Mechanical Plant Noise Impact Assessment
Planning Application

Chester Court, Lissenden Road
Hampstead Heath

Report ref.
NDT7173/24312/0

Issued to
Pellings

Prepared by
N D Treby BEng (Hons) MIOA MAES
Director

Version	Comments	Date
0	Initial report issue	11.12.24

SECTION	TITLE	PAGE

1. SUMMARY

- Pellings are assisting with the upgrade of heating plant at the Chester Court, Lissenden Rd, Hampstead Heath.
- The works include in the installation of 18 Air Source Heat Pumps (ASHP) on the roof of the building.
- The Local Authority, London Borough of Camden, require a noise impact assessment in accordance with their current guidelines to demonstrate that the proposed plant items meet their planning noise criteria.
- The nearest noise sensitive receptors to the plant are residential properties to the north and south of the site.
- The new plant will have the potential to operate at any time.
- This report describes the analysis carried out in determining the baseline noise environment, noise emission levels from the proposed condenser unit and the resultant sound pressure levels at the nearest noise-sensitive location for assessment purposes.
- The calculated rating level from the new plant, with all 18 units operating simultaneously is below the background sound level at all times.
- The noise impact therefore has been assessed as being low.

2. INTRODUCTION

Pellings are supporting the installation of 18 Air Source Heat Pumps (ASHP) intended to upgrade the heating, on the roof of Chester Court, Lissenden Rd, Hampstead Heath.

As part of planning policy The London Borough of Camden (LBC) require an acoustic report to be prepared assessing the noise impact of the proposed mechanical plant installation.

Spectrum Acoustic Consultants have been commissioned to assess the noise impact from the proposed equipment.

This report presents the results of the assessment, including:

- Details of LBC's noise policy;
- Measurements of existing background sound levels;
- Manufacturers noise data for the proposed condenser units;
- Predictions of noise levels to the nearest noise-sensitive receptor;
- Assessment of the noise impact against LBC policy.

3. SITE DESCRIPTION AND PROPOSALS

3.1 GENERAL DESCRIPTION OF THE SITE AND AREA

The site is in a predominantly residential area, and Chester Court is the tallest building, so the roof, which also has a low parapet wall is not overlooked by neighbouring residences.

The ambient sound at this location is predominantly road traffic, with intermittent noise from the nearby railway.

Figure 1: Site Location

Figure 2: Aerial image

The proposed plant layout is shown in Appendix A.

3.2 DETAILS OF PLANT

A product datasheet for the ASHP, including noise emission data, are given in Appendix B. The sound power levels of the proposed equipment is summarised in Table 1 below.

Manufacturer	Model and mode	Manufacturer's noise data
Samsung	EHS Monobloc – 8kW	Manufacturer's data is given as a sound power level L_{WA} of 63 dB.

Table 1: Manufacturer's noise data for proposed plant

The ASHP can operate at any time. This report assumes all units are operating simultaneously at all times.

4. CRITERIA

LBS Local Plan states:

> *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.*

LBC has prepared planning guidance on noise[1] as a formal Supplementary Planning Document (SPD) to support the Local Plan Policies.

The SPD requires an acoustic report to accompany any application where plant, ventilation, air extraction or conditioning equipment and flues are proposed. It states:

> *6.27 Developments proposing plant, ventilation, air extraction or conditioning equipment and flues will need to provide the system's technical specifications to the Council accompanying any acoustic report. 'BS4142 Method for rating Industrial and Commercial Sound' contains guidance and standards which should also be considered within the acoustic report.*

[1] Camden Planning Guidance Amenity, January 2021

6.28 There are however likely to be instances where the Council will consider that a BS4142 assessment alone is not sufficient to provide all the information necessary. Plant such as electrical substations for example, may meet BS4142 standards, but are also known to emit low frequency noise, which also needs to be considered. Developers are therefore encouraged to discuss proposals of this nature with the Council's Noise team before preparing their acoustic report - Email: RegulatoryServices@camden.gov.uk.

6.29 Plant, ventilation, air extraction or conditioning equipment and flues can cause disturbance to residential properties. The Council would therefore welcome the use of long-term maintenance agreements to ensure that equipment maintains acceptable noise levels over its lifetime and the use of timers to limit any unnecessary operation of the equipment.

We do not anticipate this plant requiring specifical additional requirements as outline in 6.28

The principle of BS 4142[2] referenced in the LBC SPD is to determine an initial estimate of impact of industrial/commercial sound on nearby residents by comparing the Rating Level (sound level from the industrial/commercial source, with a correction applied for any acoustic features that characterise the sound) with the Background Sound Level (L_{A90} as measured in absence of the industrial/commercial source).

Generally, the greater the difference by which the Rating Level exceeds the Background Sound Level, the greater the magnitude of impact. BS 4142 states that *'a difference of around +10 dB or more is likely to be an indication of a significant adverse impact […]. A difference of around +5 dB is likely to be an indication of an adverse impact […]. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.'*

However, BS 4142 also advises that ' *when making assessments and arriving at decisions […] it is essential to place the sound in context'* so in each case, the context in which the sound is placed must be considered and the initial estimate of impact should be modified accordingly. For example it advises '*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*.' It also indicates that impacts estimated during '*the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes*.'

Annex 3[3] of the local plan, referred to in Policy A4, suggests that a rating level 10 dB below the background sound level is needed to achieve a low observed adverse effect level. If achieved, this considered by the local plan as "green" where noise is considered acceptable. The plan advises that if the rating level is greater than 5 dB above the background sound, this is considered "significant" and so is categorised as red. In between these categories ins the zone defined as "amber" where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development. It should be noted this is more onerous than the guidelines of BS 4142.

[2] BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound
[3] Also forms part of the Draft Camden Local Plan 2024 Annex 3. We understand the engagement phase has concluded, but the document is not currently adopted.

5. SURVEY

5.1 MEASUREMENT PROCEDURE

An unmanned 24 hour background noise survey has been carried out between Tuesday 22nd and Friday 25th October 2024. The measurement position was located on the roof of the building representative of the background sound level of at the nearest noise-sensitive windows of the adjacent flats.

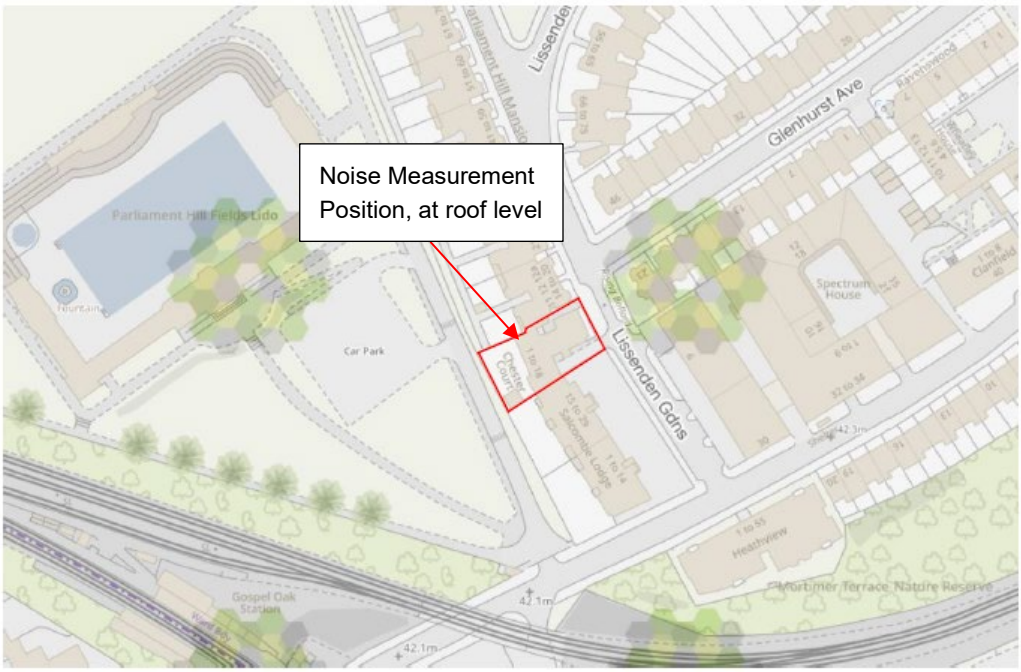


Figure 3: Noise Measurement Position

5.2 INSTRUMENTATION

The following instrumentation was used during the survey:

- Bruel & Kjaer Type 2250 Sound Level Meter s/n 3023840
- Bruel & Kjaer Type 4189 Microphone s/n 3130623
- Bruel & Kjaer Type 4231 Acoustic Calibrator s/n 3030524

Before and after the survey, the sound level meter was field-calibrated in accordance with the manufacturer's guidelines, and no significant drift was observed. The meter, microphone and field calibrator are laboratory calibrated biennially in accordance with UKAS procedures or to traceable National Standards.

5.3 MEASUREMENT RESULTS

Continuous measurements were taken over a 24-hour period, at 5 minute samples. Noise metrics consisted of equivalent continuous ($L_{Aeq,15min}$) noise levels and maximum (LAmax) noise levels as well as statistical noise levels (termed Ln, where n is the percentage of time the level is exceeded during the measurement period) including $L_{A90,15min}$ levels (the noise level exceeded for 90% of the individual measurement period) which is taken to be the background noise level. Overall A-weighted measurements were stored for later analysis.

Results of the background noise survey are included graphically in Appendix D. Table 2 summarise the measured background sound level.

Proposed Operating Period	Typical measured background noise level (L_{A90},5 min dB)
Day (0700-2300)	48
Night (2300-0700)	39

Table 3: Typical measured background sound level (based on the mode noise level over the defined time period)

6. ASSESSMENT

6.1 DESCRIPTION OF CALCULATIONS

The calculations have been based on the manufacturer's noise data, as discussed in more detail in Section 3.2 and Appendix B for the outdoor condenser unit.

The following receptor positions, 1 m from the nearest window, have been considered:

- Top floor windows of flats to the north of the site (11-20 Lissenden Gardens), to the front (east facing) and rear (west facing), referenced as N_1 and N_2 respectively
- Top floor windows of flats to the south of the site to the front (Salcombe Lodge), to the front (east facing) and rear (west facing) referenced as S_1 and S_2 respectively

Noise propagation to these receptor locations has been calculated based on the following assumptions:

- All units are operating simultaneously at full capacity at all times (including night)
- Attenuation is due to distance from noise source (geometric spreading);
- Directivity Index of 3 dB allowing for hemispherical propagation, as plant is mounted on the roof;
- Screening of 10 dB to the noise sensitive receptors, as the plant is well screened, by the geometry of the buildings;
- There is no atmospheric or ground absorption.

These assumptions will tend to predict a higher noise level at the receptor, so are considered a "noisiest case" assessment.

6.2 CALCULATIONS

The calculations are attached at Appendix E. The noise level resulting from the ASHP operating simultaneously is as follows:

- N_1: North (11-20 Lissenden Gardens), front (east facing), $L_{Aeq,T}$ 32 dB
- N_2: North (11-20 Lissenden Gardens), rear (west facing), $L_{Aeq,T}$ 33 dB
- S_1: South (Salcombe Lodge), front (east facing), $L_{Aeq,T}$ 35 dB
- S_2: South (Salcombe Lodge), rear (east facing), $L_{Aeq,T}$ 35 dB

To assess this against the requirements of BS 4142, as required by LBC planning policy, it is necessary to consider whether the sound generated by the ASHPs contains any acoustic features (such as tones and impulses) that would be present (ie would be audible at) the receptor location. In this case, even at night with all plant operating, the noise level from the ASHPs is quieter than the background sound level. As such, acoustic features would not be audible at the receptor locations. In any event, well maintained equipment would not be expected to be inherently tonal or impulsive. Therefore, the rating level (as defined in BS 4142) is equal to the calculated figures given above.

As advised in Section 4, where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact. This occurs at every location as shown in table.

Proposed Operating Period	Typical measured background noise level (L_{A90},5 min dB)	Equipment rating level (L_{Aeq}, dB)				Excess of Rating Level over Background Level			
		N_1	N_2	S_1	S_2	N_1	N_2	S_1	S_2
Day (0700-2300)	48	32	33	35	35	-16	-15	-13	-13
Night (2300-0700)	39					-7	-6	-4	-4

Table 4: Comparison of the plant rating level to the background sound level

Therefore, the noise impact of the plant is low when assessed in accordance with BS 4142 as advocated by the LBC SPD.

If assessed against the Draft Camden Local Plan[3], this would be considered a low observed adverse effect level (LOAEL) during the day (green category as defined in plan, where noise is considered acceptable), and at the low end of the range between a low observed adverse effect level, and a significant adverse effect level, at night (the amber category, where noise can be considered acceptable in the context of other merits of the development). Contextually, the assessment is considered worst case, as it includes for all ASHPs operating simultaneously, an unlikely operation scenario at night, is inherently quiet (the noise levels outside are sufficiently low such that noise levels inside, even with partially open windows, would meet BS 8233 recommendations for internal noise levels), and is in a location unlikely to be affected by background noise creep (where more and more plant is added over time).

Therefore, the proposed plant installation is unlikely to result in an adverse noise impact at nearby sensitive receptors and is considered compliant with relevant policy.

7. CONCLUSIONS

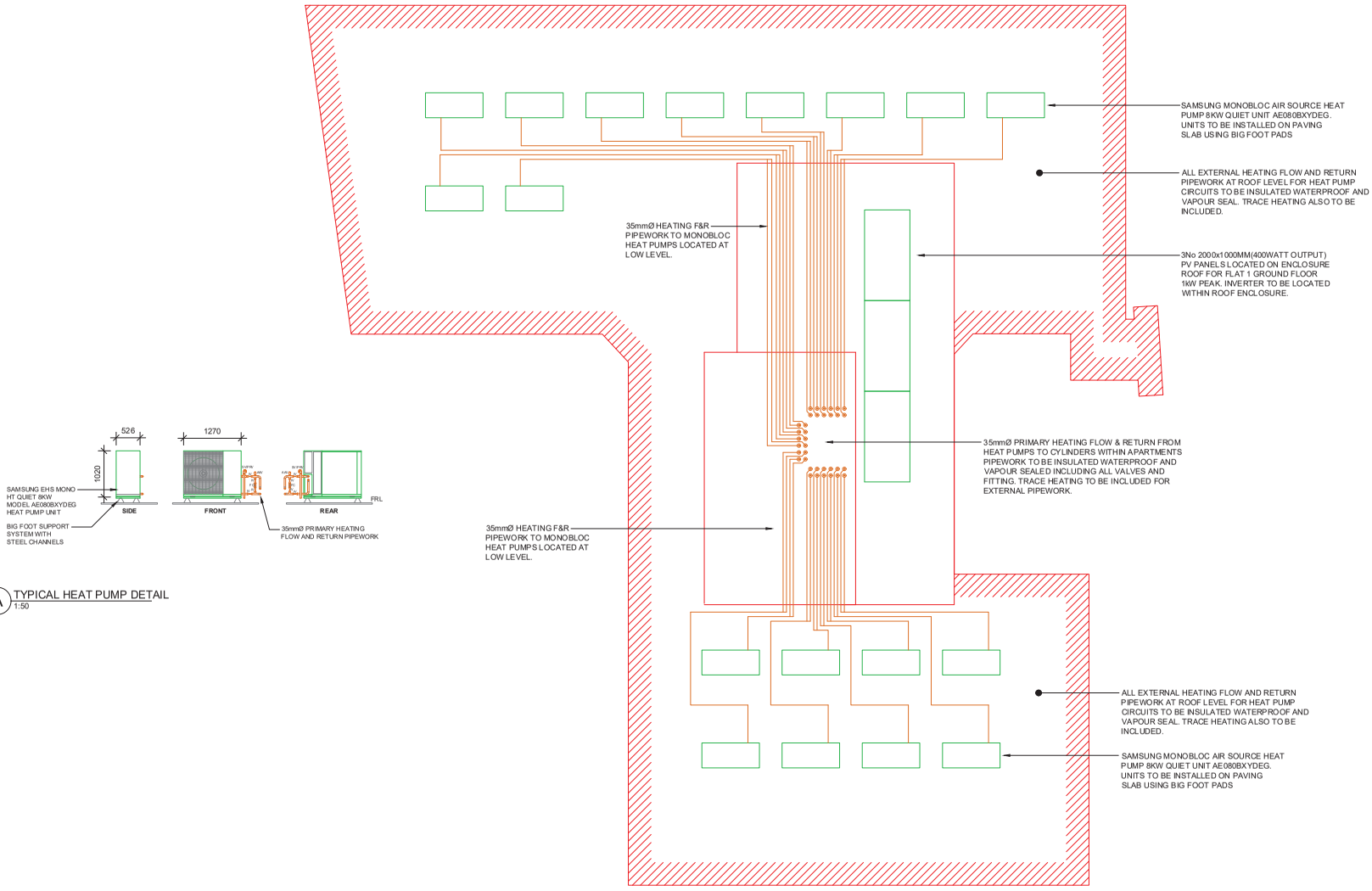
Pellings are assisting with the upgrade of heating plant at the Chester Court, Lissenden Rd, Hampstead Heath. 18 Air Source Heat Pumps (ASHP) are to be installed on the roof of the building.

A noise survey has been carried out to determine the existing ambient sound levels, and noise emission from the proposed plant has been calculated at the nearest noise-sensitive receptors.

Noise from the proposed plant has been assessed to show a low impact on nearby residents.

APPENDIX A

Proposed Plant Layout Drawings



A TYPICAL HEAT PUMP DETAIL
1:50

A1

Code	Usage	Revision Example
Work in Progress (WIP)		
S0	Initial Status or still in development for issuing to internal task teams	Preliminary revision and version: P00.01
Shared (non-contractual)		
S1	Issued to an external task team for coordination purposes	Preliminary revision: P00
S2	Issued to an external task team for information reference purposes	Preliminary revision: P00
S3	Issued to an external task team for review and comment purposes	Preliminary revision: P00
S4	Issued to the lead appointed party for review and authorization purposes	Preliminary revision: P00
S5	Issued to the appointing party for review and authorization purposes	Preliminary revision: P00
Published (contractual)		
A	Final issue with no comments from lead / appointing party	Contractural revision: C00
B	Partially approved with comments from lead / appointing party	Contractural revision and version: C00.01
CR	Construction record document	Contractural revision: C00

Suitability Code Table adapted from
ISO 19650-2:2018 NA.42 - Table NA2

NOTES:

1. This drawing is to be read in conjunction with all relevant architectural, structural and engineering services specifications, schedules and project specific documents.
2. All plant and equipment is to be installed to manufacturers recommendations allowing;
3. Full access for commissioning, maintenance and removal/replacement.
4. All dimensions in mm unless otherwise stated.
5. DO NOT SCALE from this drawing.
6. All external equipment to be IP65.
7. All fittings, plant and equipment to be installed, regulated and tested in accordance with the manufacturers printed instructions. All connections to equipment are indicative only.
8. Should any discrepancies be found with this drawing and any other associated drawings/specifications/reports this should be brought to the attention of the engineer immediately.
9. All below ground services are to be installed in line with NJUG documents.
10. Below ground drainage is shown only for coordination purposes. Refer to Civils documents for design details.

REV	DESCRIPTION	DATE	ISSUED BY	ISSUED TO
P00.01	INFORMATION	2024-11-26	CS	MS

CES GROUP
Coppergate House,
10 Whites Row,
London, United Kingdom
E1 7NF
Tel: +44 (0) 203 668 0387
Email: info@cesgroupglobal.com
Web: www.cesgroupglobal.com

Project
Chesterfield Court, Hampsted Heath

Client
The London Borough of Camden

Drawing Title
Mechanical Services
Mechanical Infrastructure
Roof Level

Architect

Internal Project Code
UK24087

Scale
1: 50

Suitability Code
S2 - INFORMATION

Client Project Code

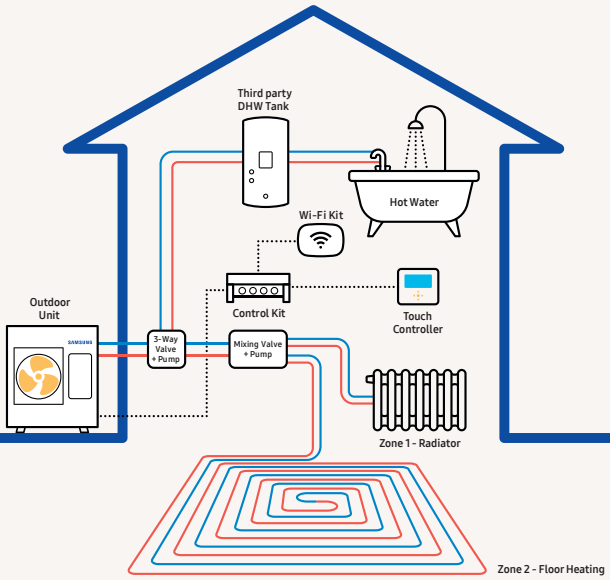
Drawing Reference
Project - Originator - Zone - Level - Type - Role - Number
24087-CES-ZZ-RF-DR-M-59007

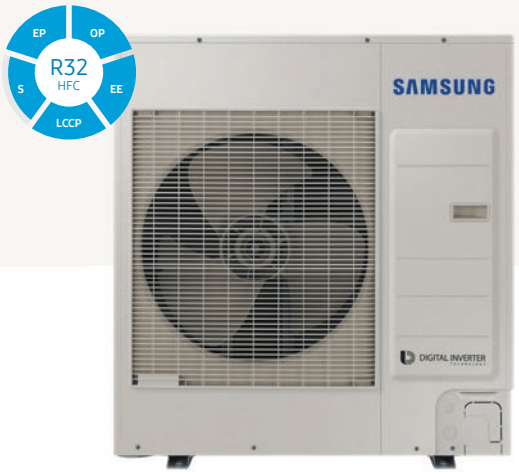
Revision
P00.01

APPENDIX B

ASHP Data Sheet

SAMSUNG





Samsung EHS Monobloc - 8kW

The EHS Mono can be used with the Samsung ClimateHub or connected to third party equipment such as a Domestic Hot Water (DHW) Tank thanks to the Samsung Mono control kit.

A+++ A++

Available Samsung product range						
Indoor Units			Outdoor Units	Controls		
Tank Integrated Hydro Unit	Wall-Mounted Hydro Unit	Third party DHW Tank	R32	Wireless	Wired	Centralised
Wall-Mounted	Duct	Console	R410A	Mono Control Kit	Wi-Fi Kit	

The SmartThings App can make any home a Smart Home with a simple click. The SmartThings App provides connectivity with the EHS heat pumps, WindFree™ air conditioners and Samsung audio/video appliances and devices through home Wi-Fi.

SmartThings

Specifications

Outdoor Unit / Control Kit					AE080RXYDEG/EU / MIM-E03CN
System	Operation	Nominal Capacity	Heating A7/W35[1] / A7/W55[2]	kW	8.0/7.1
			Cooling A35/W18[1]	kW	7.5
		Power Input (Nominal)	Heating A7/W35[1] / A7/W55[2]	kW	1.77/2.53
			Cooling A35/W18[1]	kW	1.90
		COP (Nominal Heating) A7/W35[1] / A7/W55[2]		W/W	4.52/2.81
		EER (Nominal Cooling) A35/W18[1]		W/W	3.95
		SCOP LWT 35°C/55°C		W/W	4.44/3.23
		Seasonal space heating enr.efficiency ηs LWT 35°C/ 55°C		ETA%	175/126
		Seasonal space heating eff. class* LWT 35°C/ 55°C		-	A+++ / A++
		Current	MCA	A	22.00
			MFA	A	27.50
		Leaving Water Temperature[3]	Heating	°C	15~65
			Cooling	°C	5~25
	Functions	Smart Grid Ready / PV Enabled		-	•
		3-Step Quiet Mode		-	•
		2-zone Control		-	•
Outdoor Unit	Power Supply			Φ, V, Hz	1Φ, 220~240 V, 50 Hz
	Compressor	Type		-	BLDC Twin Rotary
	Base Heater	Capacity		kW	0.15
	Sound	Sound Pressure[4]	Heating Std	dB(A)	48
			Cooling Std	dB(A)	48
		Sound Power	Heating Std	dB(A)	63
	Dimensions	Net Weight		kg	76.0
		Net Dimensions (WxHxD)		mm	940 x 998 x 330
	Piping	Water Pipe	Inlet/ Outlet	Φ, mm	25/ 25
	Refrigerant	Type			R32 (Fluorinated greenhouse gas, GWP=675)
		Factory Charging		tCO_2e	0.78
				kg	1.15
	Operation	Ambient Temperature	Heating	°C	-25~35
			Cooling	°C	10~46
			DHW	°C	-25~43

*A+++ energy label is available according to EU No. 811/2013 label classification 2019, on a scale from D to A+++

[1] A2W Condition : (Heating) Water In/Out 30°C/35°C, Outdoor Air 7°C[DB]/6°C[WB]; (Cooling) Water In/Out 23°C/18°C, Outdoor Air 35°C[DB].

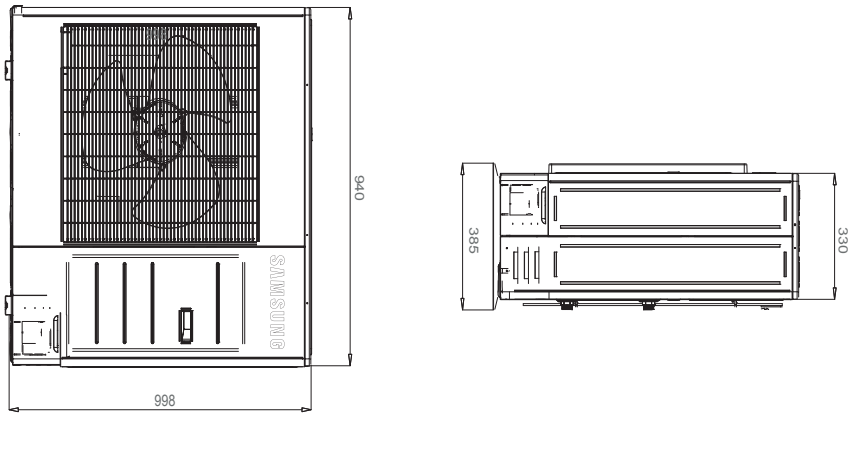
[2] A2W Condition : (Heating) Water In/Out 47°C/55°C, Outdoor Air 7°C[DB]/6°C[WB].

[3] 65°C down to +10°C (max. 60°C down to -5°C)

[4] Sound pressure level is obtained in an anechoic room. Sound pressure level is a relative value, depending on the distance and acoustic environment. Sound pressure level may differ depending on operation conditions.

PV enabled & Smart Grid Ready

It optimises the self-consumption of electricity produced by photovoltaic panels.
Connection is already prepared on the hydronic modules and in the ClimateHub and Samsung EHS systems.



Samsung Electronics Air Conditioner Europe B.V.

Evert van de Beekstraat 310, 1118 CX Schiphol
P.O. Box 75810, 1118 ZZ Schiphol
The Netherlands
+31 (0)8 81 41 61 00

APPENDIX C

London Borough of Camden Criteria – Noise Excerpts

Camden Planning Guidance

Amenity

January 2021

Camden

CPG Amenity

1 Introduction

What is Camden Planning Guidance?

1.1 The Council has prepared this guidance to support the policies in the Camden Local Plan 2017. It is a formal Supplementary Planning Document (SPD), which is therefore a "material consideration" in planning decisions.

1.2 This document should be read in conjunction with, and within the context of the relevant policies in the Camden Local Plan 2017.

Amenity in Camden

1.3 Standards of amenity (the features of a place that contribute to its attractiveness and comfort) are major factors in the health and quality of life of the borough's residents, workers and visitors and fundamental to Camden's attractiveness and success. Camden's Inner London location, the close proximity of various uses and the presence of major roads and railways means that amenity is a particularly important issue within the borough.

What does this guidance cover?

1.4 This guidance provides information on key amenity issues within the borough and includes the following sections relating to Local Plan Policy A1 – Managing the impact of development:

- Overlooking, privacy and outlook
- Daylight and sunlight
- Artificial light
- Construction management plans
- Noise and vibration
- Wind and micro-climate
- Contaminated land.

1.5 This document was adopted on 15 January 2021 following statutory consultation and replaces the Amenity CPG adopted March 2018 version which replaced the above sections in CPG 6 Amenity (adopted 2011).

6 Noise and vibration

KEY MESSAGES:

- The Council will assess the impact of noise and vibration through the consideration of acoustic reports submitted by applicants.
- Noise mitigation (where appropriate) is expected to be incorporated into developments at the design stage.
- The Council will secure mitigation measures through planning condition or legal agreement where necessary.
- The Council will adopt the 'agent of change' principle.

6.1 Noise and vibration can have a significant impact on amenity, quality of life and wellbeing. This section provides guidance regarding the application of Local Plan Policies A4 Noise and vibration and A1 Managing the impact of development, which seek to protect residents of both existing and new residential developments and the occupiers of other noise-sensitive developments from the adverse effects of noise and vibration. Appendix 3 of the Local Plan supports these policies and sets out expected standard in terms of noise and vibration.

6.2 This chapter contains guidance on the following:

- Assessing the impact of noise and vibration
- Acoustic reports
- Internal noise levels and vibration
- Plant and other noise generating equipment
- Food, drink, entertainment and leisure noise
- Delivery management.

Assessing the impact of noise and vibration.

6.3 The Council will assess the impact of noise and vibration though acoustic reports submitted by applicants.

When should acoustic reports be prepared?

6.4 When a planning application is submitted, an acoustic report should accompany the application where any of the following are proposed:

- plant, ventilation, air extraction or conditioning equipment and flues;
- uses likely to create significant noise such as food/drink/entertainment and leisure uses, industrial uses, day nurseries, places of worship, schools and colleges;
- a noise-sensitive use located in noisy environment (e.g. near to a busy road, railway line, noisy industry)
    - noise sensitive uses include housing, schools/libraries, hospitals, offices, workshops, laboratories, hotels and open spaces.
    - a noisy environment is considered to be an area where non-standard adaptations have to be made to a development in order to prevent harmful or otherwise unwanted effects, such as annoyance or sleep disturbance.

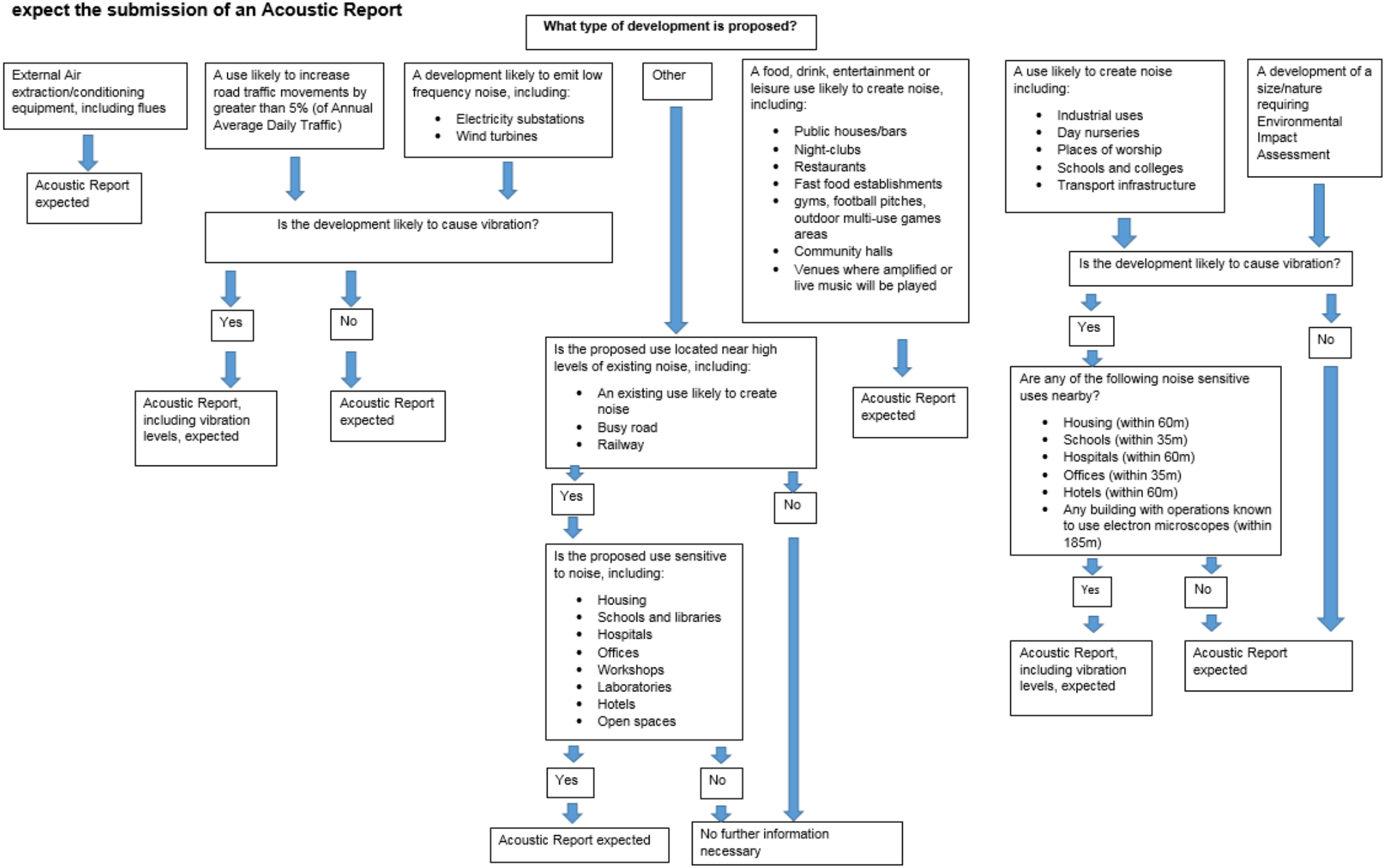
- uses likely to generate a significant amount of traffic (defined as road traffic movements greater than 5% of Annual Average Daily Traffic); and
- developments emitting low frequency noise (e.g. electricity substation).

6.5 Diagram 1 below summarises the instances of where an acoustic report is expected and where the report should also consider vibration impacts.

6.6 After planning permission is granted, an additional acoustic report should also be submitted to consider the noise impacts of the construction stage as part of Construction Management Plans (CMPs). Please see Camden Planning Guidance relating to CMPs and information on the Council's website for further information.

6.7 Development of a size and/or nature requiring Environmental Impact Assessment (EIA) should also submit an acoustic report.

Diagram 1: Flow chart showing when the Council will expect the submission of an Acoustic Report



Noise and vibration thresholds

6.8 When assessing acoustic reports, the Council will consider the reported measurements against the noise thresholds set out in Appendix 3 of the Local Plan. The thresholds are expressed as 'effect levels', which sets out a hierarchy of expected changes in behaviour and impact on health and wellbeing in response to increasing noise levels (measured in decibels - dB). The 'effect levels' are summarised below and explained in detail in National Planning Practice Guidance (NPPG). The table detailing each 'effect level' from NPPG is also set out in Appendix 1 to this guidance for ease of reference.

- No observed effect level (NOEL) – the level below which no effect can be detected on health and quality of life.
- Lowest observable adverse effect level (LOAEL) – the level above which changes in behaviour (e.g. closing windows for periods of the day) and adverse effects on health (e.g. sleep disturbance) and quality of life can be detected.
- Significant observed adverse effect level (SOAEL) – the level above which adverse effects on health and quality of life occur. This could include psychological stress, regular sleep deprivation and loss of appetite.

6.9 Where appropriate, the Council will also consider the cumulative impact of numerous individual noise sources where noise is known to be an issue. Camden's town centres for example are known to have a proliferation of air conditioning machinery and contain numerous food, drink, leisure and entertainment uses which all contribute to creating noisy environments.

Mitigating noise impacts

6.10 The implications of noise and vibration should be considered at the beginning of the design process so that the impacts of noise and vibration can be minimised. Examples of design features which could reduce noise impacts include (but are not limited to):

- locating noise sensitive areas/rooms away from the parts of the site most exposed to noises;
- creating setbacks;
- designing a building so its shape and orientation reflect noise and protect the most sensitive uses;
- stacking similar rooms (such as kitchens and living rooms) above each other;
- positioning non-residential uses closer to the noise source in mixed use developments;
- insulating and soundproofing doors, walls, windows, floors and ceilings;
- sealing air gaps around windows;
- double glazing;
- including architectural fins (where appropriate);
- laminated glass;
- anti-vibration foundations;
- noise barriers such as landscaping, fencing and solid balconies to reflect sound; and
- incorporating 'sound proof' construction/cladding materials.

6.11 In instances where noise mitigation is necessary, proposals will be expected to include appropriate attenuation to alleviate or mitigate the impact of noise and

vibrations to an acceptable level. Where noise mitigation has not been proposed adequately, but is considered necessary, the Council will consider the use of planning conditions or a legal agreement. Guidance regarding mitigation can be found within *BS8233:2014 Guidance on sound insulation and noise reduction for buildings*.

6.12 Examples of mitigation include:

- reducing the noise emitted at its point of generation (e.g. by using quiet machines and/or quiet methods of working);
- containing the noise generating equipment (e.g. by insulating buildings which house machinery and/or providing purpose-built barriers around the site);
- protecting any surrounding noise-sensitive buildings (e.g. by improving sound insulation in these buildings and/or screening them by purpose-built barriers);
- ensuring an adequate distance between source and noise-sensitive buildings or areas;
- screening by natural barriers, buildings, or non-critical rooms in the development.
- limiting the operating time of the source;
- restricting activities allowed on the site;
- specifying an acceptable noise limit;
- restricting window openings;
- sound proofing internal and external walls; and
- using cladding specifically designed for sound reduction.

Agent of change principle

6.13 In order so existing businesses do not have unreasonable restrictions put onto them because of changes in nearby land uses, the Council will apply the 'agent of change' principle. The 'agent of change' principle identifies the person or business responsible for the change is also responsible for managing the impact of the change.

6.14 Noise sensitive uses proposed near to existing uses/businesses likely to create significant noise should therefore include necessary features to mitigate the anticipated noise and vibration effects of the existing use/business nearby.

Acoustic reports

6.15 Camden's noise and vibration thresholds in Appendix 3 of the Local Plan provide the starting point for developing acoustic reports relating to:

- vibration;
- developments likely to be sensitive to noise;
- industrial and commercial noise; and
- entertainment noise.

6.16 Developers should also seek guidance from the Council's Noise team prior to any acoustic work being carried out in order so they can advise on the best methodology for the proposed development and any bespoke reporting for developments that may fall outside of the above categories.

The Camden Council Noise team can be contacted at RegulatoryServices@camden.gov.uk

6.17 Assessments should be carried out and produced by a suitably qualified and competent consultant and conform to the standards in *BS7445 1-3:2003 Description and measurement of environmental noise* (or any later replacement guidance).

6.18 As assessment and guidance for noise and vibration control is always evolving, applicants must ensure that they consider amendments or updates to existing noise guidance. Where there is uncertainty, they should contact the Council's Noise team for clarification.

6.19 The appropriate amount and detail of information required will depend on the specific circumstances of a proposal. Details and information forming the minimum requirements for specific types of development can be provided by the Council's Noise team.

6.20 The minimum below information is expected to be submitted as part of an acoustic report:

- description of the proposal;
- description of the site and surroundings, a site map showing noise and vibration sources and measurement locations;
- background noise levels measured over a minimum of 24 hours;
- details of instruments and methodology used for noise measurements (including reasons for settings and descriptors used, calibration details);
- details of the plant or other source of noise and vibration both on plan and elevations and manufacturers specifications;
- noise or vibration output from proposed plant or other source of noise and vibration, including:
    - noise or vibration levels;
    - frequency of the output; and
    - length of time of the output.
- features of the noise or vibration e.g. impulses, distinguishable continuous tone, irregular bursts;
- specification of the plant, supporting structure, fixtures and finishes;
- location of noise sensitive uses and neighbouring windows;
- details of measures to mitigate noise and vibration;
- details of any associated work including acoustic enclosures and/or screening;
- cumulative noise levels; and;
- hours/days of operation.

6.21 In order to demonstrate all the above has been submitted, a copy of the Council's acoustic report Checklist should also be submitted along with the report.

Internal noise levels and vibration

Internal noise levels

6.22 The requirements of the Building Regulations are usually adequate for the sound insulation between floors and walls of adjoining dwellings, making planning conditions unnecessary.

6.23 The requirements of the Building Regulations are however likely to be inadequate in instances where:

- a new commercial use likely to generate noise adjoins an existing residential building (and vice versa); and/or
- a change of use will result in a residential development being sited in a noisy environment.

6.24 Where such development is proposed, the Council is likely to use planning conditions requiring substantially enhanced sound insulation of relevant walls, floors and ceilings compared to the minimum specifications of the Building Regulations. In proposing conditions, the Council will consider guidance available within *BS8233:2014 Guidance on sound insulation and noise reduction for buildings*, Guidelines for Community Noise (1999) and Night Noise Guidelines for Europe (2009) published by the World Health Organisation.

Vibration

6.25 Vibrations transmitted through the structure of a building can be detected by its occupants and can result in adverse effects. Depending on the timing and the nature of the vibration, occupants may have disturbed sleep or struggle to work efficiently. Vibration at higher magnitudes can even act to damage a building over time.

6.26 When assessing the impact of vibration, the Council will expect the vibration thresholds within Camden Local Plan Appendix 3 not be exceeded and consider guidance from *B6472-1:2008 'Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting'*.

Plant and other noise generating equipment

6.27 Developments proposing plant, ventilation, air extraction or conditioning equipment and flues will need to provide the system's technical specifications to the Council accompanying any acoustic report. '*BS4142 Method for rating Industrial and Commercial Sound*' contains guidance and standards which should also be considered within the acoustic report.

6.28 There are however likely to be instances where the Council will consider that a BS4142 assessment alone is not sufficient to provide all the information necessary. Plant such as electrical substations for example, may meet BS4142 standards, but are also known to emit low frequency noise, which also needs to be considered. Developers are therefore encouraged to discuss proposals of this nature with the Council's Noise team before preparing their acoustic report - Email: RegulatoryServices@camden.gov.uk.

6.29 Plant, ventilation, air extraction or conditioning equipment and flues can cause disturbance to residential properties. The Council would therefore welcome the use of long-term maintenance agreements to ensure that equipment maintains acceptable noise levels over its lifetime and the use of timers to limit any unnecessary operation of the equipment.

Food, drink, entertainment and leisure noise

6.30 Food, drink, entertainment and leisure uses can pose particular difficulties in terms of noise and disturbance, as their peak operating time is usually in the evening and late at night.

6.31 Where such uses are proposed, access routes, outdoor standing/seating areas, smoking areas, pub gardens, etc. should be sited away from noise sensitive facades and/or effectively screened.

6.32 The Council expects the noise impacts of these uses to be considered within an acoustic report. Assessments of noise from entertainment and leisure premises must include consideration of amplified and unamplified music, human voices, footfall, vehicle movements and other general activity. Developers should contact the Council's Noise team to discuss the most appropriate methodologies to undertake the assessment.

6.33 Principally, in order to manage food, drink, entertainment and leisure noise, the Council will consider the use of planning conditions to control aspects such as (but not limited to):

- opening times;
- amplified music (e.g. times when music can be played and maximum volumes); and
- restrictions on times where outdoor standing/seating areas can be used.

6.34 In line with Local Plan policies TC4 and C5, the Council will also consider the use of management plans secured through a section 106 legal agreement, which may include elements principally seeking to manage noise off-site. Examples could include:

- staff training;
- positioning queues away from residential buildings; and
- ensuring that bottles and cans are not disposed of in outdoor bins areas late at night.

In order for existing businesses to continue operating without restriction, in instances where a noise sensitive use is proposed near to an existing food, drink, entertainment or leisure venue known to generate noise and vibration, the Council will apply the 'agent of change' principle (referred to in Section 1). Within Camden, this will often mean that residential development will be expected to include sufficient insulation to mitigate the anticipated noise and vibration effects of a nearby food, drink, entertainment or leisure venue.

Delivery management

6.35 Deliveries and collections can cause disruption to nearby residential properties. When preparing Delivery and Servicing Management Plans, in order to reduce noise impacts regard should be given to the following:

- Noise Abatement Society's Silent Approach Quiet Night Time Delivery Scheme;
- Guidance published by Transport for London regarding retiming and consolidating deliveries;
- Freight Transport Association Guidance Delivering the Goods – a toolkit for improving night-time deliveries; and
- Camden Local Plan Policy T4 Sustainable movement of goods and materials and associated Camden Planning Guidance to reduce the number of overall deliveries.

6.36 The Council expects that deliveries and refuse collections to be carried out between 08:00-20:00hrs. Developments requiring deliveries outside of these times should provide an acoustic report to demonstrate there will be no adverse impact in relation to noise, with particular reference to residential occupiers as a result of these activities. When preparing the assessment, regard should be given to *BS4142 Method for rating and assessing industrial and commercial sound*. Developers are however encouraged to discuss their proposals with the Council's Noise team before conducting their acoustic report. (Email: RegulatoryServices@camden.gov.uk.)

Appendix 1: Effect level hierarchy

Perception	Examples of outcomes	Increasing effect level	Action
No observed effect level (NOEL)			
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 observable adverse effect level (LOAEL)			
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; 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 perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant observed adverse effect level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Adapted from table cited in NPPG Paragraph: 005 Reference ID: 30-005-201

Camden Local Plan

2017

Camden

Noise and vibration

6.84 This policy seeks to ensure that noise and vibration is appropriately considered at the design stage and that noise sensitive uses are not negatively impacted by noise and vibration or that existing uses (such as music venues, theatres and some employment uses) are not unduly restricted through the introduction of nearby noise sensitive uses.

6.85 Noise and vibration can have a major effect on health and amenity and quality of life. Camden's high density and mixed use nature means that disturbance from noise and vibration is a particularly important issue for health and wellbeing in the borough. The Council may seek to explore the identification and designation of Quiet Areas, which are local green spaces identified for their particular tranquility and amenity value.

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.

Sources and the character of noise in Camden

6.86 The main sources of noise and vibration in Camden are; road traffic, railways, industrial uses, plant and mechanical equipment, food, drink and entertainment uses, and building sites. The top six sources of noise that receive the most complaints in Camden are; music, construction noise, general people noise (e.g. footsteps, gathering), parties, fixed machinery and burglar alarms.

6.87 There is a proliferation of fixed machinery, such as air conditioning units in Camden's centres which cumulatively can have a harmful impact. The borough is also home to a large number and variety of food, drink and entertainment uses, often close to where people live, and as a result, conflicts can arise (see Policy TC4 Town centre uses). Such sources of noise and the character of noise can increase stress levels and cause significant disturbance. Other sources of noise such as those associated with construction are considered in Policy A1

Appendix 3: Noise thresholds

The significance of noise impact varies dependent on the different noise sources, receptors and times of operation presented for consideration within a planning application. Therefore, Camden's thresholds for noise and vibration evaluate noise impact in terms of various 'effect levels' described in the National Planning Policy Framework and Planning Practice Guidance:

- NOEL – No Observed Effect Level
- LOAEL – Lowest Observed Adverse Effect Level
- SOAEL – Significant Observed Adverse Effect Level

Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables. The values will vary depending on the context, type of noise and sensitivity of the receptor:

- Green – where noise is considered to be at an acceptable level.
- Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.
- Red – where noise is observed to have a significant adverse effect.

Vibration

Table A: Vibration levels from uses such as railways, roads, leisure and entertainment premises and/or plant or machinery at which planning permission will not normally be granted

Vibration description and location of measurement	Period	Time	Vibration Levels (Vibration Dose Values)
Vibration inside critical areas such as a hospital operating theatre	Day, evening and night	00:00-24:00	0.1 VDV ms-1.75
Vibration inside dwellings	Day and evening	07:00-23:00	0.2 to 0.4 VDV ms-1.75
Vibration inside dwellings	Night	23:00-07:00	0.13 VDV ms-1.75
Vibration inside offices	Day, evening and night	00:00-24:00	0.4 VDV ms-1.75
Vibration inside workshops	Day, evening and night	00:00-24:00	0.8 VDV ms-1.75

Proposed Developments likely to be Sensitive to Noise

Special consideration will need to be given to noise sensitive developments that are proposed in areas which are, or expected to become, subject to levels of noise likely to have an adverse effect. The threshold of acceptability of the noise will primarily depend on two factors: the intended use of the noise sensitive development and the source of the noise experienced, or likely to be experienced.

Table B: Noise levels applicable to noise sensitive residential development proposed in areas of existing noise

Dominant Noise Source	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Anonymous noise such as general environmental noise, road traffic and rail traffic ~	Noise at 1 metre from noise sensitive façade/free field	Day	<50dB$L_{Aeq,16hr}$*	50dB to 72dB$L_{Aeq,6hr}$*	>72dB$L_{Aeq,16hr}$*
		Night	<45dB$L_{Aeq,8hr3}$ <40 dB$L_{Aeq,8hr}$**	45dB to 62dB$L_{Aeq,8hr}$* >40dBL_{night}**	>62dB$L_{Aeq,8hrs}$*
	Inside a bedroom	Day	<35dB$L_{Aeq,16hr}$	35dB to 45dB$L_{Aeq,16hr}$	>45dB$L_{Aeq,16hr}$
		Night	<30dB$L_{Aeq,8hr}$ 42dB$L_{Amax,fast}$	30dB to 40dB$L_{Aeq,16hr}$ 40dB to 73dB$L_{Amax,fast}$	>40dB$L_{Aeq,\ 8hr}$ >73dB$L_{Amax,fast}$
	Outdoor living space (free field)	Day	<50dB$L_{Aeq,16hr}$	50dB to 55dB$L_{Aeq,6hr}$	>55dB$L_{Aeq,16hr}$
Non-anonymous noise	See guidance note on non-anonymous noise				

*LAeq, T values specified for outside a bedroom window are façade levels
**Lnight values specified for outside a bedroom window are free field levels

The levels given above are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises. The Council will also 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.

Industrial and Commercial Noise Sources

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).

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (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.

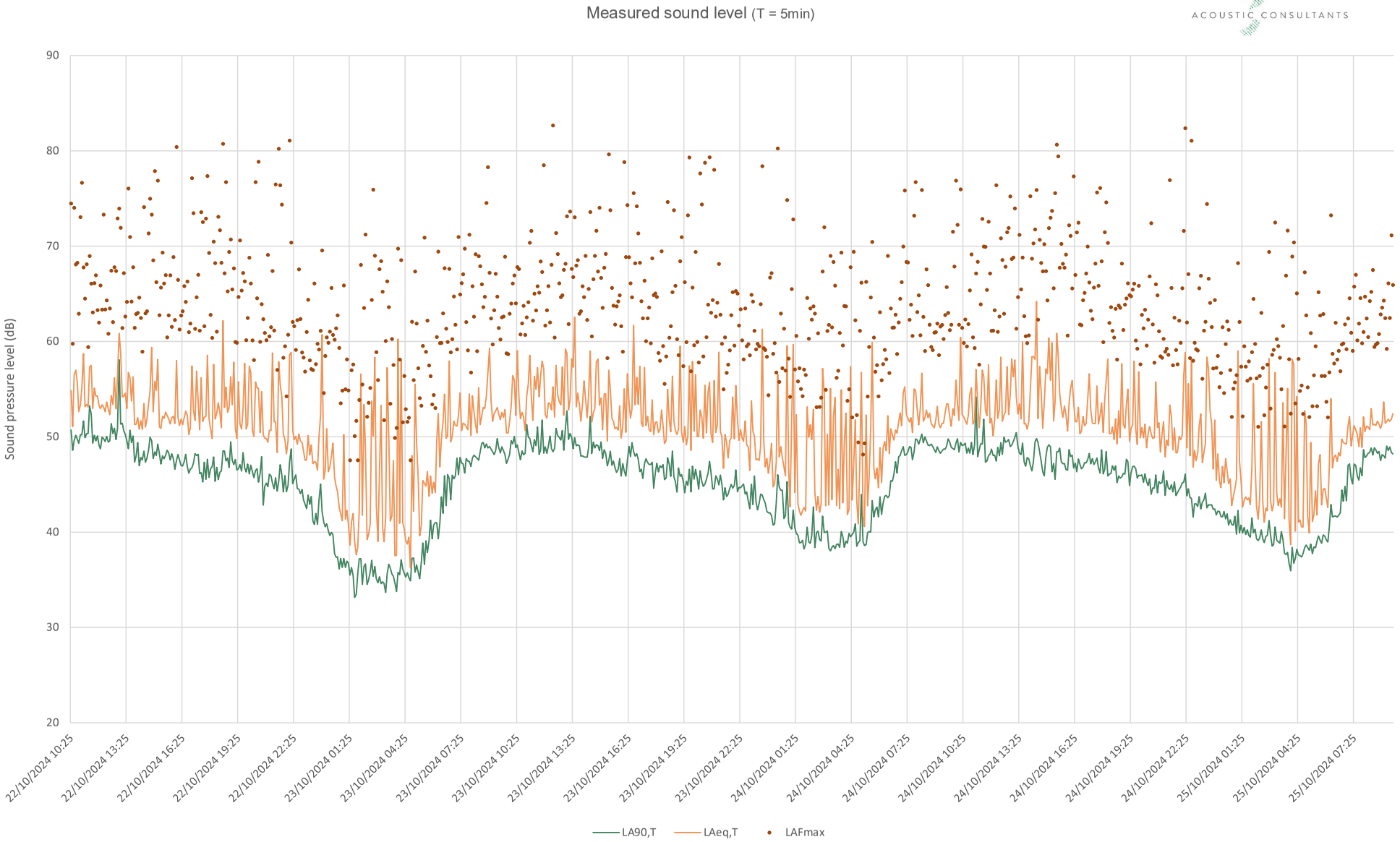
There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally 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.

APPENDIX D

Noise Survey Details and Results

Chester Court rooftop, western corner



APPENDIX E

Calculated Noise Levels

Simple noise propagation calculation

Project:	Chester Court
Project number:	24312
Date:	11/12/2024

Operating condition/scenario:	ASHP Operation
Receptor:	North, front

Source	Sound Power Level, dB(A)	Distance to receptor (m)	Directivity Index, dB	Attenuation			% On-Time	Predicted noise level, dB(A)
				Geometric spreading, dB(A)	Screening, dB(A)	Total attenuation, dB(A)		
ASHP 1	63	21	3	34	10	44	100%	19
ASHP 2	63	22	3	35	10	45	100%	18
ASHP 3	63	24	3	36	10	46	100%	17
ASHP 4	63	26	3	36	10	46	100%	17
ASHP 5	63	27	3	37	10	47	100%	16
ASHP 6	63	28	3	37	10	47	100%	16
ASHP 7	63	29	3	37	10	47	100%	16
ASHP 8	63	30	3	38	10	48	100%	15
ASHP 9	63	30	3	38	10	48	100%	15
ASHP 10	63	29	3	37	10	47	100%	16
ASHP 11	63	13	3	30	10	40	100%	23
ASHP 12	63	13	3	30	10	40	100%	23
ASHP 13	63	13	3	30	10	40	100%	23
ASHP 14	63	13	3	30	10	40	100%	23
ASHP 15	63	18	3	33	10	43	100%	20
ASHP 16	63	18	3	33	10	43	100%	20
ASHP 17	63	18	3	33	10	43	100%	20
ASHP 18	63	18	3	33	10	43	100%	20
Total								**32**

$$L_p = L_{wA} - 20\log(r) - 11 + DI - A_{misc}$$

where L_p is the predicted noise level; L_{wA} is the sound power level; r is distance; DI is the directivity index; and A_{misc} is the attenuation from other miscellaneous factors (i.e. screening/ground effect/atmospheric absorption/foliage).

Simple noise propagation calculation

Project:	Chester Court
Project number:	24312
Date:	11/12/2024

Operating condition/scenario:	ASHP Operation
Receptor:	North, rear

Source	Sound Power Level, dB(A)	Distance to receptor (m)	Directivity Index, dB	Attenuation			% On-Time	Predicted noise level, dB(A)
				Geometric spreading, dB(A)	Screening, dB(A)	Total attenuation, dB(A)		
ASHP 1	63	8	3	26	10	36	100%	27
ASHP 2	63	12	3	30	10	40	100%	23
ASHP 3	63	15	3	32	10	42	100%	21
ASHP 4	63	19	3	34	10	44	100%	19
ASHP 5	63	23	3	35	10	45	100%	18
ASHP 6	63	26	3	36	10	46	100%	17
ASHP 7	63	29	3	37	10	47	100%	16
ASHP 8	63	32	3	38	10	48	100%	15
ASHP 9	63	32	3	38	10	48	100%	15
ASHP 10	63	29	3	37	10	47	100%	16
ASHP 11	63	15	3	32	10	42	100%	21
ASHP 12	63	15	3	32	10	42	100%	21
ASHP 13	63	15	3	32	10	42	100%	21
ASHP 14	63	15	3	32	10	42	100%	21
ASHP 15	63	17	3	33	10	43	100%	20
ASHP 16	63	17	3	33	10	43	100%	20
ASHP 17	63	17	3	33	10	43	100%	20
ASHP 18	63	17	3	33	10	43	100%	20
Total								**33**

$$L_p = L_{wA} - 20\log(r) - 11 + DI - A_{misc}$$

where L_p is the predicted noise level; L_{wA} is the sound power level; r is distance; DI is the directivity index; and A_{misc} is the attenuation from other miscellaneous factors (i.e. screening/ground effect/atmospheric absorption/foliage).

Simple noise propagation calculation

Project:	Chester Court
Project number:	24312
Date:	11/12/2024

Operating condition/scenario:	ASHP Operation
Receptor:	South, front

Source	Sound Power Level, dB(A)	Distance to receptor (m)	Directivity Index, dB	Attenuation			% On-Time	Predicted noise level, dB(A)
				Geometric spreading, dB(A)	Screening, dB(A)	Total attenuation, dB(A)		
ASHP 1	63	35	3	39	10	49	100%	14
ASHP 2	63	31	3	38	10	48	100%	15
ASHP 3	63	27	3	37	10	47	100%	16
ASHP 4	63	23	3	35	10	45	100%	18
ASHP 5	63	19	3	34	10	44	100%	19
ASHP 6	63	15	3	32	10	42	100%	21
ASHP 7	63	10	3	28	10	38	100%	25
ASHP 8	63	10	3	28	10	38	100%	25
ASHP 9	63	10	3	28	10	38	100%	25
ASHP 10	63	10	3	28	10	38	100%	25
ASHP 11	63	17	3	33	10	43	100%	20
ASHP 12	63	17	3	33	10	43	100%	20
ASHP 13	63	17	3	33	10	43	100%	20
ASHP 14	63	17	3	33	10	43	100%	20
ASHP 15	63	13	3	30	10	40	100%	23
ASHP 16	63	13	3	30	10	40	100%	23
ASHP 17	63	13	3	30	10	40	100%	23
ASHP 18	63	13	3	30	10	40	100%	23
Total								**35**

$$L_p = L_{wA} - 20\log(r) - 11 + DI - A_{misc}$$

where L_p is the predicted noise level; L_{wA} is the sound power level; r is distance; DI is the directivity index; and A_{misc} is the attenuation from other miscellaneous factors (i.e. screening/ground effect/atmospheric absorption/foliage).

Simple noise propagation calculation

Project:	Chester Court
Project number:	24312
Date:	11/12/2024

Operating condition/scenario:	ASHP Operation
Receptor:	South, rear

Source	Sound Power Level, dB(A)	Distance to receptor (m)	Directivity Index, dB	Attenuation			% On-Time	Predicted noise level, dB(A)
				Geometric spreading, dB(A)	Screening, dB(A)	Total attenuation, dB(A)		
ASHP 1	63	31	3	38	10	48	100%	15
ASHP 2	63	27	3	37	10	47	100%	16
ASHP 3	63	23	3	35	10	45	100%	18
ASHP 4	63	19	3	34	10	44	100%	19
ASHP 5	63	15	3	32	10	42	100%	21
ASHP 6	63	11	3	29	10	39	100%	24
ASHP 7	63	8	3	26	10	36	100%	27
ASHP 8	63	8	3	26	10	36	100%	27
ASHP 9	63	8	3	26	10	36	100%	27
ASHP 10	63	8	3	26	10	36	100%	27
ASHP 11	63	25	3	36	10	46	100%	17
ASHP 12	63	25	3	36	10	46	100%	17
ASHP 13	63	25	3	36	10	46	100%	17
ASHP 14	63	25	3	36	10	46	100%	17
ASHP 15	63	21	3	34	10	44	100%	19
ASHP 16	63	21	3	34	10	44	100%	19
ASHP 17	63	21	3	34	10	44	100%	19
ASHP 18	63	21	3	34	10	44	100%	19
Total								**35**

$$L_p = L_{wA} - 20\log(r) - 11 + DI - A_{misc}$$

where L_p is the predicted noise level; L_{wA} is the sound power level; r is distance; DI is the directivity index; and A_{misc} is the attenuation from other miscellaneous factors (i.e. screening/ground effect/atmospheric absorption/foliage).

Head Office
Spectrum Acoustic Consultants Ltd
27-29 High Street
Biggleswade
Bedfordshire
SG18 0JE
UNITED KINGDOM

+44 (0)1767 318871
enquiries@spectrumacoustic.com
www.spectrumacoustic.com