neighbourhood noise of all forms but excluding noise occurring in the workplace.

The NPSE cites concepts from toxicology and advises that impacts should be considered with regards to health effects and quality of life:

> *"There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:*
>
> ***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.*
>
> ***LOAEL – Lowest Observed Adverse Effect Level***
>
> *This is the level above which adverse effects on health and quality of life can be detected.*
>
> *Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.*
>
> ***SOAEL – Significant Observed Adverse Effect Level***
>
> *This is the level above which significant adverse effects on health and quality of life occur."*

The NPSE does not provide any numerical thresholds for determining the magnitude of a noise impact. Moreover, the document advises that it is not possible to have *"a single objective noise-based measure…that is applicable to all sources of noise in all situations"*. It further advises that the sound level at which an adverse effect occurs is *"likely to be different for different noise sources, for different receptors and at different times."*

National Planning Policy Framework

The 'National Planning Policy Framework, July 2021, Ministry of Housing, Communities and Local Government' (NPPF) sets out the United Kingdom Government's planning policies for adoption in England and how they should be applied.

The main aims of the NPPF are set out in section 11, as stated below.

'Planning policies and decisions should:

- *Encourage multiple benefits from both urban and rural land, including through mixed use schemes and taking opportunities to achieve net environmental gains – such as developments that would enable new habitat creation or improve public access to the countryside;*
- *recognise that some undeveloped land can perform many functions, such as for wildlife, recreation, flood risk mitigation, cooling/shading, carbon storage or food production;*
- *give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land;*

- *promote and support the development of under-utilised land and buildings, especially if this would help to meet identified needs for housing where land supply is constrained and available sites could be used more effectively (for example converting space above shops, and building on or above service yards, car parks, lock-ups and railway infrastructure); and*
- *support opportunities to use the airspace above existing residential and commercial premises for new homes. In particular, they should allow upward extensions where the development would be consistent with the prevailing height and form of neighbouring properties and the overall street scene, is well designed (including complying with any local design policies and standards), and can maintain safe access and egress for occupiers.'*

The NPPF makes reference to guidance contained in 'Noise Policy Statement for England (NPSE), March 2010, Department for Environmental, Food and Rural Affairs' (NPSE). The NPSE is intended to apply to all forms of noise, other than noise occurring in the workplace and includes environmental noise and neighbourhood noise of all forms.

The NPSE provides advice regarding the impact of noise which should be assessed on the basis of adverse and significant adverse effect. However, the NPSE does not provide any specific guidance on assessment methods or the noise levels at which different effects would be applicable. Moreover, the document advises that it is not possible to have '*a single objective noise-based measure…that is applicable to all sources of noise in all situations*'. It further advises that the sound level at which an adverse effect occurs is '*likely to be different for different noise sources, for different receptors and at different times*.'

Planning Practice Guidance

The Ministry of Housing, Communities and Local Government publishes guidance on the internet in the form of the 'Planning Practice Guidance' (PPG). The guidance of PPG provides greater level of details in relation to the relevance of noise for planning following the introduction of the NPPF and NPSE.

The Planning practice guidance will be updated in due course to reflect changes to the National Planning Policy Framework. The most recent version of the noise guidance is from March 2014. Should this guidance be updated, the 2014 version will be superseded.

It is stated under the heading 'How to Determine the Noise Impact' that the following should be considered by local authorities:

- *'whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.'*

The assessed noise should include the overall effect of the development, inclusive of the construction stage once completed.

The guidance process includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation as required by the NPSE.

The observed effects are defined in Table 1 which is taken from the section headed '*How to Recognise when Noise could be a concern?*'

Table 10: PPG Noise Guidance

Perception	Examples of Outcome	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. 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

Under the section heading '*What factors influence whether noise could be a Concern?*' the subjective nature of noise is discussed. It is stated that there is no simple relationship between noise levels and the impact on those affected. It is all dependent on how various factors combine in particular situations, which include:

- *'The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;*
- *For non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;*
- *The spectral content of the noise (i.e. whether or not the noise contained particular high or low frequency content) and the general character of the noise (i.e. whether or not the noise contains particular tonal characteristics or other particular features). The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.'*
- *'Consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation can be found in the Building Regulations;*

- *In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in noise may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur.*
- *If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.'*

Similarly, to the NPSE, no specific noise parameters are defined in the guidance or target noise levels established for comparison.

ProPG: Planning & Noise - Professional Guidance on Planning & Noise - New Residential Development

The Professional Practice Guidance on Planning and Noise (May 2017) provides guidance on transportation noise affecting new residential developments. The guidance was prepared by a working group formed from members of the Institute of Acoustics (IoA), the Association of Noise Consultants (ANC) and the Chartered Institute of Environmental Health (CIEH). It is specifically for assessing noise from predominantly transportation sources. The guidance promotes a two stage assessment approach:

- Stage 1 – Initial Site Noise Risk Assessment; and,
- Stage 2 – Full assessment and systematic appraisal of four key elements.

The Stage 1 initial risk assessment provides an indication of the likely risk of adverse effects from noise assuming in the first instance that no mitigation were included within the proposals. The risk assessment is based on measured or predicted noise levels during a "typical worst case" 24-hour period. Figure 1 of the document presents the Stage 1 assessment and indicates that higher noise levels result in increased noise risk without mitigation. This is summarised in Figure A1 below. Figure A1 (Figure 1 of ProPG) does not directly relate noise levels to specific risk categories although a negligible noise risk broadly correlates to noise levels not exceeding 50dB $L_{Aeq, 16hr}$ (daytime) and 40 dB $L_{Aeq, 8hr}$ (night).

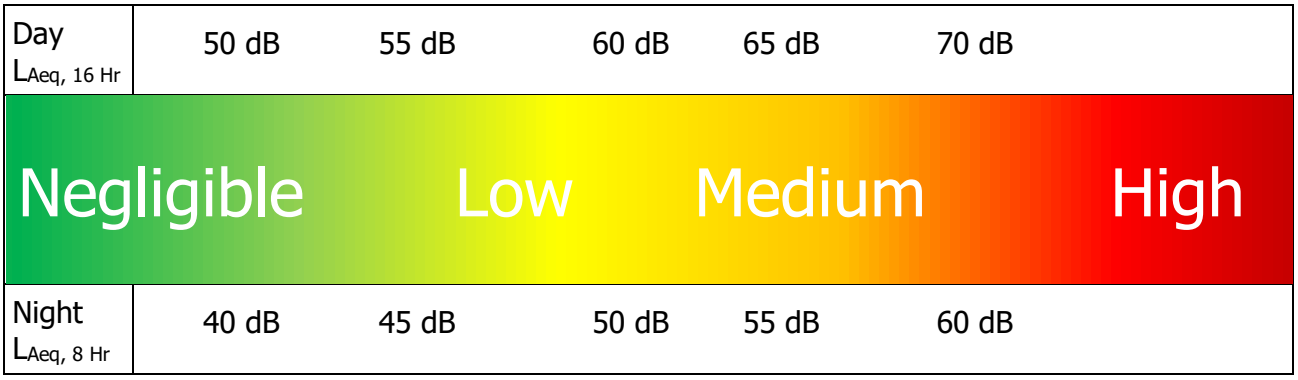

Figure A1: ProPG Stage 1 Noise Risk Assessment (adapted from ProPG Figure 1)

Where the initial noise assessment indicates a higher risk of adverse noise effects, a Stage 2 assessment is required. The Stage 2 assessment is more involved than the Stage 1 and requires systematic consideration of four elements:

Element 1 – Good Acoustic Design Process

The acoustic design of a building and any mitigation should be considered at an early stage of the design process. Following a good acoustic design process is considered a part of achieving a good design as required by the NPSE and NPPF. Guidance on the requirements for providing an Acoustic Design Statement (ADS) is given in Figure 3 of ProPG.

Element 2 – Internal Noise Level Guidelines

Guidance on internal noise levels can be found in BS8233:2014 Guidance on sound insulation and noise reduction for buildings. Figure 2 of the ProPG summarises the guidance from BS8233 but with a number of additions. The internal noise criteria presented in Figure 2 of ProPG and the relevant notes are presented in Table 1 below.

Element 3 – External Amenity Area Noise Assessment

The guidance of the ProPG reflects and extends on the advice of BS8233 and PPG Noise. The guidance in the ProPG presents five points for consideration, the first being "If the external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended".

Element 4 – Assessment of Other Relevant Issues

"Other relevant issues" within the context of the ProPG include relevant national and local policy which may have a bearing on the development.

British Standard 4142:2014+A1:2019

The standard method for assessing noise from commercial and industrial premises is British Standard BS 4142 *"Method for rating and assessing industrial and commercial sound"*. The standard is applicable for assessing noise affecting *"dwellings or premises used for residential purposes"*.

A BS 4142 assessment is made by determining the difference between the specific noise under consideration and the background sound level, as represented by the L_{A90} parameter, determined in the absence of the commercial sound. The L_{A90} parameter is defined as the level exceeded for 90% of the measurement time. This parameter therefore excludes short duration noise events, such as individual vehicle movements, and represents the underlying continuous noise.

The commercial or industrial sound is assessed in terms of the equivalent continuous noise level, L_{Aeq}. The equivalent continuous noise level (L_{Aeq}) of the commercial or industrial sound, over the applicable assessment period, is known as the specific sound level.

A character correction penalty can be applied to the specific sound level where the commercial noise exhibits distinguishable tones, impulsiveness, intermittency or other characteristics which "*are otherwise readily distinctive against the residual acoustic environment*".

The specific noise level with the character correction (if necessary) is known as rating level (L_{Ar}) and the difference between the background noise and the rating level is determined to make the BS 4142 assessment. The following is then considered.

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

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

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

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

The standard highlights the importance of considering the context in which a sound occurs. Factors including the absolute sound level, the character of the sound, the sensitivity of the receptor and the existing acoustic character of the area should be considered when assessing the noise impact. The use of the proposed premises for short term holiday rentals is also pertinent to the consideration of context.

The standard notes the need to consider absolute sound levels where background sound levels are low:

"*For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

Where the background sound levels and rating level are low, absolute levels might be as, or more, relevant than margin by which the rating level exceeds the background. This is especially true at night."

Appendix B Measurement Time Histories

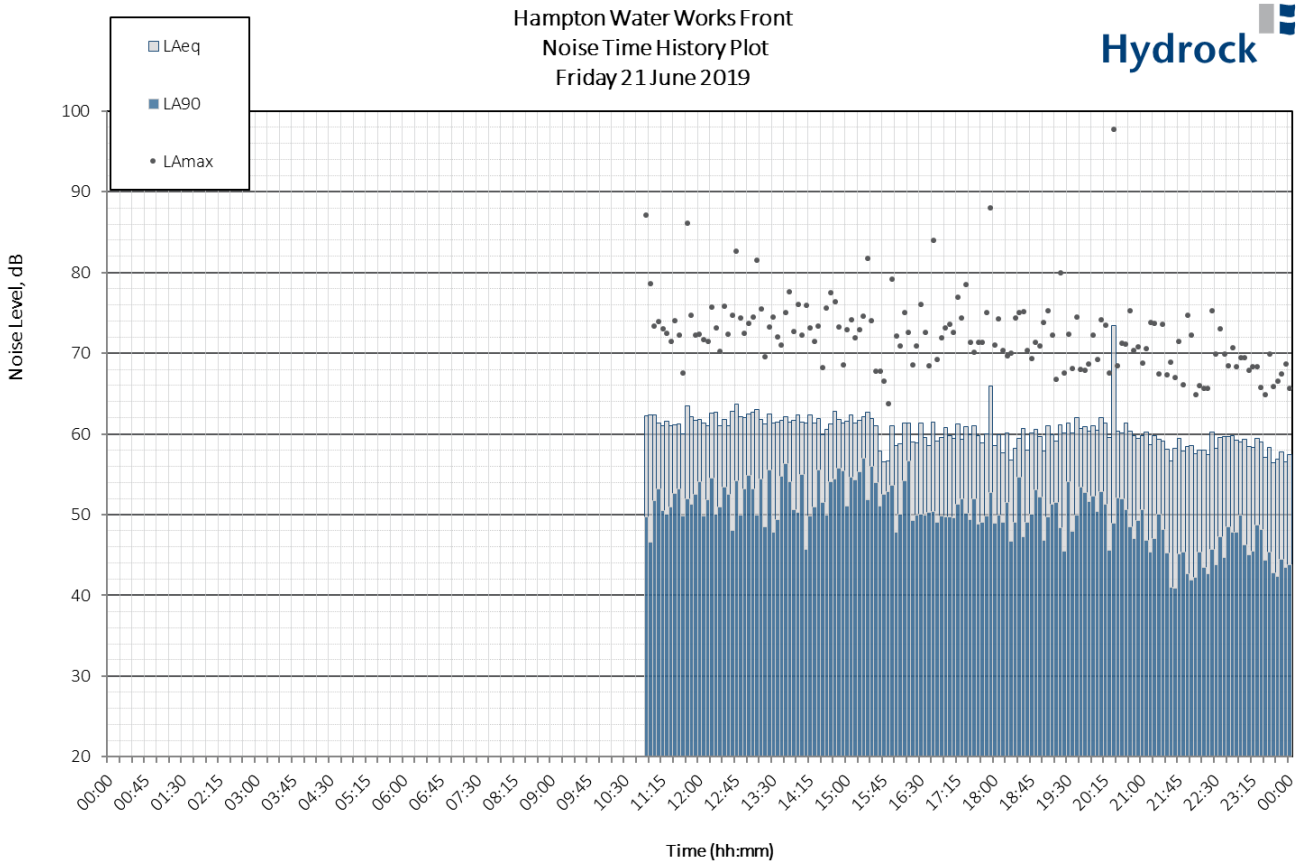

Figure 7: Environmental Noise Survey Measurement Graph - Position 1 - Friday

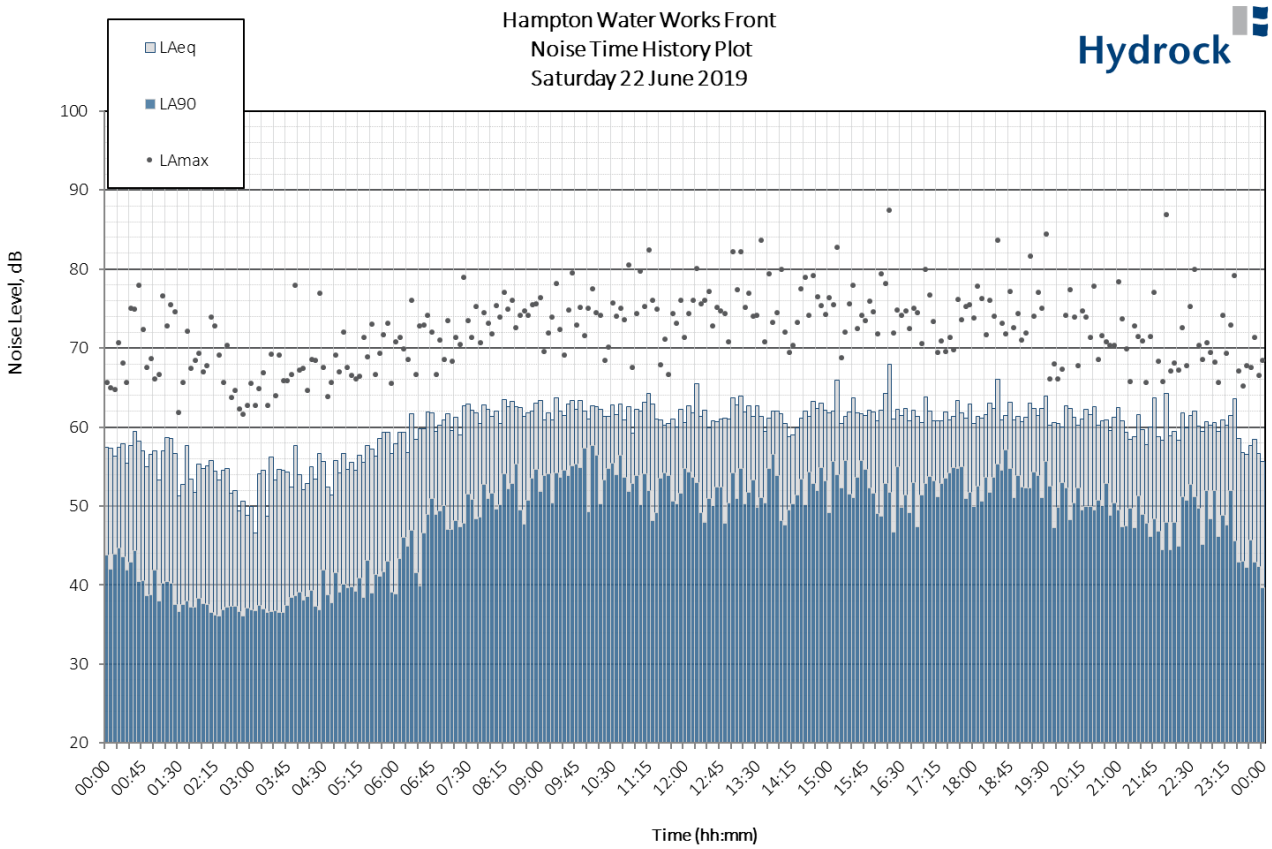

Figure 8: Environmental Noise Survey Measurement Graph - Position 1 - Saturday

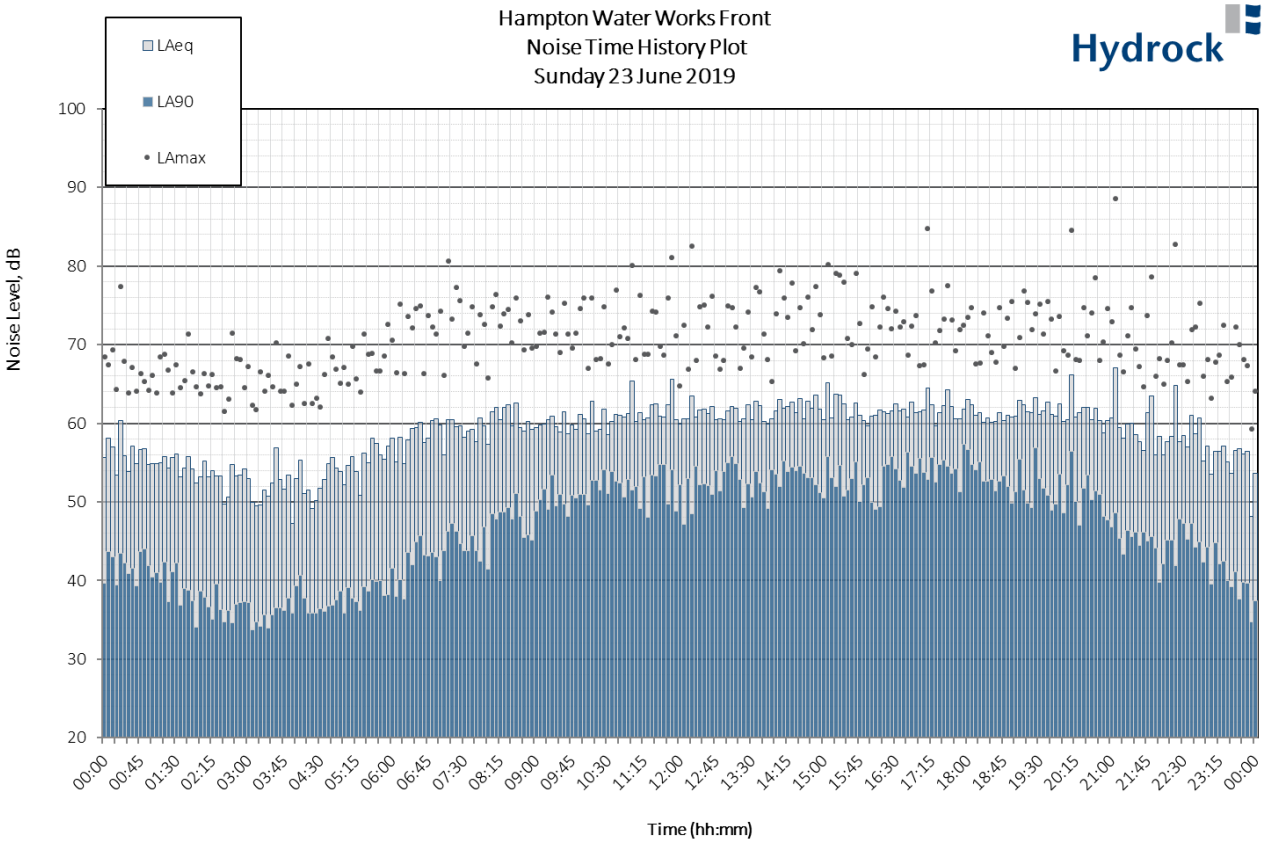

Figure 9: Environmental Noise Survey Measurement Graph - Position 1 - Sunday

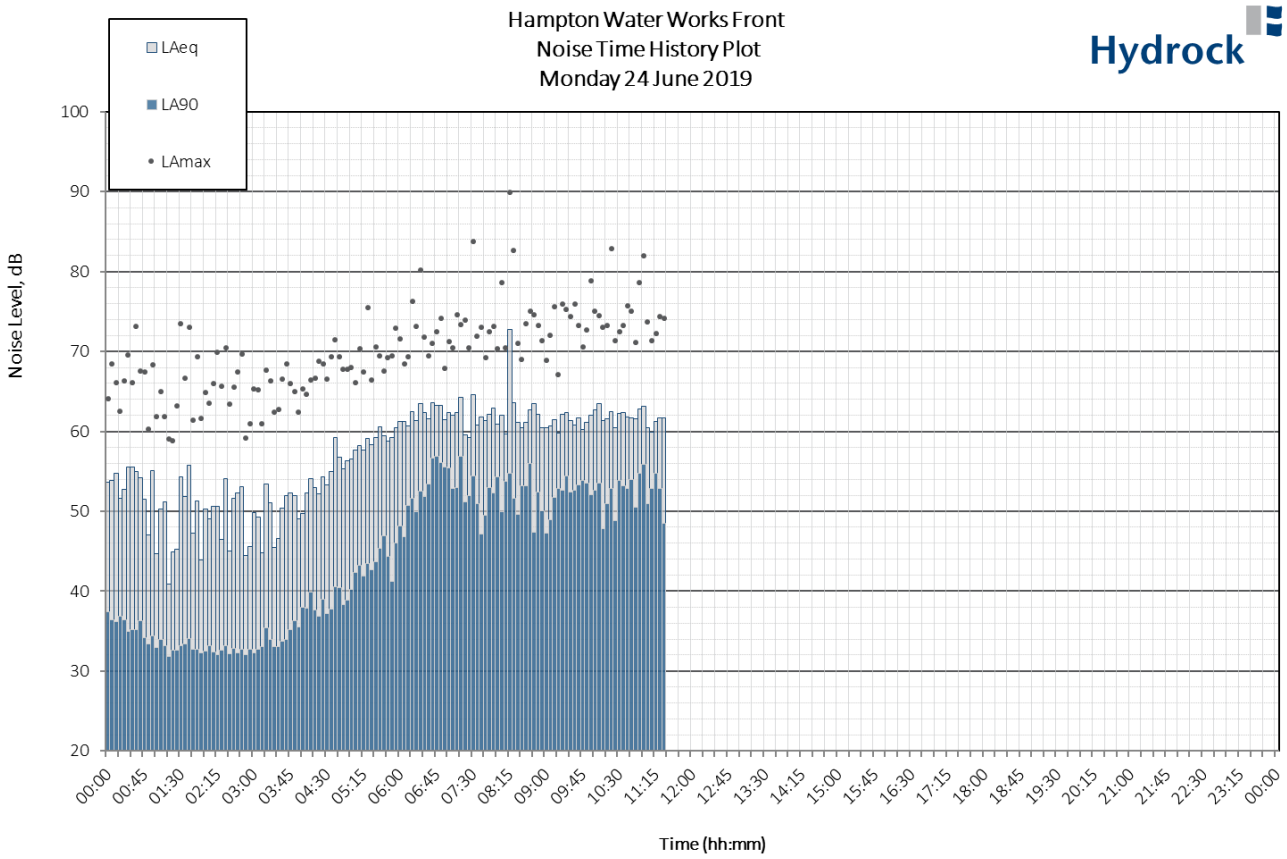

Figure 10: Environmental Noise Survey Measurement Graph - Position 1 - Monday

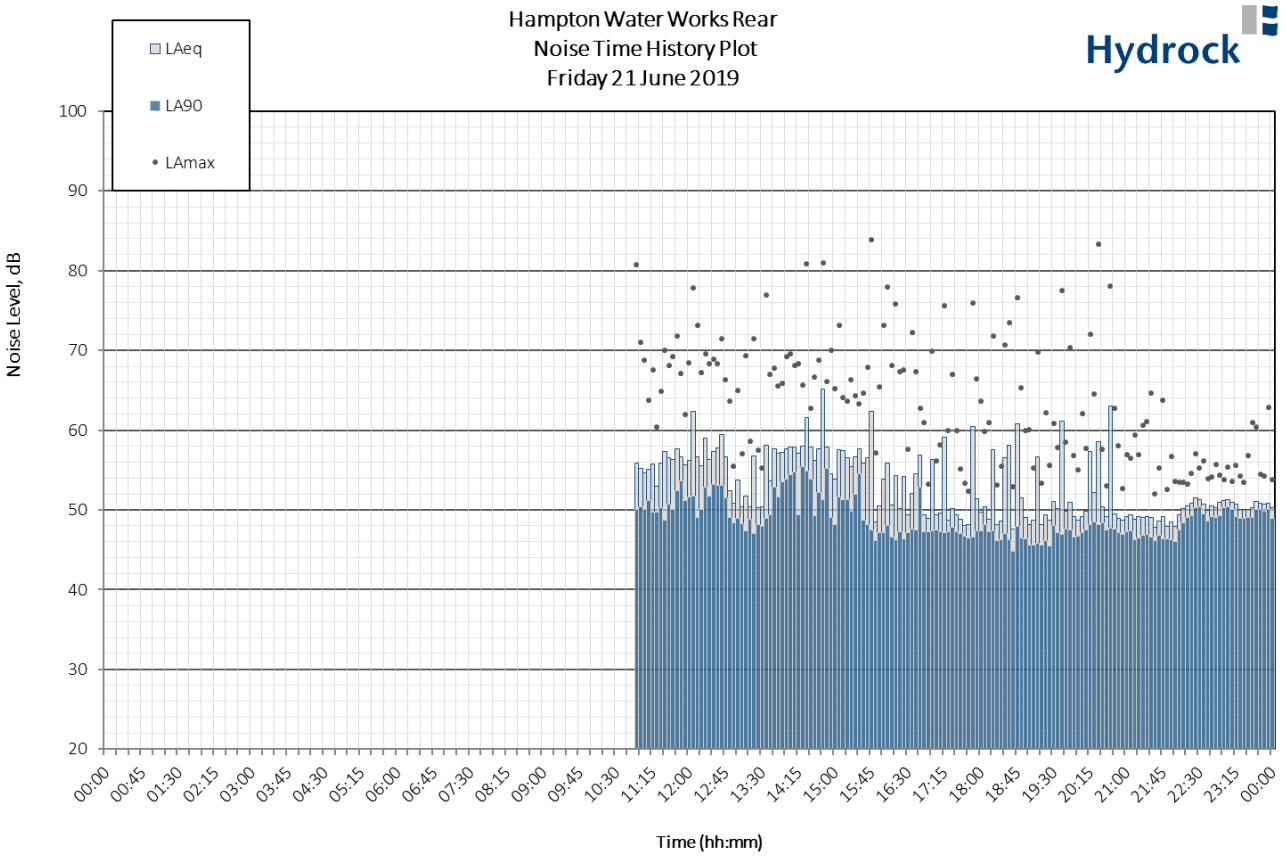

Figure 11: Environmental Noise Survey Measurement Graph - Position 2 - Friday

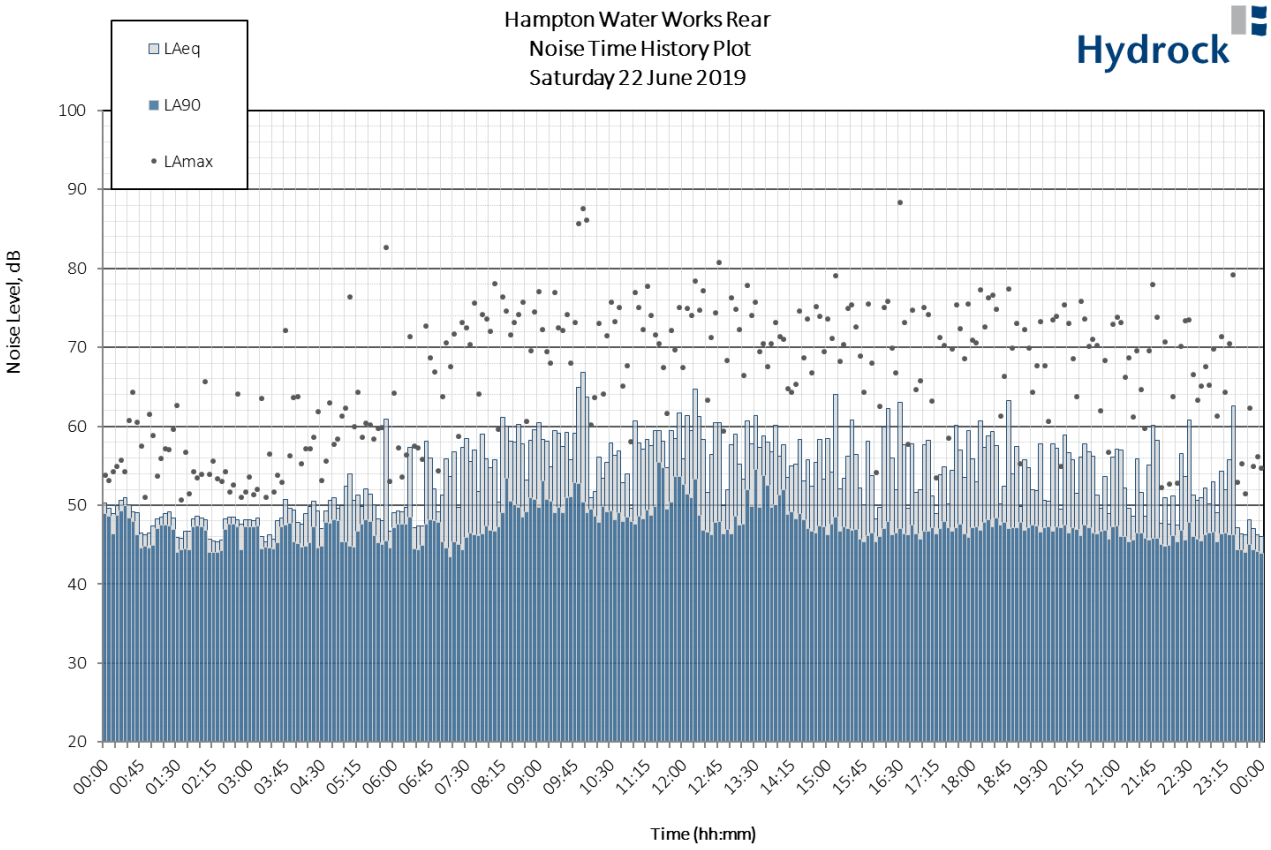

Figure 12: Environmental Noise Survey Measurement Graph - Position 2 - Saturday

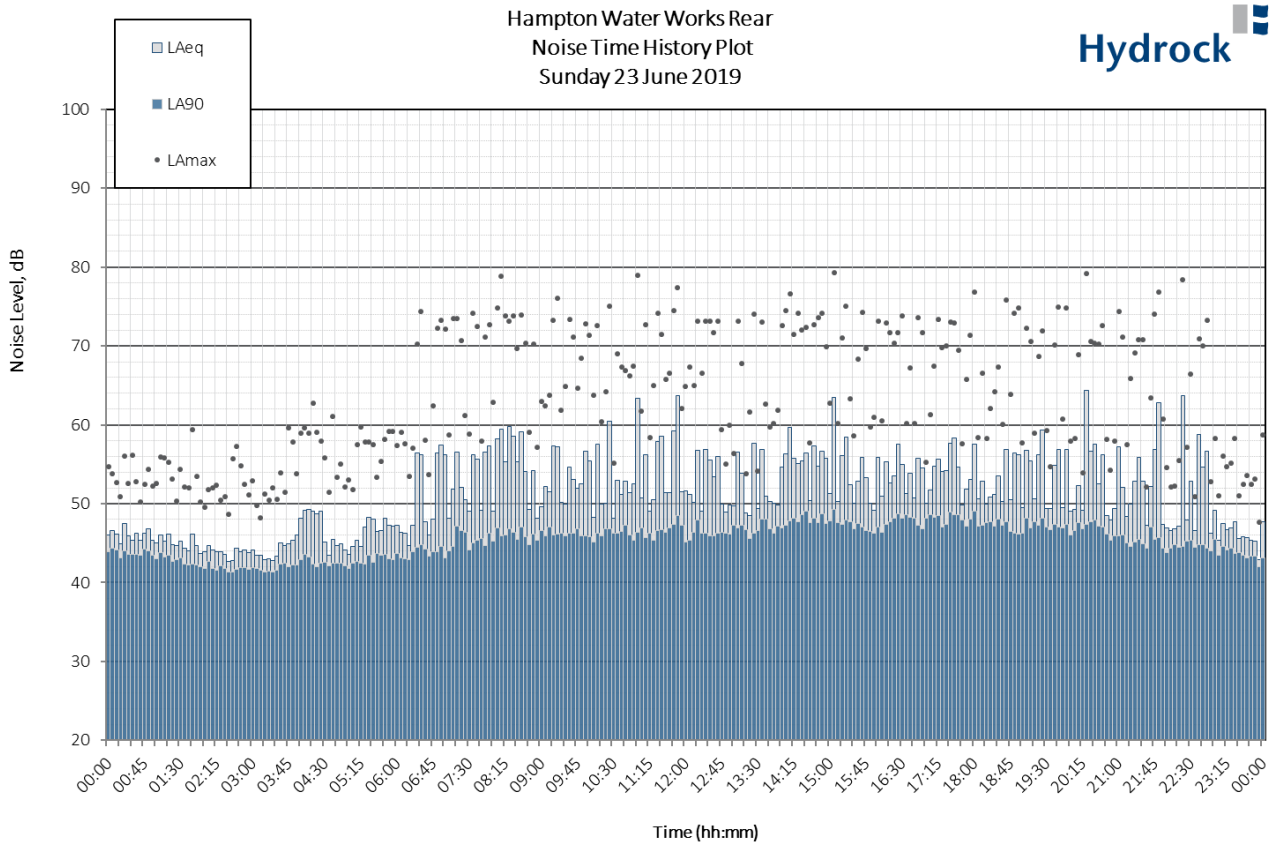

Figure 13: Environmental Noise Survey Measurement Graph - Position 2 - Sunday

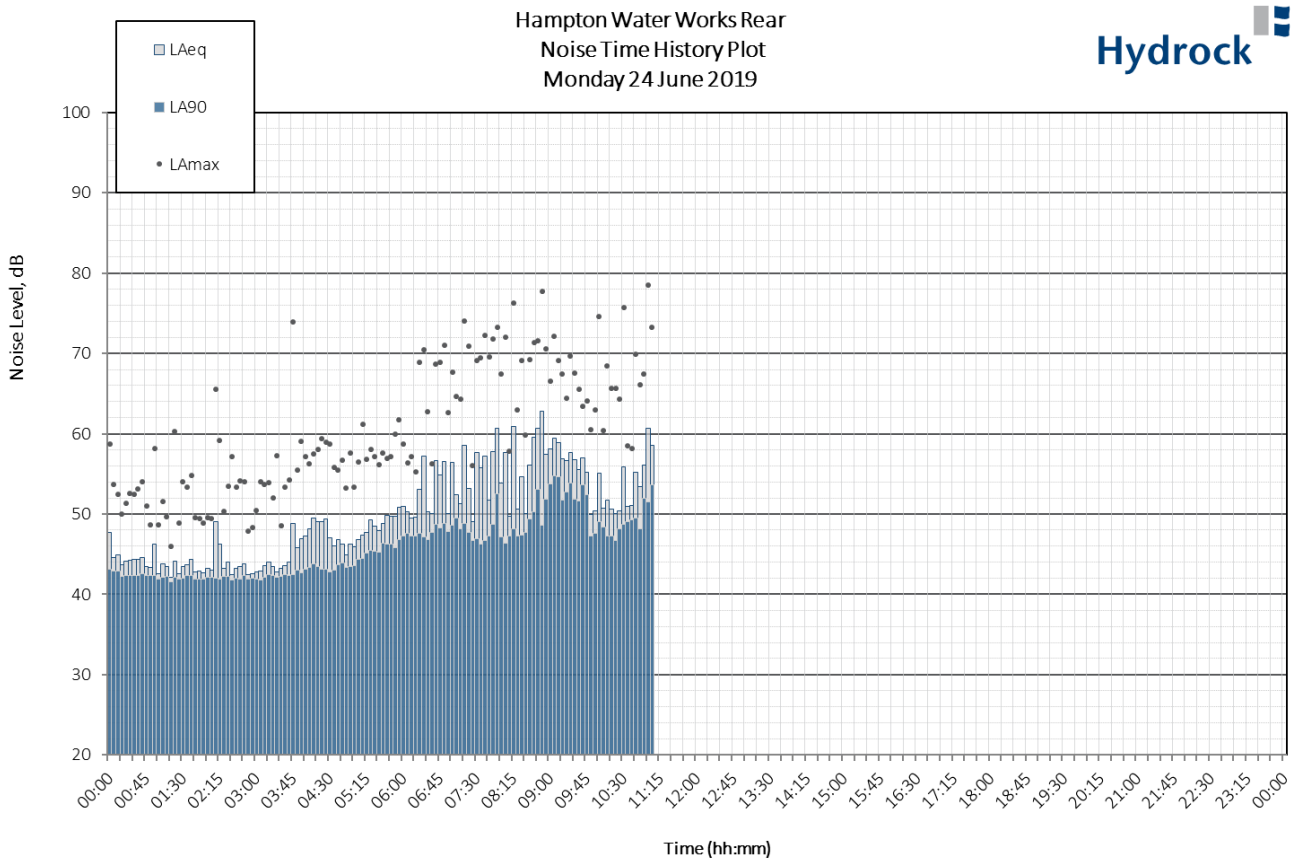

Figure 14: Environmental Noise Survey Measurement Graph - Position 2 - Monday

Appendix C Noise Ingress Calculations

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium High Refurb Day	Living rooms (Daytime - Max levels N/A)

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.7	2.2	-0.7	-4.2	-3.5	-8.7	-17.6	65
	Measured spectrum	Adjusted Spectrum (Leq)	73.7	67.2	64.3	60.8	61.5	56.3	47.4	65.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	2.5	10	-6.5	-2.3	-4.3	-13.1	-21.7	n/a
		Adjusted Spectrum (Lmax)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	163.5	Sew	Sf - Swi	0.5
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	51.1
	Sf	Facade area (inc. window) (m2)	19.2	S	Sf + Srr	70.3
	Sr	Roof Area (exposed side) (m2)	51.1	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	18.8	Attenuation to roof		0.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	8/6/9 Phonip double glazing	28	30	29	32	41	46	49	38
	Swi/S x 10-Rwi/10	C	0.00042	0.00027	0.00034	0.00017	0.00002	0.00001	0.00000	
		Leq Internal SPL	44.2	42.5	39.6	32.5	24.2	14.3	-3.1	38
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Primary wall	Rew	215mm Brick (1 Layer English Bond)	39	38	44	51	59	64	69	55
	Sew/S x 10-Rew/10	D	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	17.0	18.3	8.4	-2.7	-10.0	-19.9	-39.3	8
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Roof area	Rrr	None/Infinite	100	100	100	100	100	100	100	101
	Sr/S x 10-Rrr/10	E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-33.7	-35.7	-34.7	-37.7	-46.7	-51.7	-54.7	
	A (furnished)	Room Absorption	52	11	14	16	16	15	52	
	10 log (S/A)	G	1.3	8.1	7.0	6.4	6.4	6.7	1.3	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	44.3	42.5	39.6	32.5	24.2	14.3	-3.1	34.5

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium High Refurb Night	Bedrooms

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.3	-0.5	-2.4	-5.1	-3.1	-8.2	-14.8	59
	Measured spectrum	Adjusted Spectrum (Leq)	67.3	58.5	56.6	53.9	55.9	50.8	44.2	59.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	3.4	-1.5	-3.5	-4.7	-3.3	-7	-16	74
		Adjusted Spectrum (Lmax)	77.4	72.5	70.5	69.3	70.7	67	58	74.0
		K	6	6	6	6	6	6	6	

Room Details

Term	Derivation	Value	Term	Derivation	Value
V	Volume (m3)	42.4	Sew	Sf - Swi	13.0
RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	13.3
Sf	Facade area (inc. window) (m2)	15.7	S	Sf + Srr	28.9
Sr	Roof Area (exposed side) (m2)	13.3	Ao	Ref Area for Dnew	10.0
Swi	Window area (m2)	2.7	Attenuation to roof		0.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	4/12/4.4 acoustic pvb double glazing	19	22	22	26	37	46	47	32
	Swi/S x 10-Rwi/10	C	0.00117	0.00059	0.00059	0.00023	0.00002	0.00000	0.00000	
		Leq Internal SPL	44.3	33.4	30.5	23.2	14.2	0.4	-6.8	29
		Lmax Internal SPL	57.4	50.4	47.4	41.6	32.0	19.6	10.0	44
Primary wall	Rew	215mm Brick (1 Layer English Bond)	39	38	44	51	59	64	69	55
	Sew/S x 10-Rew/10	D	0.00006	0.00007	0.00002	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	31.1	24.2	15.3	5.0	-1.0	-10.8	-22.0	15
		Lmax Internal SPL	44.2	41.2	32.2	23.4	16.8	8.4	-5.2	29
Roof area	Rrr	None/Infinite	100	100	100	100	100	100	100	101
	Sr/S x 10-Rrr/10	E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-29.1	-31.8	-32.2	-36.2	-47.2	-56.0	-57.2	
	A (furnished)	Room Absorption	14	11	14	16	16	15	14	
	10 log (S/A)	G	3.3	4.2	3.2	2.6	2.6	2.9	3.3	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	44.5	33.9	30.6	23.2	14.3	0.7	-6.7	25.4
Lmax	Calc Tolerance	T								
	Internal Lmax,2	M+F+G+K+T	57.6	50.9	47.5	41.6	32.1	19.9	10.1	43.2

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium Low Refurb Day	Living rooms (Daytime - Max levels N/A)

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.7	2.2	-0.7	-4.2	-3.5	-8.7	-17.6	56
	Measured spectrum	Adjusted Spectrum (Leq)	64.7	58.2	55.3	51.8	52.5	47.3	38.4	56.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	2.5	10	-6.5	-2.3	-4.3	-13.1	-21.7	n/a
		Adjusted Spectrum (Lmax)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	163.5	Sew	Sf - Swi	0.5
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	51.1
	Sf	Facade area (inc. window) (m2)	19.2	S	Sf + Srr	70.3
	Sr	Roof Area (exposed side) (m2)	51.1	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	18.8	Attenuation to roof		0.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	4/12/4 double glazing	22	24	20	25	35	38	35	31
	Swi/S x 10-Rwi/10	C	0.00168	0.00106	0.00267	0.00084	0.00008	0.00004	0.00008	
		Leq Internal SPL	41.2	39.5	39.6	30.5	21.2	13.3	1.9	36
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Primary wall	Rew	215mm Brick (1 Layer English Bond)	39	38	44	51	59	64	69	55
	Sew/S x 10-Rew/10	D	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	8.0	9.3	-0.6	-11.7	-19.0	-28.9	-48.3	-1
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Roof area	Rrr	None/Infinite	100	100	100	100	100	100	100	101
	Sr/S x 10-Rrr/10	E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-27.7	-29.7	-25.7	-30.7	-40.7	-43.7	-40.7	
	A (furnished)	Room Absorption	52	11	14	16	16	15	52	
	10 log (S/A)	G	1.3	8.1	7.0	6.4	6.4	6.7	1.3	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	41.2	39.5	39.6	30.5	21.2	13.3	1.9	33.4

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium Low Night	Bedrooms

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.3	-0.5	-2.4	-5.1	-3.1	-8.2	-14.8	52
	Measured spectrum	Adjusted Spectrum (Leq)	60.3	51.5	49.6	46.9	48.9	43.8	37.2	52.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	3.4	-1.5	-3.5	-4.7	-3.3	-7	-16	64
		Adjusted Spectrum (Lmax)	67.4	62.5	60.5	59.3	60.7	57	48	64.0
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	42.4	Sew	Sf - Swi	13.0
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	13.3
	Sf	Facade area (inc. window) (m2)	15.7	S	Sf + Srr	28.9
	Sr	Roof Area (exposed side) (m2)	13.3	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	2.7	Attenuation to roof		0.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	4/12/4 double glazing	22	24	20	25	35	38	35	31
	Swi/S x 10-Rwi/10	C	0.00059	0.00037	0.00093	0.00030	0.00003	0.00001	0.00003	
		Leq Internal SPL	34.3	24.4	25.5	17.2	9.2	1.4	-1.8	23
		Lmax Internal SPL	44.4	38.4	39.4	32.6	24.0	17.6	12.0	35
Primary wall	Rew	215mm Brick (1 Layer English Bond)	39	38	44	51	59	64	69	55
	Sew/S x 10-Rew/10	D	0.00006	0.00007	0.00002	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	24.1	17.2	8.3	-2.0	-8.0	-17.8	-29.0	8
		Lmax Internal SPL	34.2	31.2	22.2	13.4	6.8	-1.6	-15.2	19
Roof area	Rrr	None/Infinite	100	100	100	100	100	100	100	101
	Sr/S x 10-Rrr/10	E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-31.9	-33.5	-30.2	-35.2	-45.2	-48.2	-45.3	
	A (furnished)	Room Absorption	14	11	14	16	16	15	14	
	10 log (S/A)	G	3.3	4.2	3.2	2.6	2.6	2.9	3.3	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	34.7	25.2	25.5	17.2	9.3	1.4	-1.8	19.7
Lmax	Calc Tolerance	T								
	Internal Lmax,2	M+F+G+K+T	44.8	39.2	39.4	32.6	24.1	17.6	12.0	34.3

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium High Extension Day	Living rooms (Daytime - Max levels N/A)

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.7	2.2	-0.7	-4.2	-3.5	-8.7	-17.6	64
	Measured spectrum	Adjusted Spectrum (Leq)	72.7	66.2	63.3	59.8	60.5	55.3	46.4	64.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	2.5	10	-6.5	-2.3	-4.3	-13.1	-21.7	n/a
		Adjusted Spectrum (Lmax)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	76.6	Sew	Sf - Swi	9.0
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	26.4
	Sf	Facade area (inc. window) (m2)	17.4	S	Sf + Srr	43.8
	Sr	Roof Area (exposed side) (m2)	13.2	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	8.4	Attenuation to roof		2.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	8/12/6.4 acoustic pvb double glazing	20	24	27	32	43	46	52	38
	Swi/S x 10-Rwi/10	C	0.00191	0.00076	0.00038	0.00012	0.00001	0.00000	0.00000	
		Leq Internal SPL	51.0	44.0	37.1	28.0	17.7	9.8	-7.3	36
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Primary wall	Rew	PineCemBoard100SFS_2xSoundblock	14	31	43	49	52	53	59	50
	Sew/S x 10-Rew/10	D	0.00822	0.00016	0.00001	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	57.4	37.3	21.4	11.3	9.0	3.1	-13.9	35
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Roof area	Rrr	Example Roof from BS8233	22	28	34	40	45	49	52	44
	Sr/S x 10-Rrr/10	E	0.00240	0.00060	0.00015	0.00004	0.00001	0.00000	0.00000	
		Leq Internal SPL	52.0	43.0	33.1	23.0	18.7	9.8	-4.3	34
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-19.0	-28.2	-32.7	-37.9	-46.4	-49.7	-54.1	
	A (furnished)	Room Absorption	24	11	14	16	16	15	24	
	10 log (S/A)	G	2.5	6.0	5.0	4.4	4.4	4.7	2.5	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	59.2	47.0	38.6	29.2	21.5	13.2	-2.2	34.5

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium High Extension Night	Bedrooms

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.3	-0.5	-2.4	-5.1	-3.1	-8.2	-14.8	59
	Measured spectrum	Adjusted Spectrum (Leq)	67.3	58.5	56.6	53.9	55.9	50.8	44.2	59.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	3.4	-1.5	-3.5	-4.7	-3.3	-7	-16	74
		Adjusted Spectrum (Lmax)	77.4	72.5	70.5	69.3	70.7	67	58	74.0
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	36.8	Sew	Sf - Swi	2.7
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	12.7
	Sf	Facade area (inc. window) (m2)	8.4	S	Sf + Srr	21.1
	Sr	Roof Area (exposed side) (m2)	12.7	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	5.7	Attenuation to roof		2.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	6/12/7 Audioscreen double glazing	21	26	25	33	43	46	57	37
	Swi/S x 10-Rwi/10	C	0.00214	0.00068	0.00085	0.00014	0.00001	0.00001	0.00000	
		Leq Internal SPL	46.1	32.6	30.7	19.4	11.4	3.6	-13.0	29
		Lmax Internal SPL	59.2	49.6	47.6	37.8	29.2	22.8	3.8	43
Primary wall	Rew	PineCemBoard100SFS_2xSoundblock	14	31	43	49	52	53	59	50
	Sew/S x 10-Rew/10	D	0.00511	0.00010	0.00001	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	49.9	24.4	9.5	0.2	-0.8	-6.6	-18.2	27
		Lmax Internal SPL	63.0	41.4	26.4	18.6	17.0	12.6	-1.4	37
Roof area	Rrr	Example Roof from BS8233	22	28	34	40	45	49	52	44
	Sr/S x 10-Rrr/10	E	0.00240	0.00060	0.00015	0.00004	0.00001	0.00000	0.00000	
		Leq Internal SPL	46.6	32.1	23.2	13.9	10.9	2.1	-6.5	26
		Lmax Internal SPL	59.7	49.1	40.1	32.3	28.7	21.3	10.3	39

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-20.2	-28.6	-30.0	-37.6	-45.8	-49.1	-55.1	
	A (furnished)	Room Absorption	12	11	14	16	16	15	12	
	10 log (S/A)	G	2.5	2.8	1.8	1.2	1.2	1.5	2.5	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	52.7	35.7	31.4	20.5	14.3	6.1	-5.4	25.7
Lmax	Calc Tolerance	T								
	Internal Lmax,2	M+F+G+K+T	65.8	52.7	48.3	38.9	32.1	25.3	11.4	44.6

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium Low Roof Extension Day	Living rooms (Daytime - Max levels N/A)

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.7	2.2	-0.7	-4.2	-3.5	-8.7	-17.6	56
	Measured spectrum	Adjusted Spectrum (Leq)	64.7	58.2	55.3	51.8	52.5	47.3	38.4	56.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	2.5	10	-6.5	-2.3	-4.3	-13.1	-21.7	n/a
		Adjusted Spectrum (Lmax)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	76.6	Sew	Sf - Swi	9.0
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	26.4
	Sf	Facade area (inc. window) (m2)	17.4	S	Sf + Srr	43.8
	Sr	Roof Area (exposed side) (m2)	13.2	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	8.4	Attenuation to roof		2.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	4/12/4 double glazing	22	24	20	25	35	38	35	31
	Swi/S x 10-Rwi/10	C	0.00120	0.00076	0.00191	0.00060	0.00006	0.00003	0.00006	
		Leq Internal SPL	41.0	36.0	36.1	27.0	17.7	9.8	1.7	33
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Primary wall	Rew	PineCemBoard100SFS_2xSoundblock	14	31	43	49	52	53	59	50
	Sew/S x 10-Rew/10	D	0.00822	0.00016	0.00001	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	49.4	29.3	13.4	3.3	1.0	-4.9	-21.9	27
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Roof area	Rrr	Example Roof from BS8233	22	28	34	40	45	49	52	44
	Sr/S x 10-Rrr/10	E	0.00240	0.00060	0.00015	0.00004	0.00001	0.00000	0.00000	
		Leq Internal SPL	44.0	35.0	25.1	15.0	10.7	1.8	-12.3	26
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-19.3	-28.2	-26.8	-31.9	-41.3	-44.4	-42.0	
	A (furnished)	Room Absorption	24	11	14	16	16	15	24	
	10 log (S/A)	G	2.5	6.0	5.0	4.4	4.4	4.7	2.5	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	50.9	39.0	36.4	27.3	18.5	10.5	1.9	30.6

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium Low Roof Refurb Night	Bedrooms

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.3	-0.5	-2.4	-5.1	-3.1	-8.2	-14.8	52
	Measured spectrum	Adjusted Spectrum (Leq)	60.3	51.5	49.6	46.9	48.9	43.8	37.2	52.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	3.4	-1.5	-3.5	-4.7	-3.3	-7	-16	64
		Adjusted Spectrum (Lmax)	67.4	62.5	60.5	59.3	60.7	57	48	64.0
		K	6	6	6	6	6	6	6	

Room Details

Term	Derivation	Value	Term	Derivation	Value
V	Volume (m3)	36.8	Sew	Sf - Swi	2.7
RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	12.7
Sf	Facade area (inc. window) (m2)	8.4	S	Sf + Srr	21.1
Sr	Roof Area (exposed side) (m2)	12.7	Ao	Ref Area for Dnew	10.0
Swi	Window area (m2)	5.7	Attenuation to roof		2.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	4/12/4 double glazing	22	24	20	25	35	38	35	31
	Swi/S x 10-Rwi/10	C	0.00170	0.00107	0.00270	0.00085	0.00009	0.00004	0.00009	
		Leq Internal SPL	38.1	27.6	28.7	20.4	12.4	4.6	2.0	26
		Lmax Internal SPL	48.2	41.6	42.6	35.8	27.2	20.8	15.8	38
Primary wall	Rew	PineCemBoard100SFS_2xSoundblock	14	31	43	49	52	53	59	50
	Sew/S x 10-Rew/10	D	0.00511	0.00010	0.00001	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	42.9	17.4	2.5	-6.8	-7.8	-13.6	-25.2	20
		Lmax Internal SPL	53.0	31.4	16.4	8.6	7.0	2.6	-11.4	27
Roof area	Rrr	Example Roof from BS8233	22	28	34	40	45	49	52	44
	Sr/S x 10-Rrr/10	E	0.00240	0.00060	0.00015	0.00004	0.00001	0.00000	0.00000	
		Leq Internal SPL	39.6	25.1	16.2	6.9	3.9	-4.9	-13.5	19
		Lmax Internal SPL	49.7	39.1	30.1	22.3	18.7	11.3	0.3	29

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-20.4	-27.5	-25.4	-30.5	-40.1	-43.2	-40.6	
	A (furnished)	Room Absorption	12	11	14	16	16	15	12	
	10 log (S/A)	G	2.5	2.8	1.8	1.2	1.2	1.5	2.5	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	45.5	29.8	28.9	20.6	13.0	5.1	2.2	23.2
Lmax	Calc Tolerance	T								
	Internal Lmax,2	M+F+G+K+T	55.6	43.8	42.8	36.0	27.8	21.3	16.0	38.4

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Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium Low Karslake Extension Day	Living rooms (Daytime - Max levels N/A)

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.7	2.2	-0.7	-4.2	-3.5	-8.7	-17.6	52
	Measured spectrum	Adjusted Spectrum (Leq)	60.7	54.2	51.3	47.8	48.5	43.3	34.4	52.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	2.5	10	-6.5	-2.3	-4.3	-13.1	-21.7	n/a
		Adjusted Spectrum (Lmax)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	77.3	Sew	Sf - Swi	13.1
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	32.2
	Sf	Facade area (inc. window) (m2)	19.2	S	Sf + Srr	51.4
	Sr	Roof Area (exposed side) (m2)	16.1	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	6.1	Attenuation to roof		2.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	4/12/4 double glazing	22	24	20	25	35	38	35	31
	Swi/S x 10-Rwi/10	C	0.00075	0.00047	0.00119	0.00038	0.00004	0.00002	0.00004	
		Leq Internal SPL	35.6	30.7	30.7	21.6	12.3	4.4	-3.7	28
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Primary wall	Rew	215mm Brick (1 Layer English Bond)	39	38	44	51	59	64	69	55
	Sew/S x 10-Rew/10	D	0.00003	0.00004	0.00001	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	21.9	20.0	10.0	-1.1	-8.4	-18.3	-34.4	10
		Lmax Internal SPL	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Roof area	Rrr	None/Infinite	100	100	100	100	100	100	100	101
	Sr/S x 10-Rrr/10	E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-31.1	-32.9	-29.2	-34.2	-44.2	-47.2	-44.2	
	A (furnished)	Room Absorption	25	11	14	16	16	15	25	
	10 log (S/A)	G	3.2	6.7	5.6	5.1	5.1	5.3	3.2	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	35.8	31.0	30.7	21.6	12.4	4.4	-3.7	24.6

Hydrock

Hydrock

Building Envelope Sound Insulation Calculation According to EN 12354-3

Project: HWW	27/02/2023
Medium Low Karslake Extension Night	Bedrooms

Incident noise levels

	Term	Label	Octave band centre frequency (Hz)							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Leq,ff	Measured Leq	Spectrum Adjustment Terms (Leq)	8.7	2.2	-0.7	-4.2	-3.5	-8.7	-17.6	46
	Measured spectrum	Adjusted Spectrum (Leq)	54.7	48.2	45.3	41.8	42.5	37.3	28.4	46.0
		K	3	3	3	3	3	3	3	
Lmax,ff	Measured Lmax	Spectrum Adjustment Terms (Lmax)	3.4	-1.5	-3.5	-4.7	-3.3	-7	-16	64
		Adjusted Spectrum (Lmax)	67.4	62.5	60.5	59.3	60.7	57	48	64.0
		K	6	6	6	6	6	6	6	

Room Details

	Term	Derivation	Value	Term	Derivation	Value
	V	Volume (m3)	16.8	Sew	Sf - Swi	4.7
	RT	RT (secs)	0.5	Srr	Area of ceiling (m2)	7.0
	Sf	Facade area (inc. window) (m2)	6.7	S	Sf + Srr	13.7
	Sr	Roof Area (exposed side) (m2)	7.0	Ao	Ref Area for Dnew	10.0
	Swi	Window area (m2)	2.0	Attenuation to roof		2.0

Sound Insulation Calculation elements

	Term	Label/element	Octave band centre frequency (Hz)							Rw
			63	125	250	500	1 k	2 k	4 k	
vent openings	Dn,e	Mech Vent	100	100	100	100	100	100	100	101
	A0/S x 10-Dn/10	B	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lmax Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	Rwi	4/12/4 double glazing	22	24	20	25	35	38	35	31
	Swi/S x 10-Rwi/10	C	0.00094	0.00059	0.00149	0.00047	0.00005	0.00002	0.00005	
		Leq Internal SPL	31.5	19.9	19.9	10.9	1.6	-6.4	-7.8	17
		Lmax Internal SPL	47.2	37.2	38.1	31.4	22.8	16.3	14.8	34
Primary wall	Rew	215mm Brick (1 Layer English Bond)	39	38	44	51	59	64	69	55
	Sew/S x 10-Rew/10	D	0.00004	0.00005	0.00001	0.00000	0.00000	0.00000	0.00000	
		Leq Internal SPL	18.1	9.5	-0.5	-11.5	-18.8	-28.8	-38.2	0
		Lmax Internal SPL	33.8	26.8	17.7	9.0	2.4	-6.1	-15.6	15
Roof area	Rrr	Example Roof from BS8233	22	28	34	40	45	49	52	44
	Sr/S x 10-Rrr/10	E	0.00203	0.00051	0.00013	0.00003	0.00001	0.00000	0.00000	
		Leq Internal SPL	34.8	19.2	9.3	-0.8	-5.1	-14.0	-21.5	14
		Lmax Internal SPL	50.5	36.5	27.5	19.7	16.1	8.7	1.1	28

Calculated Internal Noise Levels

	10 Log (B+C+D+E)	F	-25.2	-29.4	-27.9	-33.0	-42.4	-45.6	-43.1	
	A (furnished)	Room Absorption	5	11	14	16	16	15	5	
	10 log (S/A)	G	4.1	1.0	-0.1	-0.7	-0.7	-0.4	4.1	
Leq	Calc Tolerance	T								
	Internal Leq,2	L+F+G+K+T	36.6	22.8	20.3	11.2	2.4	-5.7	-7.6	14.5
Lmax	Calc Tolerance	T								
	Internal Lmax,2	M+F+G+K+T	52.3	40.1	38.5	31.7	23.6	17.0	15.0	34.3