SWAN HOUSE
37 – 39 HIGH HOLBORN
LONDON WC1V 6AA

PLANT NOISE IMPACT ASSESSMENT

JUNE 2022

the journey is the reward

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Project Code:	**25969_QHighHolburn(N).9**
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SWAN HOUSE, 37 – 39 HIGH HOLBORN, LONDON WC1V 6AA
PLANT NOISE IMPACT ASSESSMENT

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1 Introduction

1.1 Mayer Brown Limited has been instructed by Acai (Swan House) Ltd to prepare this noise assessment which accompanies a planning application for the installation of 4 new condenser units at Swan House, High Holborn, London WC1V 6AA.

1.2 This report is structured as follows:

- **Section 2** describes the location of the site and use of neighbouring buildings;
- **Section 3** outlines the proposed plant installation;
- **Section 4** presents the results of noise survey work undertaken to determine the existing noise environment at the site;
- **Section 5** discusses relevant national and local planning policy and other supporting technical design standards;
- **Section 6** assesses the impact of plant noise emissions on neighbouring land uses;
- Conclusions are presented in **Section 7**.

1.3 A glossary of the acoustic terminology used in this report is attached at **Appendix A**.

2 Site Location and Proposal Details

2.1 The application site is an existing office building (Swan House) located at 37 – 39 High Holborn, London WC1V 6AA. The location of the site is shown in **Figure 2.1** below.

Figure 2.1: Site Location

2.2 The site is bounded by the A40 (High Holborn) to the south. Land usage on the opposing side of the A40 appears to be a mix of retail and café uses with office floorspace on the upper levels.

2.3 To the north the property adjoins 2-5 Warwick Court (Tanfield Chambers), a five storey terrace having commercial (office) use. Slightly further north is no. 7 Warwick Court, a five storey block having residential use.

2.4 To the east the site adjoins Bracton House, a building of similar height having commercial (office) use.

2.5 Warwick Court lies to the west of the site with First Avenue House (a nine storey office building) on the opposing side.

2.6 The proposed condenser units are to be installed on the roof of the building, replacing 2 redundant existing units in the location shown in **Figures 2.2** below:

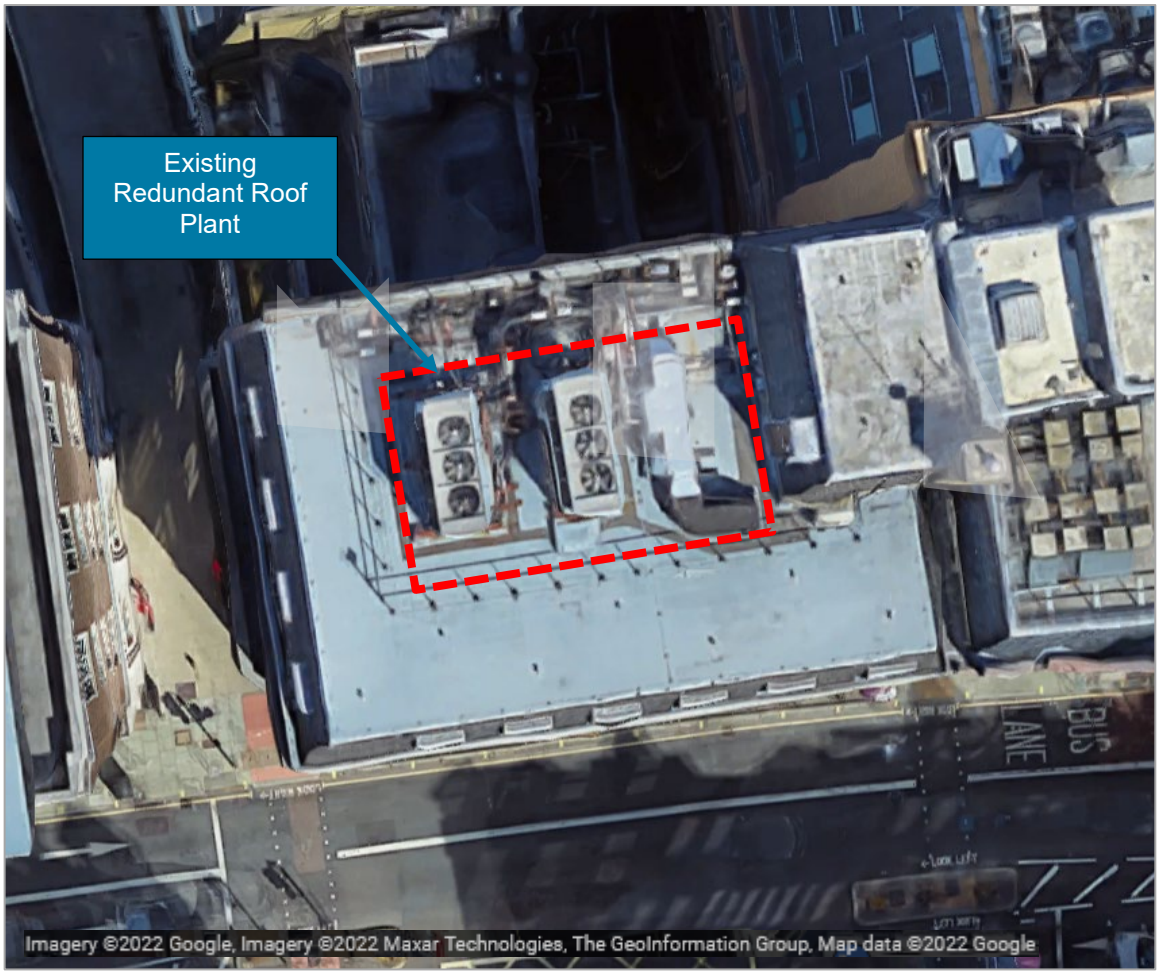


Figure 2.2: Existing Roof Plant Location

3 Proposed Plant

3.1 The proposals consist of the replacement of existing condenser plant with 4 replacement units. The location of the proposed condenser units are shown in **Figure 3.1** below.

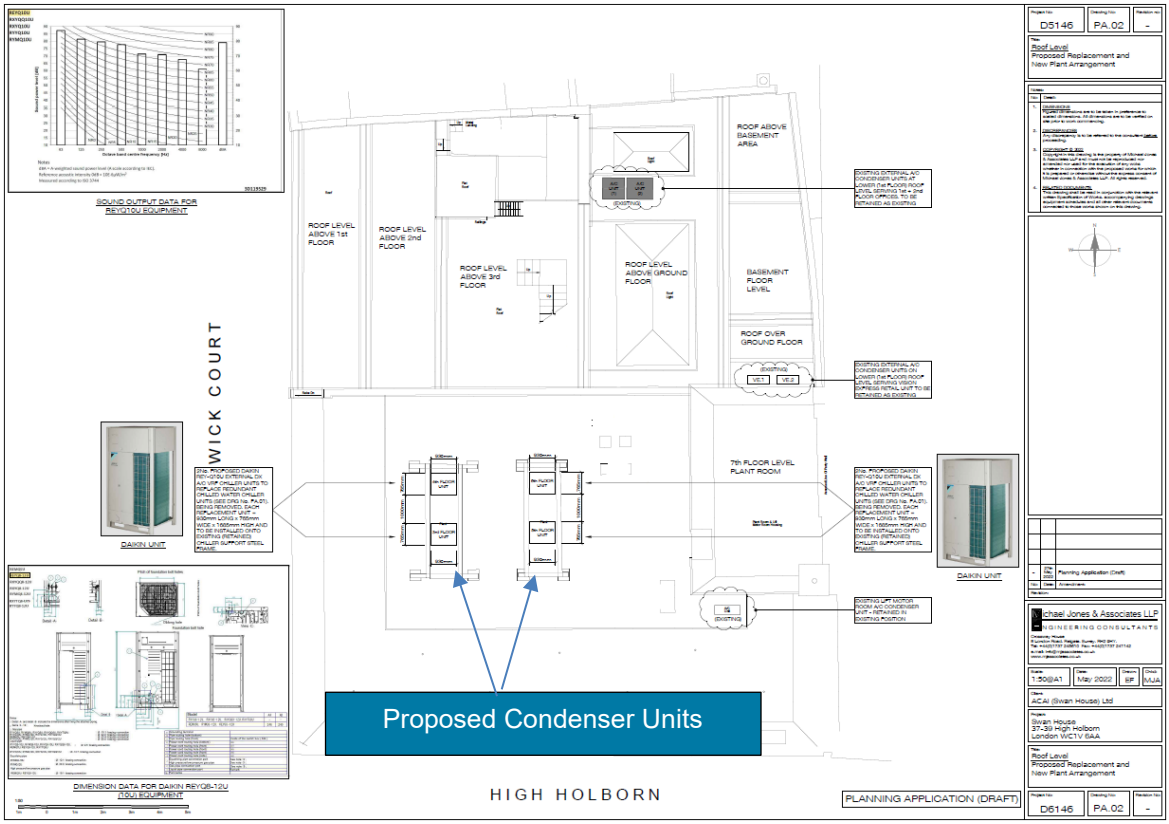


Figure 3.1: Location of Proposed Condenser Units

3.2 It is proposed to install 4 Daikin VRV REYQ10U units. The manufacturer's noise specification for this unit have been obtained and are summarised in **Table 3.2** and **3.3** below:

Octave Band Sound Pressure Level @ 1m, dB re 20µPa								dBA
63	125	250	500	1k	2k	4k	8k	
59	62	57	56	49	47	46	36	57

Table 3.2: Manufacturers' Plant Noise Data – Daikin VRV REYQ10U

Octave Band Sound Pressure Level @ 1m, dB re 20µPa								dBA
63	125	250	500	1k	2k	4k	8k	
55	55	48	47	47	45	43	39	52

Table 3.3: Manufacturers' Plant Noise Data - Daikin VRV REYQ10U: Quiet Mode

3.3 Manufacturer's published literature certifying the above noise data is reproduced in **Figures 3.2** and **3.3** below and overleaf and attached at **Appendix B**.

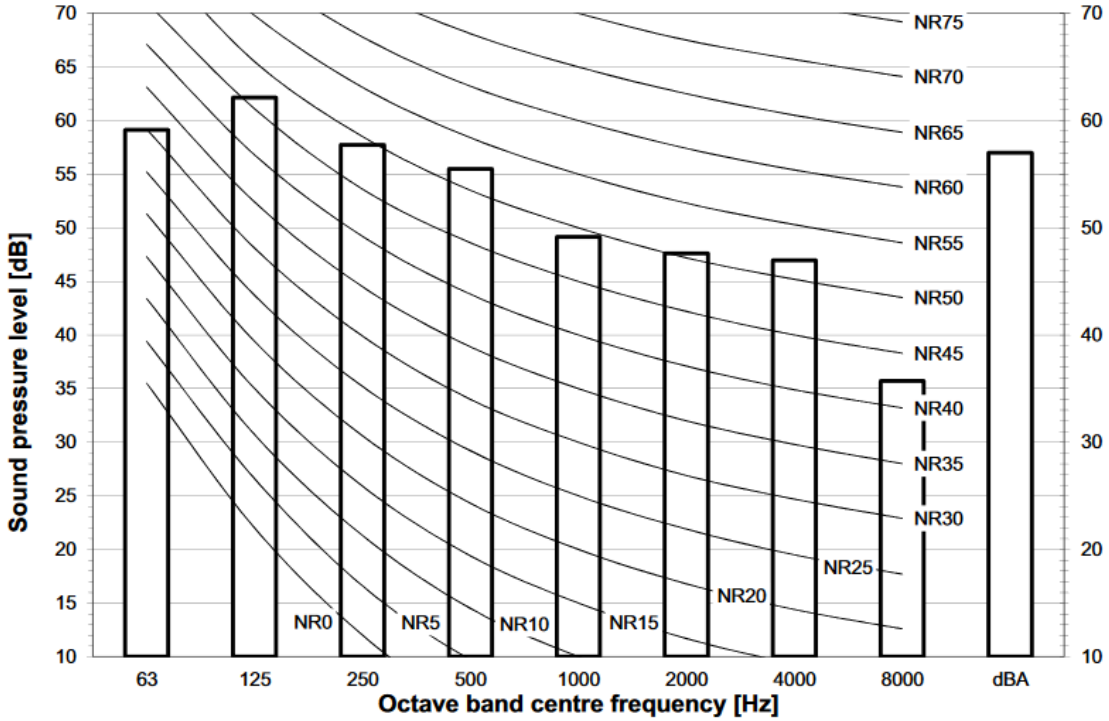


Figure 3.2: Manufacturer's Noise Data Graph – Daikin REYQ10U

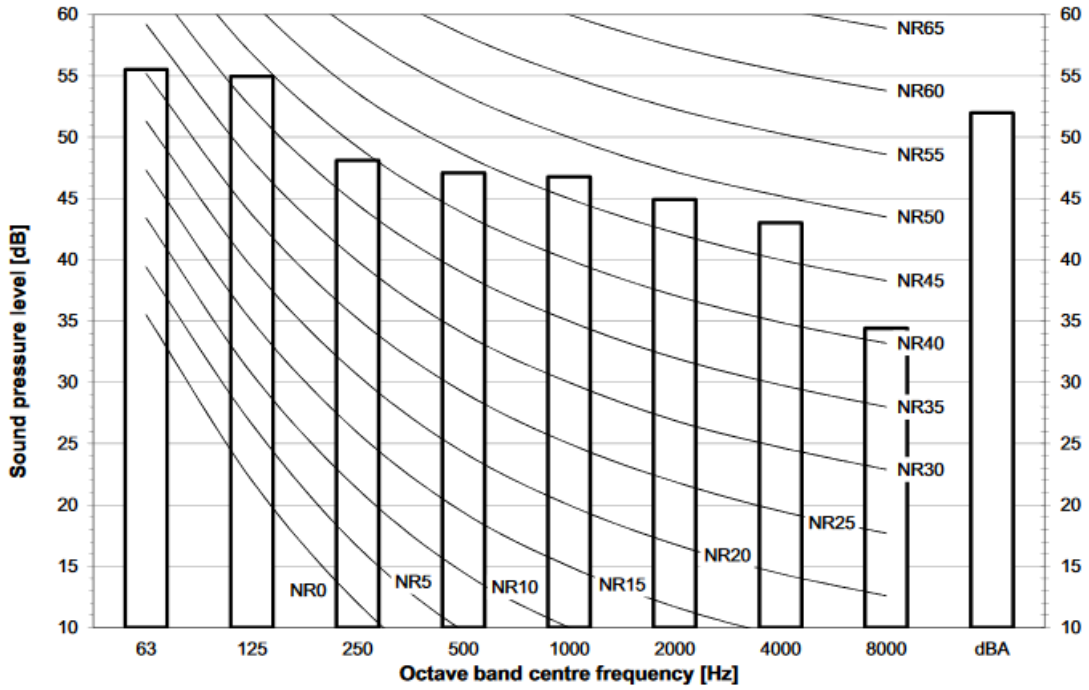


Figure 3.3: Manufacturer's Noise Data Graph – Daikin REYQ10U: Quiet Mode

4 Planning Policy Context and Acoustic Design Criteria

National Planning Policy Framework

4.1 Current governmental guidance for the determination of planning applications is given in the *"National Planning Policy Framework"* (NPPF), published in July 2021.

4.2 Paragraph 174 of the NPPF advises:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *….. 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.*

4.3 With specific regard to noise, paragraph 185 of the NPPF states:

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
>
> *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
>
> *c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

4.4 With regard to *'adverse'* impacts and *'significant adverse'* impacts, the NPPF directs the reader to the advice contained in DEFRA's *"Noise Policy Statement for England"* (NPSE). This Policy Statement introduces the concept of a *"Significant Observed Adverse Effect Level"* (SOAEL), *"Lowest Observed Adverse Effect Level"* (LOAEL) and

"No Observed Adverse Effect Level" (NOAEL). These are concepts aligned with toxicology outcomes derived from guidance given by the World Health Organisation.

Noise Policy Statement for England

4.5 Whilst the intent of the NPSE in relation to the NPPF is clear, the NPSE does not provide any quantitative threshold values for each identified level of *"effect"*. Indeed, the NPSE carefully highlights that:

> *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

National Planning Practice Guidance

4.6 The application of national planning is amplified in the government's *"National Planning Practice Guidance"* (NPPG) (July 2019). This seeks to help clarify understanding the perception of noise effects, potential outcomes of noise exposure and actions that should be taken to align decision making with the NPPF. In line with the NPPF concept of basing decision making on the identification of *"adverse"* or *"significant adverse"* impacts on health and quality of life, the NPPG aligns its guidance with the NPSE.

4.7 The table overleaf summarises this guidance:

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

Table 4.1: PPG Noise Exposure Hierarchy Table

4.8 To assist in quantifying when noise may have a particular effect, Paragraph 015 (Reference ID: 30-015-20190722) of PPG makes reference to a number of '*industry standard'* guidance documents (including BS 8233: 2014). The paragraph does, however, clarify:

> *"Some of these documents contain numerical criteria. These values are not to be regarded as fixed thresholds and as outcomes that have to be achieved in every circumstance".*

Local Planning Policy

4.9 The London Borough of Camden's Local Plan was adopted on 3rd of July 2017 and includes the following policy specific to noise and vibration.

Policy A4 Noise and vibration

The Council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:

a. development likely to generate unacceptable noise and vibration impacts; or
b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.

4.10 The technical guidance provided in Appendix 3 of the Local Plan states that in relation to commercial plant that:

> *'A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below*

background (15dB if tonal components are present) should be considered as the design criterion).

Existing Noise sensitive receptor	*Assessment location*	*Design period*	*LOAEL (Green)*	*LOAEL to SOAEL (Amber)*	*SOAEL (Red)*
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}

**10dB should be increased to 15dB if the noise contains audible tonal elements (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.*

***levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room' (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the

façade of affected premises, where the noise sensitive premise is located in a quiet background area.'

BS 4142: 2014:+A1:2019 "Methods for Rating and Assessing Industrial and Commercial Sound"

4.11 Camden's noise guidance makes specific reference to the assessment methodology of BS 4142: 2014, which has been superseded by a subsequent revision of the standard. The current standard is BS 4142: 2014:+A1:2019.

4.12 As noted earlier, this standard provides a rating and assessment methodology for assessing the potential adverse impact of industrial and commercial noise sources on neighbouring dwellings.

4.13 The assessment procedure initially compares the ***'Rating Level'*** of the source with the '***Background*** Noise ***Level'*** when the source is not present.

4.14 The ***'Rating*** Level' (L_{Ar}) referred to is the specific noise level of the noise source under investigation (in terms of the L_{Aeq} noise index), to which corrections are applied if the noise has certain audible characteristics. The following corrections (based on a subjective assessment of noise source characteristics is given:

Character Correction				
Feature / Perception	**Tonality**	**Impulsivity**	**Intermittency**	**Other acoustic characteristics**
Just Perceptible	+2dB	+3dB	When the specific sound has identifiable On/Off conditions that are readily distinctive. +3dB	+3dB
Clearly Perceptible	+4dB	+6dB		
Highly Perceptible	+6dB	+9dB		

Table 4.2: BS4142 Character Correction for Rating Level Calculation

4.15 The 'Background Noise Level' (L_{A90}) represents the noise level that is exceeded for 90% of the stated measurement period. For assessment purposes, the background noise level needs to be determined without the noise source under investigation operating.

4.16 The time of operation needs to be taken into account. During the day (normally taken to be 07.00 to 23.00 hours) a one-hour measurement period is considered appropriate.

During the night (normally taken to be 23.00 – 07.00 hours) a 15-minute time period is normally used.

4.17 The following guidance is then offered based on the outcome of this initial assessment:

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

4.18 As noted in section 4, national planning policy directs that adverse noise impacts should be mitigated and reduced to a minimum and that *"significant"* noise impacts should be avoided. If the guidance of BS 4142:2014 + A1: 2019 is aligned with these objective, it can be concluded that:

- A *"significant"* noise impact (i.e. sound above a SOAEL) is likely where the rating level ($L_{Ar,T}$) of noise is 10dB or more above the background noise level ($L_{A90,T}$); and
- A *"low"* noise impact (i.e. sound above a LOAEL) is likely where the rating level does not exceed the background level.

4.19 A note accompanying the guidance of BS 4142: 2014 + A1: 2019 states:

> *"Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

4.20 The initial estimate of the impact should then be modified to account for its context. Such considerations include:

- The absolute level of the sound - 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 background sound levels and rating levels are low, absolute levels might be as, or more, relevant

than the margin by which the rating level exceeds the background. This is especially true at night.

- Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

- The character and level of the residual sound compared to the character and level of the specific sound.

- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

4.21 The scope of application for BS 4142 clarifies that it is specifically intended for assessing the potential impact of industrial/commercial sound on residential properties. In order to ensure a robust assessment of all potential impacts, consideration should also be given to noise levels that may be experienced by neighbouring commercial properties. The following sections review design guidance for offices (including BS 8233: 2014 and guidance published by the British Council for Offices).

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

4.22 Section 7 of BS 8233: 2014 provides guidance on appropriate internal noise levels for specific types of building.

4.23 In order to assist in providing acoustic privacy in open plan office areas, Table 2 of BS 8233: 2014 recommends that a sound level of 45-50dB $L_{Aeq,T}$ should be provided.

4.24 Table 6 of the standard recommends that in order to provide acceptable noise levels for *"study and work requiring concentration"*, internal noise levels in staff/meeting and training rooms should be controlled to a level of around 35-45dB $L_{Aeq,T}$, whilst an internal level of 35-40dB $L_{Aeq,T}$ would be appropriate for an executive office. For corridors and circulation spaces, an internal sound level of 45-55 dB $L_{Aeq,T}$ is suggested.

4.25 Section 7.7.6 of BS 8233: 2014 directly deals with office accommodation and makes direct reference to the British Council For Offices *"Guide to Specification"* (2009). This guide was updated in 2019. Relevant guidance is summarised in the following section.

"Guide to Specification", British Council for Offices, London: BCO. 2019

4.26 The BCO Guide recommends the following external noise intrusion criteria for offices:

Area	Performance
Open plan offices	NR 40 ($L_{eq,T}$)
Speculative offices	NR38 ($L_{eq,T}$)
Cellular offices / meeting rooms	NR 35 ($L_{eq,T}$)

Table 4.3: BCO Noise Intrusion Guideline Values

4.27 The above guidance is specified in terms of Noise Rating (NR) levels. These rating levels are defined in Annex B of BS 8233: 2014. This Annex also notes that whilst NR values cannot be directly converted to a dB(A) level, the following approximate relation can be reasonably applied:

$$dB(A) = NR + 6$$

4.28 Based on the above, it can be seen that noise intrusion from external sources into offices should be acceptably reduced when controlled to internal levels of around 46 dB $L_{Aeq,T}$ for open plan offices, and 41 dB $L_{Aeq,T}$ for cellular offices/meetings room.

4.29 In order to align with national planning policy objectives, it is considered that these internal levels provide appropriate benchmark guidance on a *"Lowest Observed Adverse Effect Level"* (LOAEL) for internal noise levels within office accommodation.

5 Existing Noise Environment

Automated Noise Survey

5.1 Existing baseline noise conditions at the site have been established using an automated noise survey. Noise levels were monitored at the position displayed in **Figure 5.1** and shown and described in **Figure 5.2** and **Table 5.1** overleaf.

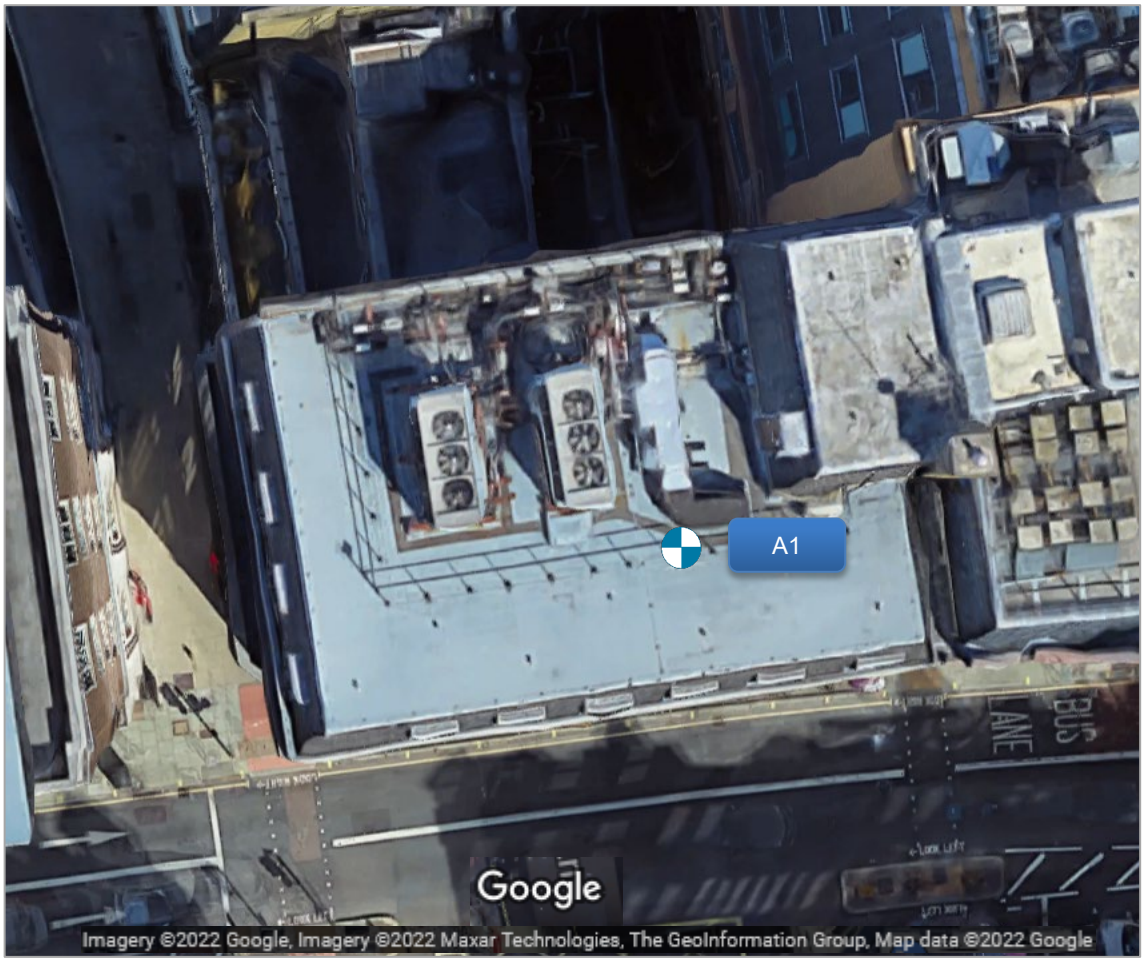


Figure 5.1: Noise Measurement Location

Figure 5.2: In-Situ Noise Monitoring Equipment

Monitoring Location	Description
A1 - Automated	The measurement microphone was positioned on the roof of Swan House, approximately 1.8m above “ground” level, mounted to railings in free field conditions. The microphone was fixed with the manufacturer’s windshield

Table 5.1: Description of Noise Measurement Location

Measurement Instrumentation

5.2 The following measurement instrumentation was used:

Description	Make	Model	Serial No.	Calibration Date
Sound Level Meter	Svantek	SVAN971	72535	13/07/2020
Microphone	ACO Pacific	7052E	68261	
Preamplifier	Svantek	SV18	72235	
Calibrator	Svantek	SA271U	--	16/07/2021

Table 5.2: Measurement Instrumentation

5.3 All measurement equipment is fully calibrated to traceable national standards, with current calibration certificates available upon request.

5.4 The sound level analyser was field calibrated prior to the survey and checked upon completion. No drift in the calibration of the meter was observed.

Survey Procedure

5.5 The sound level analyser was configured to measure the L_{A90}, L_{Aeq}, L_{A10} and $L_{Amax,fast}$ noise indices over consecutive 15 minute time periods. The equipment was also configured to log at a higher (1 second) resolution to assist with the discrimination of noise events, in addition to audio recordings to assist with source identification.

Measurement Results

5.6 The results of the automated noise monitoring are presented in **Figure 5.3** overleaf. Higher resolution copies of the time history graphs are also attached at **Appendix C**.

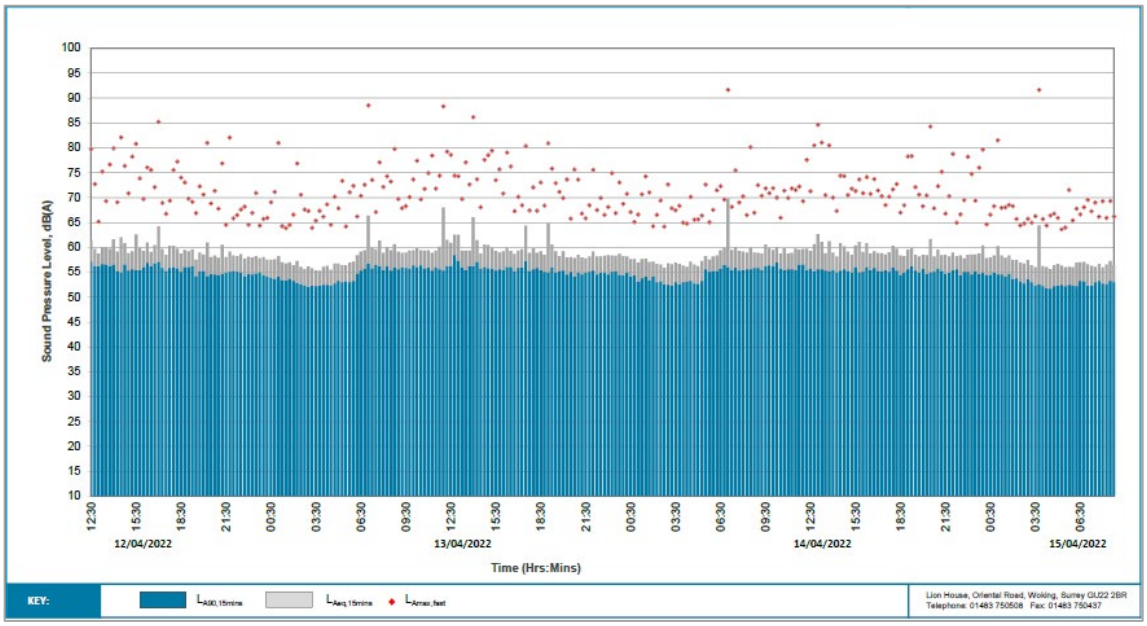


Figure 5.3: Measurement Results Graph

Automated Noise Data

5.7 The measurement data has been post-processed using SvanPC++ data analysis software to exclude periods of extraneous noise and provide an indication of likely daytime ($L_{Aeq,16hour}$) and night-time ($L_{Aeq,8hour}$) values. These are summarised in **Table 5.3** below:

A1	Day-time $L_{Aeq,16hr}$ (07:00 – 23:00)	Night-Time $L_{Aeq,8hr}$ (23:00 – 07:00)
12/04/2022*	60	57
13/04/2022	61	58
14/04/2022	60	58
15/04/2022*	57	-
*First day and last day of the monitoring are not full period, calculated using data available.		

Table 5.3: A1 Estimated Daytime $L_{Aeq,16hour}$ and Night-time $L_{Aeq,8hour}$ Noise Levels

Typical Background Noise Levels

5.8 The measurement data has been statistically analysed to determine "typical" daytime and night-time background (L_{A90}) noise levels, as presented in **Figures 5.4** and **5.5** overleaf;

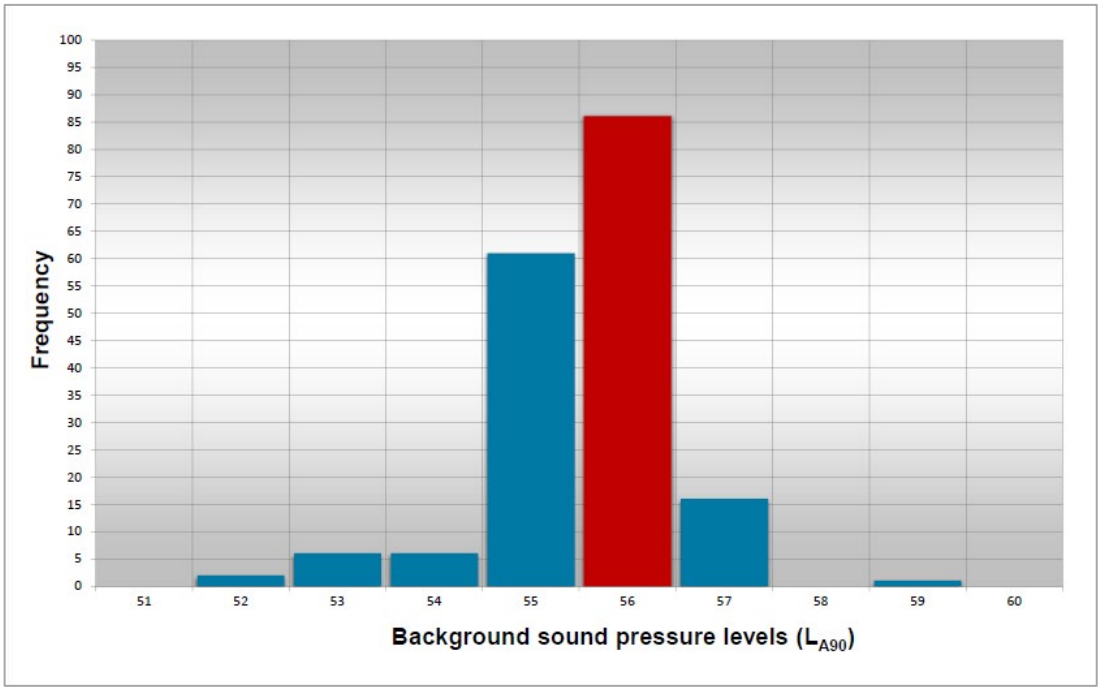


Figure 5.4: A1 - L_{A90} Statistical Analysis – Daytime

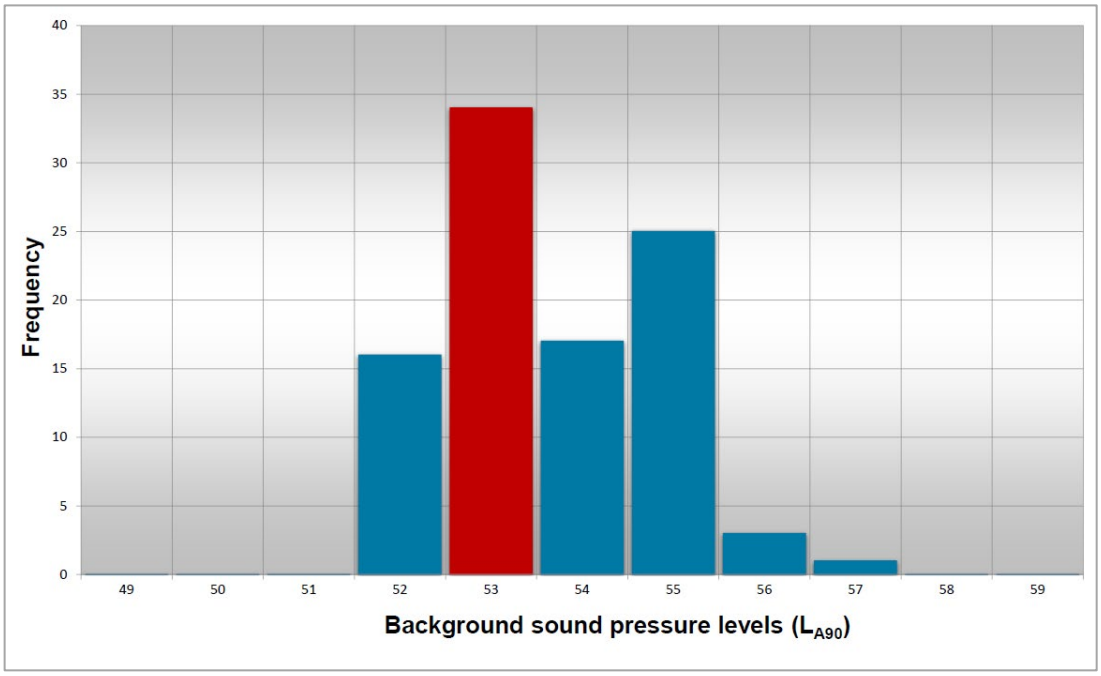


Figure 5.5: A1 - L_{A90} Statistical Analysis – Night-time

5.9 From the analysis shown, it can be seen that the typical daytime and night-time background noise levels are taken to be **56dB** L_{A90} and **53dB** L_{A90}. Analysis of the measured data and time history profile highlights that noise levels are dominated by existing plant serving adjacent buildings.

Weather

5.10 Weather conditions were not actively measured during the survey, however, observations at the time of site attendances and publicly available historic online data indicate that weather conditions were typically characterised as set out in **Table 5.4** below:

2022	Temp. (°C)	Humidity (%)	Wind Speed (mp/h)	Wind Direction	Pressure (hPa)		Rainfall(mm)
April	Avg.	Avg.	Avg.	Avg.	Max	Min	total
12	19	11	7	SE	1008	1000	0
13	18	11	8	WSW	1018	1008	0
14	19	10	6	W	1021	1017	0
15	23	12	4	SSW	1026	1021	0

Table 5.4: Weather Conditions During Survey

6 Noise Impact Assessment

Noise Sensitive Receptors

6.1 For noise impact assessment purposes, the nearest noise sensitive receptors have been identified[1] and are as shown in **Figure 6.1** and are described in **Table 6.1** below.

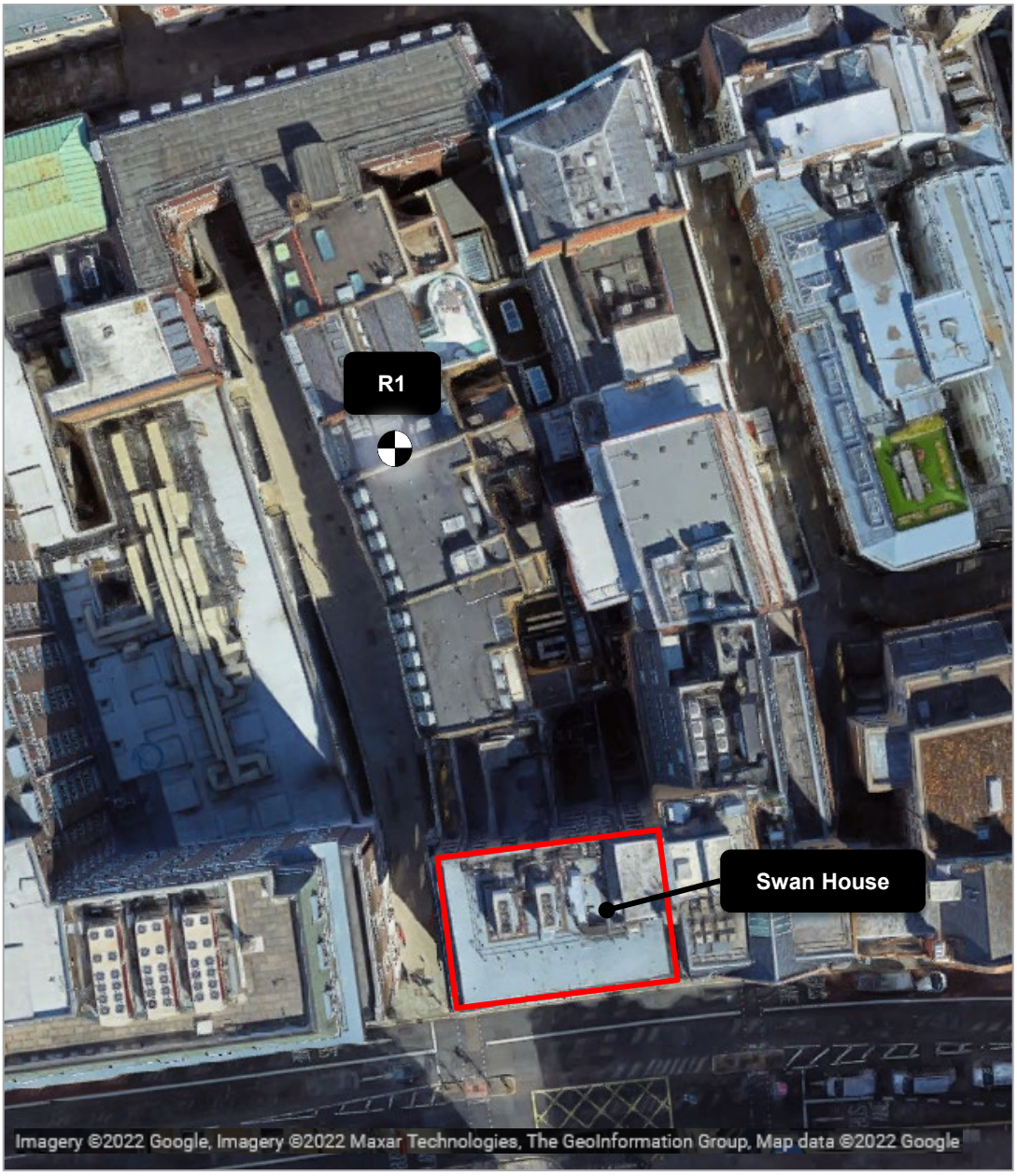


Figure 6.1: Location of Noise Sensitive Receptors

[1] This has been based on a post-code search of neighbouring properties and cross referencing these to Council Tax records available at https://www.tax.service.gov.uk/check-council-tax-band/search

Ref.	Location
R1	Flats at 7 Warwick Court, London WC1R 5DJ

Table 6.1: Description of Noise Sensitive Receptors

Proposed Noise Limits

6.2 As noted earlier, Camden Council requires that the rating level of plant noise is controlled to a level at least 10dB below the typical background noise level, which is considered to be the "*lowest observed adverse effect level*". It follows that, based on the results of the noise monitoring, the following plant noise emission limits should be targeted.

Ref.	Location	$L_{Ar, T,1hour}$ dB
R1	Flats at 7 Warwick Court, London WC1R 5DJ	46

Table 6.2: Recommended Plant Noise Emission Limits

6.3 The above values should be met at 1m from the window or any adjoining property and should represent the total cumulative value (i.e. noise emission from all plant operating at the same time).

Noise Calculations

6.4 Calculations have been undertaken in general accordance with "*ISO:9613- 2:1996 – The attenuation of sound during propagation outdoors: Part 2 General Method of Calculation"* and are based on manufacturers technical datasheets, aerial photography and general site observations regarding building heights and other features that may influence noise propagation.

6.5 The calculations are made for the *"most exposed"* uppermost window of the affected property.

6.6 Corrections have been applied to account for directivity of the noise source relative to the receiver, where these are *'off axis'*.

6.7 To ensure a robust assessment, the calculations assume that all plant will operate simultaneously and continuously.

6.8 Predicted noise levels are summarised in **Table 6.3** below:

Ref.	Location	Predicted Noise Level, $L_{Aeq,1hour}$ dB
R1	Flats at 7 Warwick Court, London WC1R 5DJ	26

Table 6.3: Predicted Noise Levels

6.9 Summary calculations supporting the above are attached at **Appendix D**.

London Borough of Camden Local Policy Requirements

6.10 As noted earlier, the technical guidance supporting the London Borough of Camden's adopted Local Plan recommends that plant noise emissions are controlled to a level set 10dB below the typical background level.

6.11 **Table 6.4** below assesses the predicted noise levels in terms of this recommendation:

Receptor Location	Rated Noise Level, $L_{Ar,T}$	LB Camden Assessment Criterion, dB	Difference between Rated Level and Assessment Criterion	Compliant Yes/No
R1	26	46	-20	**Yes**

Table 6.4: Comparison with LB Camden Plant Noise Criteria

6.12 The predicted noise levels have also been tested in the context of the additional guidance given by Camden in relation to small items of plant (such as air-conditioning units) and which recommends that noise emissions do not exceed a "Noise Rating" level of NR35.

6.13 **Table 6.5** below assess the predicted noise levels in terms of this recommendation:

	Octave Band Centre Frequency (Hz)								NR
	63	125	250	500	1000	2000	4000	8000	
NR 35	63	52	45	39	35	32	30	28	35
R1	28	31	26	24	18	16	15	5	21

Table 6.5: Noise Rating Assessment

6.14 The above Tables confirm that noise emissions from the plant comply fully with the London Borough of Camden's standard noise control recommendations.

BS4142:2014+A1:2019 Assessment

6.15 As noted earlier, the London Borough of Camden's technical guidance makes reference to BS 4142: 2014+A1: 2019: *"Method for Rating and Assessing Industrial and Commercial Sound".* If this guidance is aligned with that of the NPPF, NPPG and NPSE leads, the potential effect of plant noise emissions can be assessed in line with the following significance categorisation:

Difference Between Rating Level ($L_{Ar,T}$) and Typical Background Level ($L_{A90,15mins}$)	Effect
Less than -10	No observed effect
Between -10 and zero	No observed adverse effect
Between zero and +10	Observed adverse effect
More than +10	Significant observed adverse effect

Table 6.6: BS 4142 Noise Assessment

6.16 **Table 6.7** below provide a summary assessment in line with the principles of BS 4142:

Location	Predicted Noise Level, L_{Aeq}	Character correction, dB	Rated Noise Level, $L_{Ar,,1hour}$	Background Noise Level, L_{A90}	Difference between Rated and Background Noise Level, dB	Assessment Outcome
R1	26	0	26	56	**-30**	*"No observed effect"*

Table 6.7: BS 4142 Noise Assessment

6.17 The assessments presented above adopt a time period of 1 hour (assuming plant will operate during daytime hours only). No acoustic character corrections have been applied to the predictions as noise from plant of this nature is typically broadband i.e. it is unlikely to contain any dominant tones or characteristics based on the context of the specific noise level in the context of the (substantially higher) residual noise. It is also assumed that the plant will be in continuous in operation therefore no on-time correction has been applied. It is also assumed that all plant will be operating simultaneously at full capacity and thus represents an absolute worst-case scenario.

6.18 The above table concludes that noise levels at all receptor locations should have *"no observed effect"*.

Non-Residential Receptor

6.19 As noted earlier, a nine storey office building (First Avenue House) is located on the western side of Warwick Court, the upper windows of which will have a direct line of sight to the replacement condenser units (and existing plant installed in that locality). These windows are shown in **Figure 6.2** below;

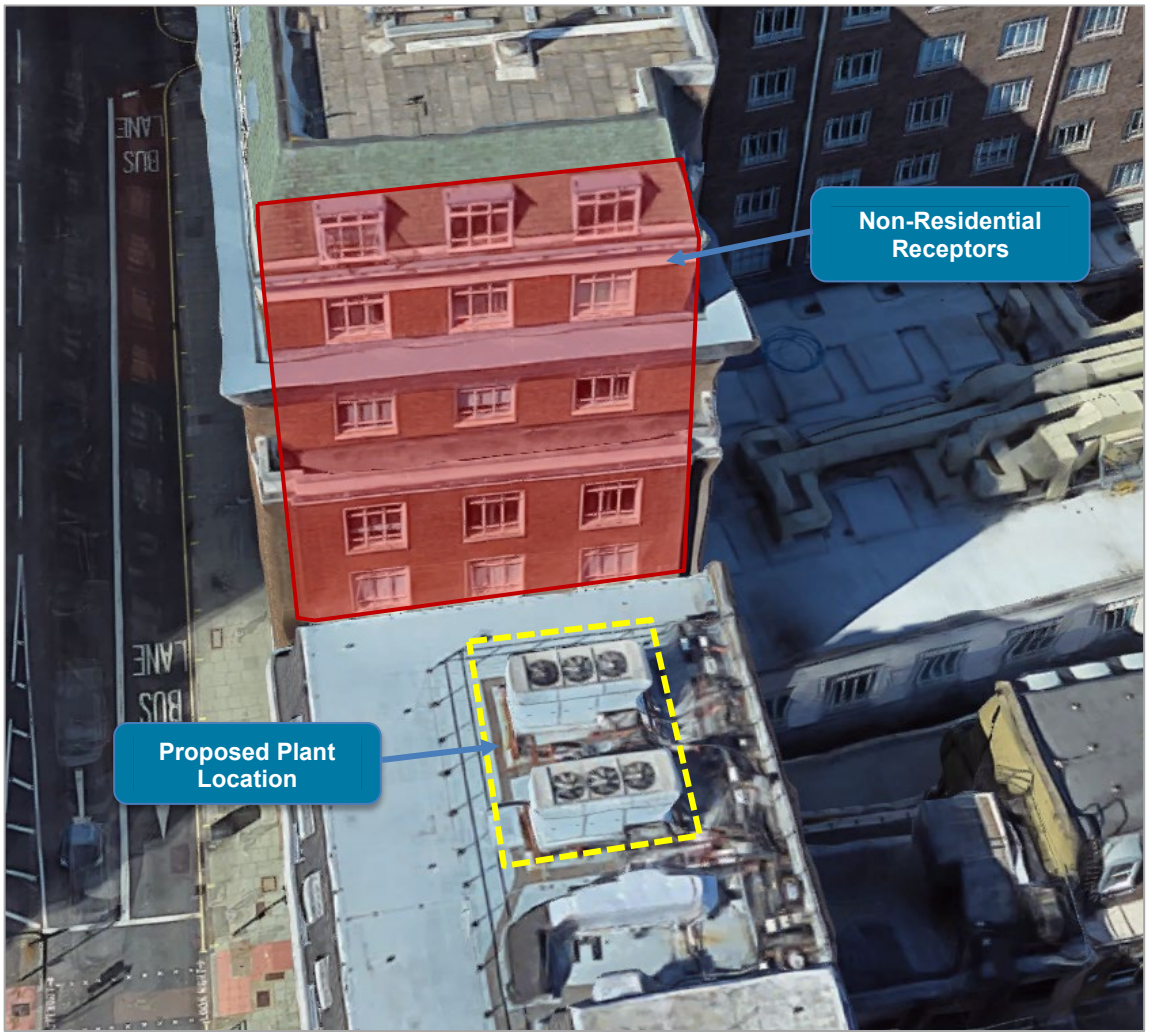


Figure 6.2: Location of Adjacent Office Accommodation

6.20 Calculations have also been undertaken to assess noise levels incident on these windows. Predicted noise level are presented in **Table 6.8** below. Summary calculations are attached at **Appendix D**.

Octave Band Centre Frequency (Hz)								
63	125	250	500	1000	2000	4000	8000	dB(A)
45	48	43	41	35	33	32	22	42

Table 6.8: Predicted Noise Levels – Eastern Elevation of First Avenue House

6.21 The above incident noise levels would equate to an internal sound level within the neighbouring office accommodation of around 29dB $L_{Aeq,T}$[2], based on a pessimistic assumption that the property was reliant on providing ventilation/ventilative cooling by means of openable windows.

6.22 It follows that plant noise intrusion into the neighbouring office space should be comfortably controlled in the context of BS 8233 and BCO guidance.

6.23 It is anticipated that the (closed) single glazed windows would provide a greater sound reduction of around 25dB(A)m which would equate to an internal sound level of around 17dB $L_{Aeq,T}$ which again would comply comfortably BS 8233/BCO guidance.

Summary

6.24 Plant noise emissions to neighbouring dwellings are calculated to comply with the London Borough of Camden's "standard" noise control policy requirements. This includes assessing the overall magnitude of predicted noise against the existing background noise levels and also the absolute level of noise relative to a reference "Noise Rating" curve of NR35.

6.25 Noise levels have also been assessed in general accordance with the principles of BS 4142: 2014 + A1: 2019, which concludes that plant noise emissions should have *"no observed effect"* on neighbouring dwellings.

6.26 Consideration has also been given to potential noise break-in to the office accommodation which has glazing overlooking the proposed roof plant compound. This assessment concludes that noise intrusion into the office space should be acceptably controlled in line with the guidance of BS 8233: 2014 / the BCO, even if windows are open (albeit that this is not required to provide thermal control to the units, given that they also benefit from the air conditioning accommodated within the plant compound).

[2] Assuming an outside to inside reduction of 13dB(A) for an open window

6.27 As highlighted earlier, the above conclusions are reached on the basis of an absolute "worst case" assumption, i.e. all plant will operate at full capacity simultaneously.

6.28 In light of the above, it is concluded that noise emissions at all receptor locations (both residential and commercial) should be controlled comfortably in line with relevant design targets.

7 Conclusions

7.1 An environmental noise survey has been undertaken to determine existing noise levels characterising the site.

7.2 National and local planning policy requirements are discussed and particular reference is made to the LB Camden's technical guidance, which includes specific advice in relation to noise emissions from building services plant installations.

7.3 An assessment of noise from the proposed condenser units has been undertaken.

7.4 This assessment indicates that the proposed plant installations would comply fully with the LPA's local policy requirement and resulting noise levels are unlikely to have any adverse impact on surrounding amenity, or constitute a material risk of creating creep to existing background and ambient noise levels currently characterizing the locality of the site.

7.5 Consideration has also been given to noise propagation to neighbouring commercial properties. Calculations again conclude that noise emissions to these should be controlled comfortably in line with relevant design guidance.

7.6 It is therefore concluded that the proposed condenser units comply fully with national and local planning policy objectives.

APPENDIX A:
Glossary of Acoustic Terminology

GLOSSARY OF ACOUSTIC TERMINOLOGY

General

A vibrating surface or turbulent fluid flow will cause pressure fluctuations in the surrounding air. These pressure fluctuations are perceived by the human ear as “sound”.

Measurement Units

The human ear can detect sound pressures as low as about 20 µPa, and can tolerate (for short periods) sound pressures as high as 200 Pa, an amplitude range of 10 million times. To take account of this huge amplitude range, sound pressure levels (often written in “acoustic shorthand” as SPL or Lp) are quantified using a logarithmic scale, the decibel (dB) scale. This is based on a reference pressure of 20µPa, thus a sound pressure of 20µPa would equate to 0dB and a pressure of 200Pa would equate to 140dB.

Frequency (Pitch) Characteristics

The sound received at any particular location is not solely influenced by the sound pressure level, the frequency characteristics (pitch) of the noise is also an important factor. Noise audible to a human (with “normal” hearing), typically covers the frequency range 20 Hertz to 20,000 Hertz. Hertz (Hz) are defined as the number of times the sound pressure fluctuates in one second. “Low” pitched sounds fluctuate less times per second than “high” pitched sounds. Whilst humans are capable of detecting a wide range of frequencies, the ear is not equally sensitive to all frequencies – the ear is most sensitive at frequencies towards the middle of the audible range and less sensitive to the lower and higher frequencies.

To take account of this frequency response, sound pressure fluctuations are normally quantified by applying a frequency-weighting network or filter which simulates the frequency response of the ear. In essence, this means that more significance is given to the frequencies at which the ear is most sensitive and less significance to those at which the ear is less sensitive. Noise measurements relating to human reaction are generally made using an “A-weighting” network. These measurements are reported as A-weighted decibels or dB(A). The A-weighted sound pressure level is written in “acoustic shorthand” as L_A.

Variation of Sound with Time

It will be appreciated that the sound pressure level of most noise sources will fluctuate with time. In order to take account of the way in which the human ear perceives noise, it is normal for the sound pressure level to be quantified using a time weighting network, to mimic the speed of response of the human ear. The standardised setting for most types of noise is a “Fast” time weighting.

The manner in which sound fluctuates with time can also influence the subjective manner in which noise is perceived. Noise can be continuous (showing no significant variation with time as in the case of a fan), intermittent (i.e. the noise is transient in it’s nature, such as a train pass-by) or impulsive (i.e. there is a sudden build up of noise - this can range from “clanking” types sounds as might be experienced next to railway goods yard or a high energy discharge such as an explosion)

Measurement of Sound

Sound pressure levels are measured using equipment comprising a pressure-sensitive microphone, associated amplifier, frequency weighting network, time weighted network and output indicator. In its simplest form this is a small hand-held instrument called a sound level meter. More sophisticated instrumentation (a sound level analyser) is also available which allows the real-time output of the frequency characteristics of the sound to be quantified.

Comparison of Sound Levels

To put the significance of noise measurement into context, the following Table presents the A-weighted sound pressure level of some typical sources:

Sound Pressure Level, dB(A)	Typical Noise Source . Activity
160	Saturn Rocket Taking Off
140	Military Jet Taking Off at 30m
100	Nightclub
90	Heavy goods vehicle driving past at 7m
80	Busy urban road
70	Domestic vacuum cleaner at 3m
60	Busy office environment
55	Normal speech at 1m
40	Whispered conversation at 2m
30	Bedroom at night (BS 8233: 1999)
20	Remote country location
0	Threshold of hearing – a very eery silence

Addition of Sound Levels

It is important to note that the use of a logarithmic scale to describe noise does not allow normal arithmetic addition. This means that two noise sources each generating a level of, say, 60dB(A) will not generate a combined sound level of 120dB(A). The values must be added logarithmically, which would actually yield a combined sound level of 63dB(A) in this example.

Subjective Perception of Sound Levels Changes

With regard to the human perception of sound level changes, the human ear:

- Cannot generally perceive a sound level difference of less than 3dB(A)
- Will perceive a sound level difference of 4-5dB(A) as “noticeable”
- Will perceive a sound level difference of 10dB(A) as a doubling (or halving) of loudness.

Acoustic Terminology

As stated previously, most sources of noise will fluctuate with time. In order to characterize such noise, it is therefore normal to represent the noise climate using a variety of noise parameters and statistical indices. The most commonly adopted noise parameters are described below:

$L_{Aeq,T}$ This is the equivalent continuous A-weighted sound level measured over a specified time period "T". This is the notional continuous sound level which, over the time T, contains the same amount of energy as the actual fluctuating sound being measured. This parameter is widely accepted as being the most appropriate noise descriptor for most environmental noise and the effects of noise on humans.

$L_{Amax,fast}$ This is maximum A-weighted sound pressure measured with a fast frequency response recorded during the stated measurement period. It is typically used to characterise the highest sound level caused during a noise event.

$L_{A90,T}$ This is the A-weighted sound pressure level exceeded for 90% of the specified time period "T". It is normally used to describe the underlying background noise level of an environment since it inherently excludes the effects of transient noise sources.

Noise Rating (NR) Level

When describing noise from building services installations, it is common to express noise levels in terms of a Noise Rating (NR) Level. The NR level is determined by plotting the measured frequency spectrum of a noise against a series of reference curves, which roughly approximate to equal loudness values. This method permits higher sound levels at low frequencies corresponding to the sensitivity of the human ear. The NR level is defined as the value of the highest curve "touched" by the plotted frequency spectrum. For typical sources of building services noise, the overall A-weighted sound level is numerically around 5-6dB higher than the NR level of the noise.

Airborne Sound Insulation Measurement Parameters

The ability of a building element to reduce airborne noise can be described by a number of different parameters relevant to both laboratory and on-site performance evaluation. In general, the higher these values, the better the resistance of the construction to the transmission of airborne sound. The most commonly used parameters include:

R_w The **"Weighted Sound Reduction Index"** (R_w) is a single value measure of the intrinsic sound reduction capabilities of a construction, as measured in an acoustic laboratory. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013.

R'_w The **"Weighted Apparent Sound Reduction Index"** (R'_w) is a single value measure of the apparent sound reduction capabilities of a construction, when installed on-site (which will normally be some way lower than the laboratory value due to less favourable installation conditions, the quality of workmanship, etc.). Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013. In practice, the R'_w of a construction can only be reliably determined if "direct" sound transfer through the partition can confidently be taken as the dominant noise transfer path (i.e. there is no "flanking" sound transmission.

D_w The **"Weighted Sound Level Difference"** (D_w) is a single value measure of the on-site sound reduction between two rooms. This value inherently includes "direct" sound transmission through any separating construction and "flanking" transmission through other building elements. Measurement values are determined in accordance with BS EN ISO 140-4: 1998 (for Building Regulations compliance purposes) or BS EN ISO 16283-1: 2014 and weighted in accordance with BS EN ISO 717-1: 2013.

$D_{n,fw}$ The "**Weighted Normalised Flanking Level Difference**" ($D_{nf,w}$) is a single figure measure of the sound reduction between two rooms solely due to sound transmission through a specified flanking path. This parameter is frequently used to provide an indication of the sound reduction capabilities of suspended ceiling and raised access floor constructions where there is common void between adjacent rooms or as a measure of sound that may be transmitted between rooms through external curtain walling. Measurements are undertaken in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-1: 2013.

Impact Sound Insulation Measurement Parameters

Some building elements also have the potential to generate "impact" noise, for example due to human "footfall" on floor structures, or the impact of rainfall on lightweight roofing components. A variety of parameters are again available to define the amount of noise likely to be generated. In general, the lower these values, the less sound the construction will generate as a result of impacts. Typical measurements parameters include:

$L_{nT,w}$ The "**Standardised Impact Sound Pressure Level**" is a "single number" rating describing the intrinsic impact sound insulation capabilities of a construction (such as a floor system) as measured in an acoustics laboratory. Values are determined in a vertical sound transmission suite by locating a "tapping machine" in the upper room of the suite and measuring the amount of sound radiated by the floor in the room below. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-2: 2013.

$L_{nf,w}$ The "**Normalised Flanking Impact Sound Pressure Level**" is a "single number" rating describing the amount of flanking sound that would be transmitted to an adjoining space (separated by a partition) due to impacts on the test sample. It is, for example, used to indicate the amount of noise that may be generated due to footfall noise on a raised access floor system. Values are determined in a horizontal sound transmission suite by locating a "tapping machine" one side of a separating partition built off the test sample and measuring the amount of noise radiated by the floor in the adjoining space on the other side of the partition. Measurement values are determined in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-2: 2013.

Room Acoustic Measurements

T The "**Reverberation Time**" (T) of a room is defined as the time taken for the sound energy produced by a source Time (RT)to decay by 60 dB after the source has been switched off. The reverberation time of a space can be calculated by considering the volume of the room and the areas and sound absorption qualities of room surface finishes. Small, "soft" rooms tend to give low reverberation times, whilst large, "hard" rooms tend to give long reverberation times.

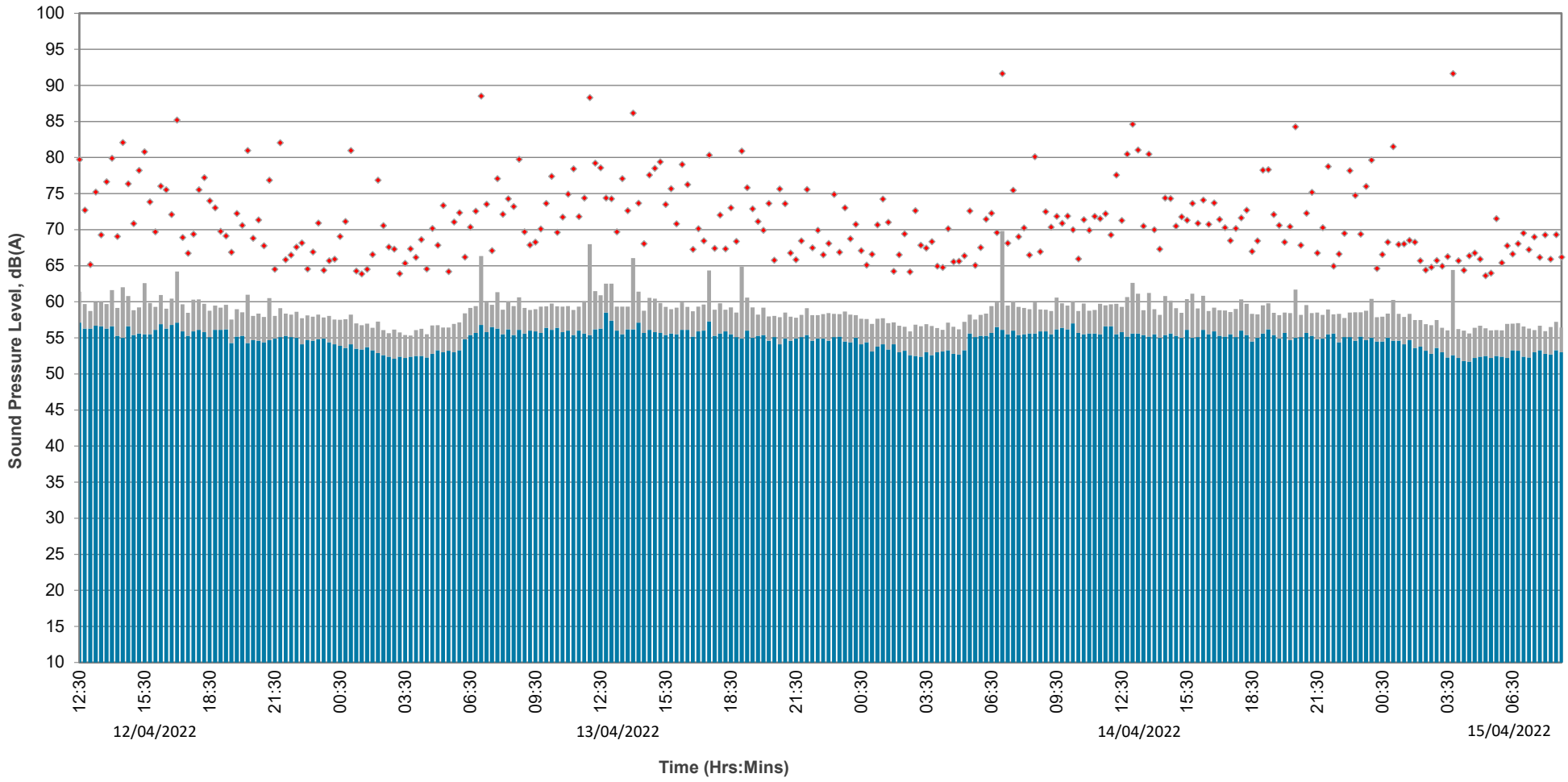
α_p The "**Practical Acoustic Absorption Coefficient**" (α_p) is a measure of how much sound energy is absorbed by a building element at a particular frequency, as measured in accordance with BS EN ISO 354: 2003.

α_w The "**Weighted Absorption Coefficient**" (α_w) is a single figure measure of the overall sound absorption capabilities of a building element determined in accordance with BS EN ISO 11654: 1997.

APPENDIX B:
Automated Noise Monitoring Results

Time History Graph A1

Project:	QHighHolburn(N).9
Measurement Location:	A1
Survey Period:	12/04/22 - 15/04/22



KEY: $L_{A90,15mins}$ $L_{Aeq,15mins}$ $L_{Amax,fast}$

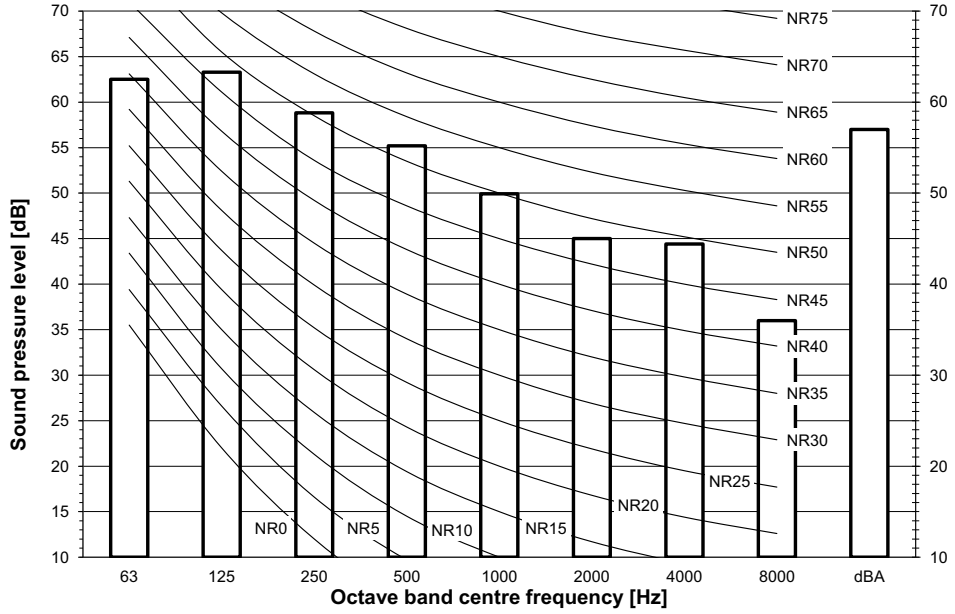
Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

APPENDIX C:
Manufacturer's Noise Specification Data

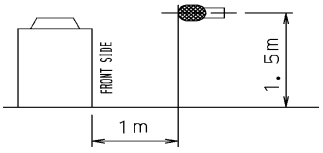
11 Sound data

11 - 2 Sound Pressure Spectrum

REMQ5U
REYQ8U
RXYQQ8U
RXYQ8U
RXYTQ8UYF
RYYQ8U
RYMQ8U

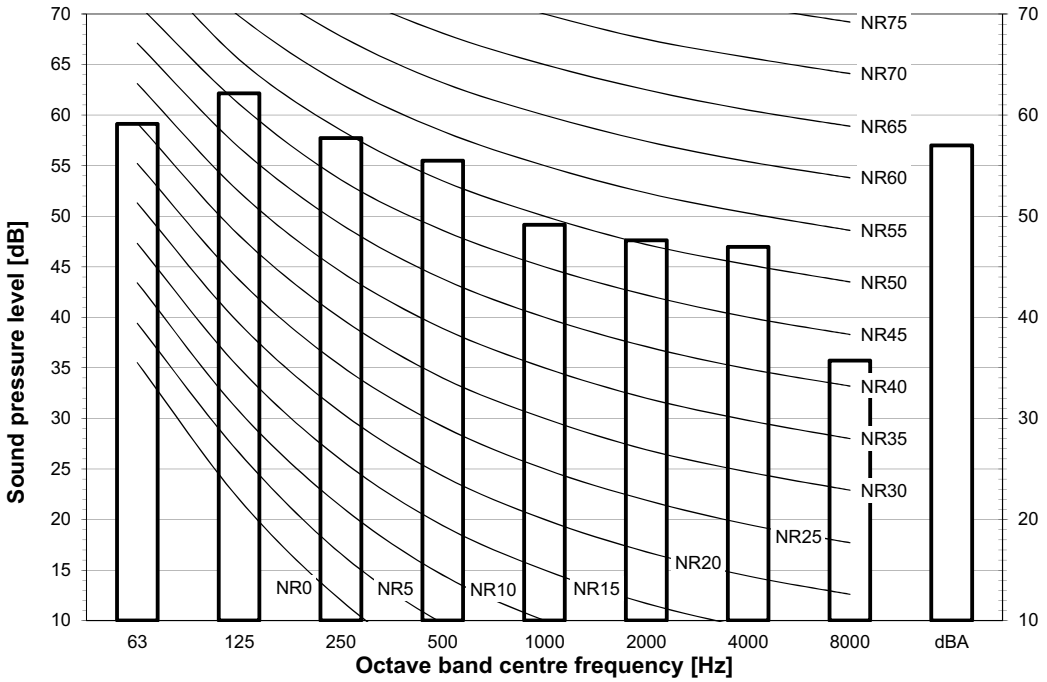


Notes
Data is valid at free field condition.
Data is valid at nominal operation condition.
dBA = A-weighted sound pressure level (A scale according to IEC).
Reference acoustic pressure 0 dB = 20 µPa

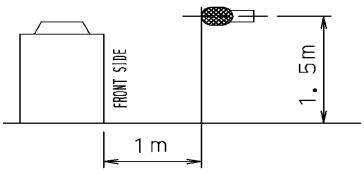


3D119521

REYQ10U
RXYQQ10U
RXYQ10U
RYYQ10U
RYMQ10U



Notes
Data is valid at free field condition.
Data is valid at nominal operation condition.
dBA = A-weighted sound pressure level (A scale according to IEC).
Reference acoustic pressure 0 dB = 20 µPa



3D119522

APPENDIX D:
Noise Propagation Calculation Sheets

CALCULATION SHEET	CS1	PAGE	1 of 1
PROJECT	Swan House, High Holburn		

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 38m)	32	32	32	32	32	32	32	32
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Component Noise Level	22	25	20	18	12	10	9	-1
Noise level at receptor	20 dB(A)							

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 38m)	32	32	32	32	32	32	32	32
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Component Noise Level	22	25	20	18	12	10	9	-1
Noise level at receptor	20 dB(A)							

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 38m)	32	32	32	32	32	32	32	32
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Component Noise Level	22	25	20	18	12	10	9	-1
Noise level at receptor	20 dB(A)							

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 38m)	32	32	32	32	32	32	32	32
Barrier Attenuation, A_{bar}	5	5	5	5	5	5	5	5
Component Noise Level	22	25	20	18	12	10	9	-1
Noise level at receptor	20 dB(A)							

TOTAL	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Octave Band Noise Levels	28	31	26	24	18	16	15	5
TOTAL SPECIFIC NOISE LEVEL	26 dB(A)							

CALCULATION SHEET	CS2	PAGE	1 of 1

PROJECT	Swan House, High Holburn

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 10m)	20	20	20	20	20	20	20	20
Component Noise Level	39	42	37	35	29	27	26	16
Noise level at receptor	**37 dB(A)**							

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 10m)	20	20	20	20	20	20	20	20
Component Noise Level	39	42	37	35	29	27	26	16
Noise level at receptor	**37 dB(A)**							

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 11m)	21	21	21	21	21	21	21	21
Component Noise Level	38	41	36	34	28	26	25	15
Noise level at receptor	**36 dB(A)**							

Daikin RXYSCQ4TVI	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level	59	62	57	55	49	47	46	36
Geometric Divergence, A_{div} (Distance = 11m)	21	21	21	21	21	21	21	21
Component Noise Level	38	41	36	34	28	26	25	15
Noise level at receptor	**36 dB(A)**							

TOTAL	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Octave Band Noise Levels	45	48	43	41	35	33	32	22
TOTAL SPECIFIC NOISE LEVEL	**42 dB(A)**							