parkerjones acoustics

133 Haverstock Hill

Belsize Park, London, NW3 1RU

Noise Impact Assessment

15th February 2024

First Issue

133 Haverstock Hill

Belsize Park, London, NW3 1RU

Noise Impact Assessment

15th February 2024

First Issue

Revision History

Version	Comments	Author	Checked By	Date
First Issue	First issued version of the report	**Patrick Shuttleworth** Acoustic Consultant BSc (Hons) MIOA	**Chris Parker-Jones** Director and Acoustic Consultant BSc (Hons) MSc MIOA	15th February 2024

ParkerJones Acoustics Limited

Bristol
11 Bankside Road
Brislington
Bristol
BS4 4LB

London
29 Lincoln's Inn Fields
Holborn
London
WC2A 3EE

Glasgow
126 West Regent Street
Glasgow
G2 2RQ

+44 (0)800 830 3338
+44 (0)117 914 6558
info@parkerjonesacoustics.com
www.parkerjonesacoustics.com

Registered in England and Wales
Company No. 12235614

Executive Summary and Conclusions

This document, a Noise Impact Assessment (NIA) has been written to assess the risk of adverse impact from noise 'pollution' generated by proposals for the installation of 2 external air source heat pump (ASHP) units at 133 Haverstock Hill, Belsize Park, London, NW3 1RU.

The assessment has been conducted by setting the maximum plant noise emissions against existing representative background noise levels at nearby noise-sensitive receptors – based on the condition typically applied by Camden Council that the plant noise level should not exceed the existing background sound level minus 10 dB when determined 1m outside of a noise-sensitive window.

The existing background sound levels have been determined by conducting a baseline noise survey (Section 4.0) at the neighbouring property over the course of several days.

As a result, the maximum plant noise level at 1m outside of neighbouring residential properties is 30 dB L_{Aeq} during the day, and 23 dB L_{Aeq} at night. The proposed unit may operate up to 24 hours a day and as such the night-time target should be designed to be met at all times.

As per Section 5.5, the predicted plant noise level outside the worst-affected neighbouring window is 39 dB when running at maximum capacity. This level is 9 dB above the day time limit and 16 dB above the night time limit.

Therefore, to ensure that the noise limits are achieved, PJA has recommended (in Section 5.6) that a full acoustic enclosure should be installed. Acoustic enclosures are typically capable of achieving noise reductions of anywhere between 12 and 26 dB(A).

It is anticipated that the proposed plant will operate during both day and night. The applicant should, therefore, submit a datasheet from the enclosure manufacturer which verifies that it can reduce noise emissions by a minimum of 16 dB(A).

Vibration has also been considered in Section 6.0. Anti-vibration mounts would be inherent in any acoustic enclosure and as such there is seen to be a negligible risk of perceptible vibration at any of the receptor locations.

Contents

Executive Summary and Conclusions 3
1.0 Introduction 5
2.0 Site and Development Description 6
3.0 Planning Policies and Guidelines 8
3.1 Local Authority Requirements 8
3.2 BS 4142:2014 9
4.0 Baseline Noise Survey 10
4.1 Methodology 10
4.2 Results 11
5.0 Noise Assessment 14
5.1 Methodology 14
5.2 Background Sound Levels 14
5.3 Plant Noise Limits 15
5.4 Proposed Plant / Source Noise Levels 15
5.5 Predicted Noise Levels at Receptors 16
5.6 Mitigation 17
6.0 Vibration Assessment 18
Appendix A – Acoustic Terminology and Concepts 19
Appendix B – Noise Survey Methodology 20
Appendix C - Manufacturer Noise Data 22
Appendix E – Calculations 23
Appendix E – Acoustic Enclosure 26
Appendix F - Author Qualifications 28

1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed to undertake a Noise Impact Assessment to assess proposals for the installation of 2 external ASHP units at 133 Haverstock Hill, Belsize Park, London, NW3 1RU.

This document has been written to assess the risk of adverse impact from noise 'pollution' generated by the installed units ('the plant') on neighbouring residential properties.

The purpose of this report is to determine the representative background sound level outside of neighbouring residential properties; set appropriate noise level criteria based upon this pre-existing noise level in line with Local Planning Policy and demonstrate whether the plant has been designed and located to sufficiently mitigate noise levels to meet these noise level limits successfully – and if not, provide recommendations on how to mitigate the impact to an acceptable level.

This report takes into consideration the noise pollution related planning conditions that have been applied to other sites in the nearby area by the LPA (in this case, Camden Council).

Whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in Appendix A.

2.0 Site and Development Description

The property is at 133 Haverstock Hill, Belsize Park, London, NW3 1RU located as shown in Figure 2.1.

The proposals assessed herein, include the installation of 2 external ASHP units within the rear garden of the property. Figure 2.2 provides an overview of the proposed site plan and plant location.

The proposed plant location is surrounded by residential dwellings, with the rear façades of dwellings on Haverstock Hill forming the nearest locations. Facades at the rear of dwellings on Antrim Grove and to a lesser extent Belsize Grove are also affected.

The assessment / 3D noise modelling described later in the report inherently calculates noise emissions to all nearby residential windows and thus determine the worst-affected receptor point, not automatically assuming that it is the closest dwelling.

Figure 2.1 – Aerial view of the site and surrounding area

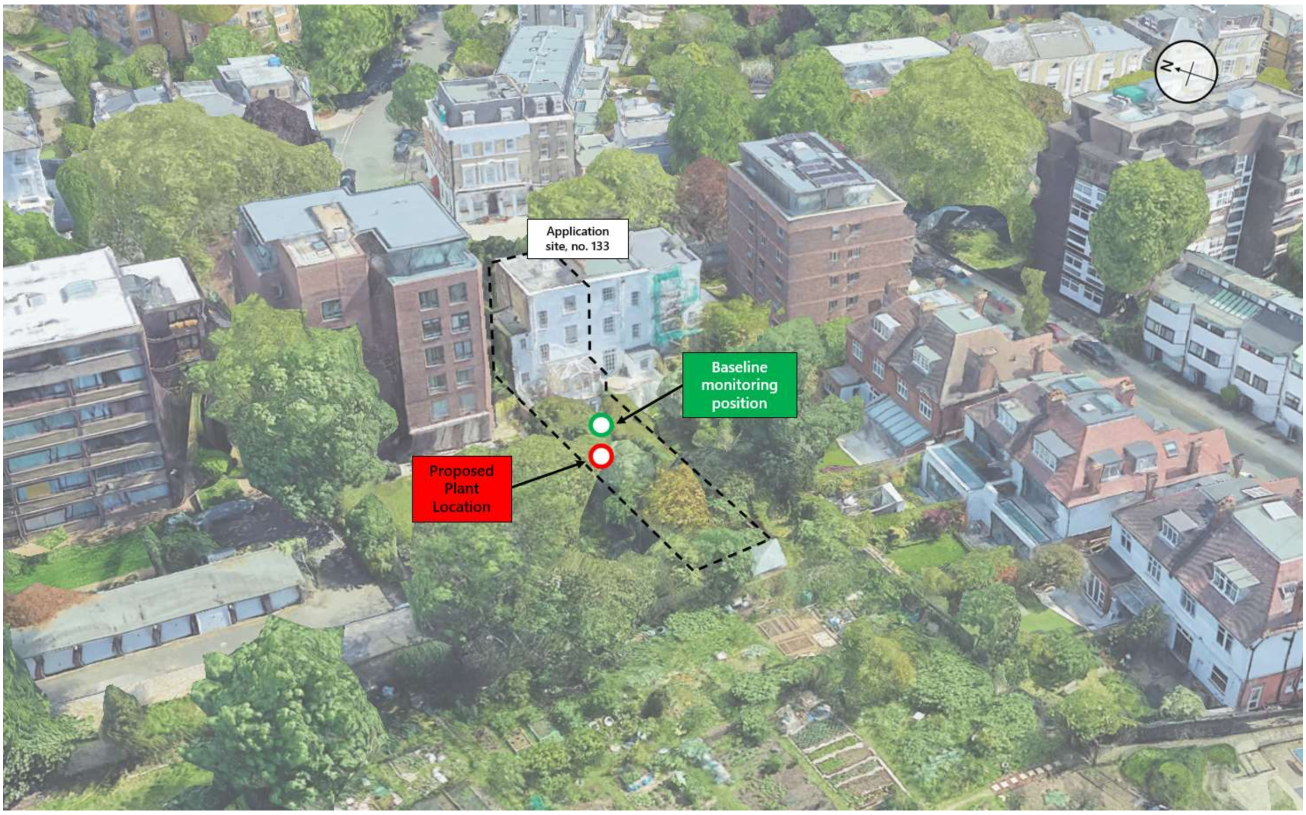
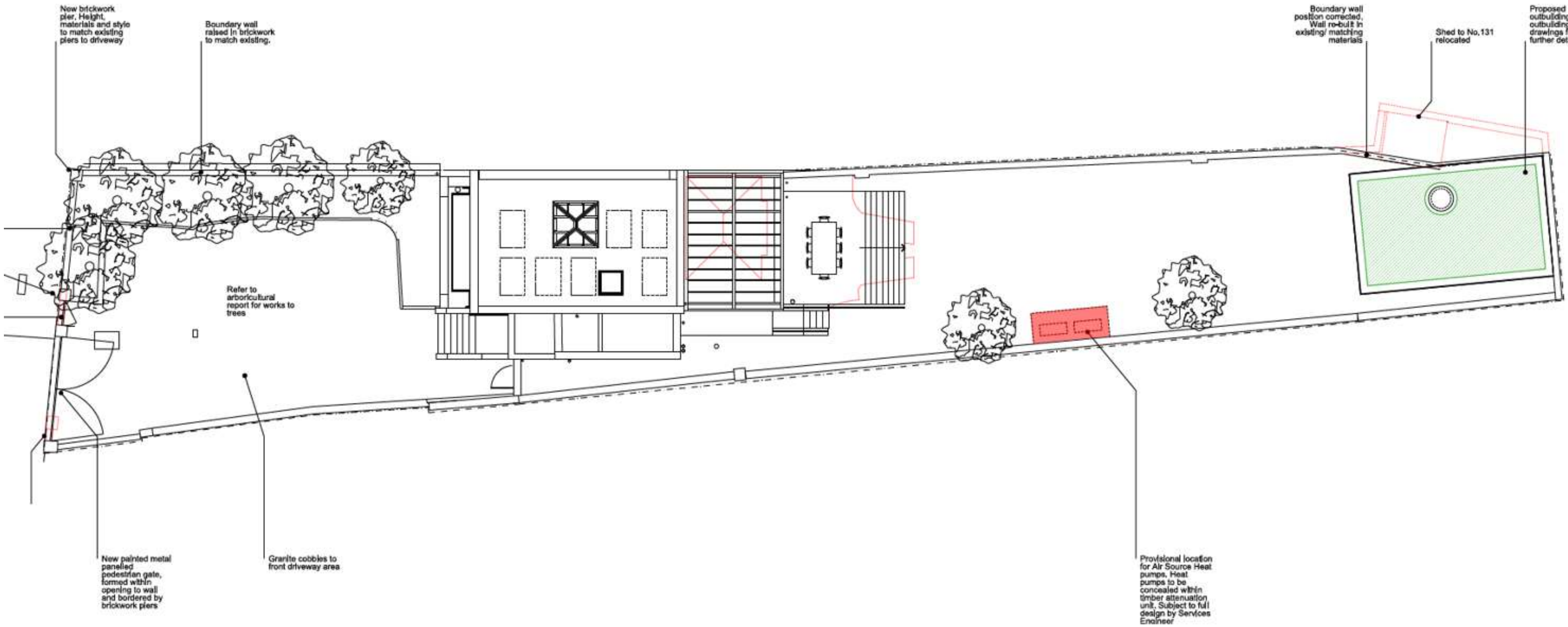


Figure 2.2 – Proposed site plan, plant location (red)



3.0 Planning Policies and Guidelines

3.1 Local Authority Requirements

PJA note that planning applications for new air conditioning units (and plant in general) in the Camden Council area typically require the *rating noise level* from plant to be no greater than 10 dB below the *representative background sound level* and when determined at 1m outside of neighbouring noise-sensitive windows. If the source is tonal, as assessed according to BS 4142:2014+A1:2019, then it should be at least 15 dB below. The following are typical conditions:

1) *The external noise level emitted from plant, machinery or equipment at the development hereby approved shall be lower than the lowest existing background noise level by at least 10dBA, by 15dBA where the source is tonal, as assessed according to BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity.*

   Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policies G1, CC1, D1,and A1 of the London Borough of Camden Local Plan 2017.

2) *Prior to use, plant or equipment and ducting at the development shall be mounted with proprietary anti-vibration isolators and fan motors shall be vibration isolated from the casing and adequately silenced and maintained as such.*

   Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policies G1, CC1, D1,and A1 of the London Borough of Camden Local Plan 2017.

3.2 BS 4142:2014

BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment.

3.2.1 Definitions

BS 4142:2014 provides the following definitions which are relevant at this pre-construction stage of assessment:

- Background Sound Level, $L_{A90,T}$: A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
- Rating Level, $L_{Ar,Tr}$: Specific sound level plus any adjustment for the characteristic features of the sound.
- Reference Time Interval, T_r: Specified interval over which the specific sound level is determined. This is 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).
- Specific Sound Level, $L_s = L_{Aeq,Tr}$: Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
- Specific Sound Source: Sound source being assessed.

3.2.2 Specific Sound Source

The BS 4142:2014 definition of sound of an industrial and/or commercial nature includes "*sound from fixed installations which comprise mechanical and electrical plant and equipment*".

The scope of BS 4142:2014 is not intended for sound from the passage of vehicles on public roads; people; and 'other sources falling within the scopes of other standards or guidance'.

3.2.3 Specific Sound Level

The specific sound level L_s is the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r, of 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).

3.2.4 Background Sound Level

BS 4142:2014 states that *"in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."*

BS 4142:2014 further states that *"a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value".*

4.0 Baseline Noise Survey

4.1 Methodology

PJA has attended the site to conduct a baseline noise survey between Thursday the 25th and Monday the 29th of January 2024. The results have been used to determine a representative background sound level at a position representative of nearby residential receptors.

A fixed monitoring position was employed with the microphone propped at a height of approx. 1.5m, within the rear garden of No 133 Haverstock Hill. This is therefore directly adjacent to the receptor locations. The location of the monitoring position is shown in Figure 2.1 (Section 2.0), and in photographs in Appendix B.

The sound level meter was set to log noise levels over continuous 15-minute averaging periods with a 1-second time history rate. The monitoring equipment was left unattended for the majority of the survey with the exception for a short period around the installation and collection of the equipment.

The following noise indices were recorded (amongst others):

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the average ambient sound level;
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise levels 'events' – i.e., emergency services sirens; and
- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level – or noise levels from continuous noise sources such as plant.

Appendix B contains further information on the methodology of the survey, including photographs taken from site and the equipment used.

4.2 Results

A graph of the measured noise levels across the monitoring period is given in Figure 4.1. Table 4.1 summarises the results of the day and night time periods.

The most relevant parameter in terms of the 'representative background sound level' is the $L_{A90,15min}$. Figure 4.2 presents histograms of the $L_{A90,15min}$ values – showing minimum values of 40 dB during the daytime (07:00 – 23:00) and 33 dB overnight (23:00 – 07:00).

Table 4.1 – Summary of measured noise levels

Period	Parameter	Maximum	Minimum	Logarithmic Average	Mean Average	Modal Average	Median Average
Daytime (07:00 – 23:00)	$L_{Aeq,15min}$ (dB)	64	42	52	49	45	47
	$L_{AFMax,15min}$ (dB)	79	49	N/A	64	67	65
	$L_{A90,15min}$ (dB)	50	40	N/A	43	43	43
Night-time (23:00 – 07:00)	$L_{Aeq,15min}$ (dB)	54	37	45	43	41	42
	$L_{AFMax,15min}$ (dB)	76	47	N/A	55	52	53
	$L_{A90,15min}$ (dB)	46	33	N/A	38	38	38

Figure 4.1 – Graph of measured noise levels

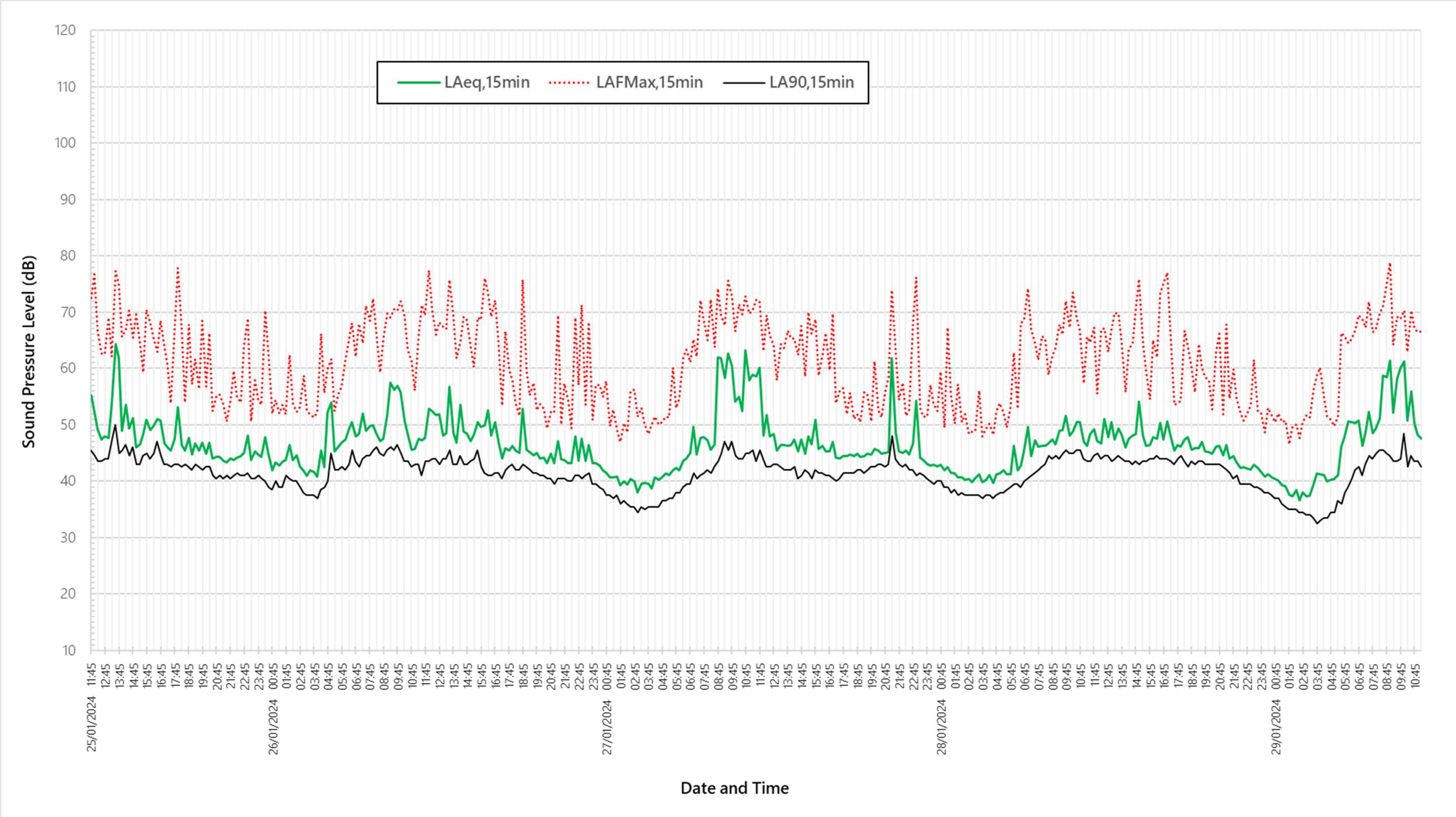
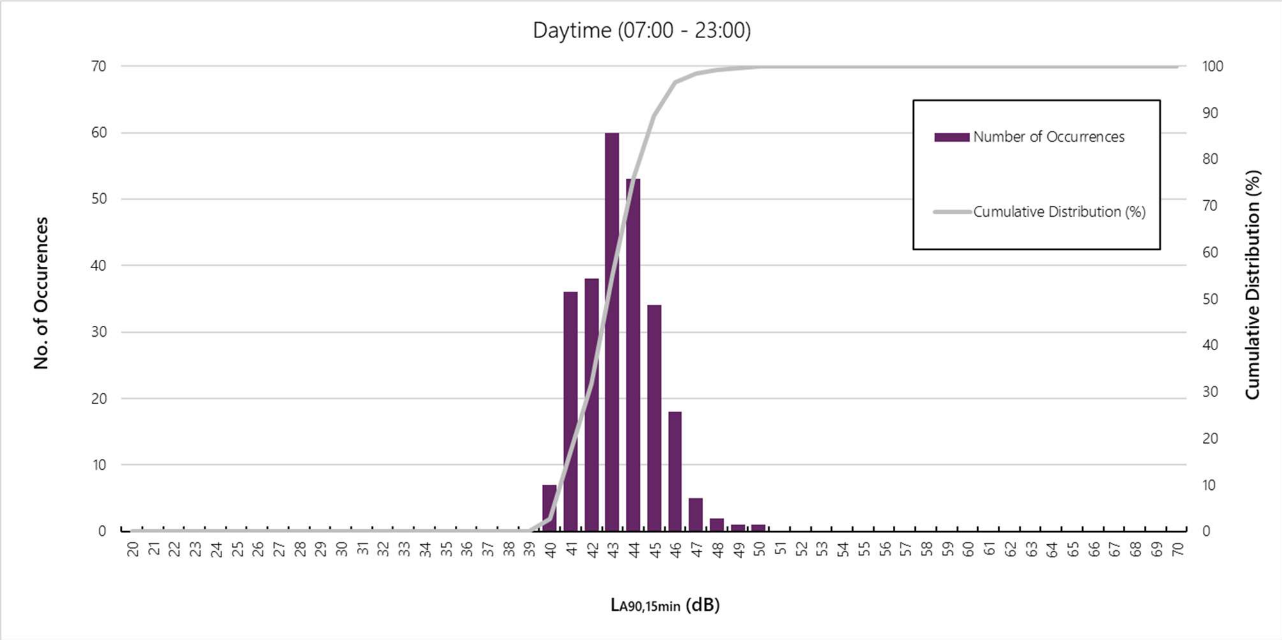
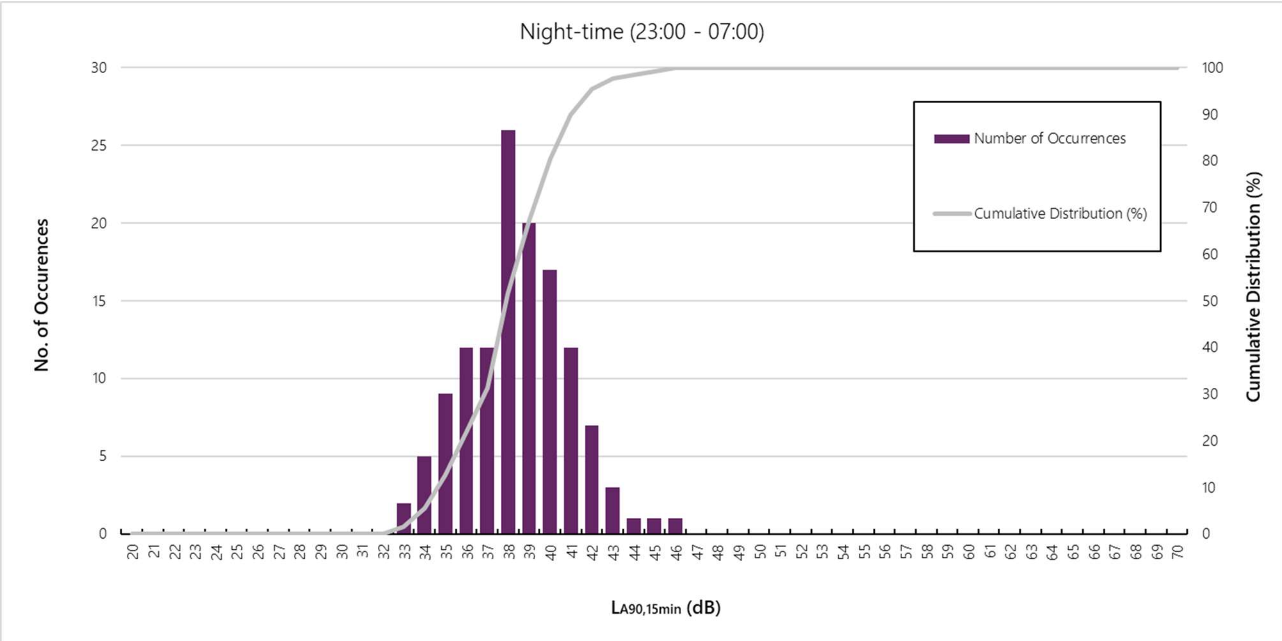


Figure 4.2 – Histogram of measured $L_{A90,15min}$ values





5.0 Noise Assessment

5.1 Methodology

The following summarises the main steps of action in the assessment method:

- a representative background sound level $L_{A90,15mins}$ is determined based upon the results of the environmental noise survey;
- the predicted noise emissions $L_{Aeq,15mins}$ generated by the proposed plant is predicted outside of the windows of neighbouring noise-sensitive windows in the area;
- the predicted noise emissions are compared to the maximum permissible plant noise rating level outside of neighbouring windows;
- if necessary, mitigation measures are recommended to reduce the predicted rating level.

5.2 Background Sound Levels

The predicted plant noise levels should be assessed against a 'representative' background sound level. This is commonly determined through the results of a baseline sound survey, as has been done in this case.

As a worst-case, the *minimum* values of $L_{A90,15min}$ are used to derive the representative background sound level – listed in Table 5.1.

Table 5.1 – Derived representative background sound level $L_{A90,T}$ at nearby residential NSRs

Noise-Sensitive Receptor (NSR)	Period	Representative Background Sound Level L_{A90} (dB)
1m outside of neighbouring residential windows	Daytime (07:00 to 23:00)	40
	Night-time (23:00 – 07:00)	33

5.3 Plant Noise Limits

As per the Council's local planning requirements (see Section 3.1), the maximum noise level from plant should not exceed the background noise level minus 10 dB when measured at 1m outside of a neighbouring premises.

This is assuming that the plant noise does not contain a tonal element. In PJA's experience of assessing domestic air source heat pumps, such units generally do not contain tonal qualities, with a broadband style noise.

This is because the fan rotates at a relatively low speed and consequently the blade passing frequency (the main cause of tonality) is at a very low frequency, meaning the sound overall is perceived as broadband in nature. It is also not expected to be intermittent during operating hours/the reference assessment period, it will be a continual noise.

The maximum plant noise emission levels at 1m outside of noise-sensitive windows is, therefore, given in Table 5.2.

Table 5.2 – Maximum plant noise level $L_{Aeq,T}$ for all nearby residential NSRs

Noise-Sensitive Receptor (NSR)	Period	Maximum Plant Noise Level $L_{Aeq,T}$ (dB)
1m outside of the windows of neighbouring residential windows	Daytime (07:00 to 23:00) Tr = 60-minutes	30
	Night-time (23:00 – 07:00) Tr = 15-minutes	23

5.4 Proposed Plant / Source Noise Levels

Both of the proposed units will be a Vaillant aroTHERM VWL 155/2 (15 kW) with dimensions of 1380mm high, 1103mm wide, and 463mm deep. Extracts from the manufacturers' datasheets [1] are given in Appendix C.

Table 5.3 presents the noise data used in the assessment. The manufacturer provides the sound power level (SWL) for the unit as a single dB(A) value. Spectral data is not provided by the manufacturer.

Table 5.3 – Source noise emission data for the external ASHPs

Model	Sound Power Level, dB(A)
Vaillant aroTHERM VWL 155/2	66

1 - https://professional.vaillant.co.uk/for-installers/products/arotherm-air-source-heat-pump-2944.html#downloads

5.5 Predicted Noise Levels at Receptors

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package that implements a wide range of national and international standards, guidelines, and calculation algorithms, including those set out in ISO 9613-2:1996. A full explanation of the noise modelling is provided in Appendix D, along with images and noise maps/results from the model.

The noise map in Figure D.2 shows the predicted specific noise levels (L_{Aeq}) from the proposed plant at maximum capacity.

The receptor points on facades are at heights representative of the receptor windows (at floor heights of 1.5m, 4.5m, 7.5m, etc), with the figure showing the worst affected floor level on each elevation. The colours/contour is plotted at a height of 7.5m to match the worst affected receptor window location.

Table 5.4 summarises the assessment result, showing the predicted level outside of the worst-affected neighbouring windows. The most affected receptor location is the rear of 131 Haverstock Hill.

Table 5.4 – Predicted noise levels outside of the worst-affected neighbouring window

Period	Predicted Plant Noise Level $L_{Aeq,Tr}$ (dB)	Maximum Plant Noise Level $L_{Aeq,Tr}$ (dB)	Compliant?
Daytime (07:00 to 23:00) Tr = 60-minutes	39	≤30	**No (+9 dB)**
Night-time (23:00 – 07:00) Tr = 15-minutes		≤23	**No (+16 dB)**

It is seen that the maximum permissible level during the daytime is exceeded by 9 dB, and the night-time by 16 dB. Therefore, mitigation will be required to meet the Council's criteria.

5.6 Mitigation

Some form of mitigation will be required for plant noise emissions to be reduced to a level that is compliant with the criteria stipulated by the Local Planning Authority.

The assessment suggests that a 16 dB(A) reduction in emissions is required to achieve this.

It is unlikely that noise would be sufficiently mitigated by either a) moving the unit to a different location, b) changing to a quieter alternative, or c) installing a barrier/fence around the unit to create an open topped enclosure.

The required level of reduction *can* be achieved by installing a full ventilated acoustic enclosure. Such an enclosure is usually metal clad with an inner layer of acoustically absorbent insulation – with a staggered air path (louvres placed to the side of the fan opening, rather than directly in front).

These enclosures typically achieve noise reductions of anywhere between 12 and 26 dB(A).

A suitable enclosure could be sourced from Environ, who produce domestic acoustic enclosures for condensers that are able to achieve a sound transmission loss of 18 - 22 dB(A). More information on this enclosure (and alternatives) is given in Appendix E, including the manufacturer's claimed transmission losses. This enclosure would be sufficient to meet the noise limit in this case.

Other manufacturers [2 3 4] are available who may be able to supply enclosures that achieve a similar loss (Environ data has been presented as it is more publicly available, and the design of these enclosures include a staggered/dog leg type air path through the sides of the enclosure which theoretically make them perform better than other enclosures where the air intake is in front out the fan outlet).

It is anticipated that the proposed plant will operate during both day and night. The applicant should, therefore, submit a datasheet from the enclosure manufacturer which verifies that it can reduce noise emissions by a minimum of 16 dB(A).

2 - https://www.soundplanning.co.uk/acoustic-enclosures/
3 - https://acousticenclosuresltd.co.uk/
4 - https://www.ambientacoustics.co.uk/enclosures.html

6.0 Vibration Assessment

Given that the proposed units are to be located externally with no structural connection to any adjoining buildings, the risk of adverse vibration is seen to be negligible.

An acoustic enclosure would inherently include anti-vibration mounts, and therefore the risk of structure-borne vibration/noise should be further negated.

However, in the unlikely event that the applicant receives a formal complaint from the neighbouring property, the applicant is committed to investigating the source of the problem and re-installing the offending unit on an upgraded anti-vibration mount if necessary.

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2x10-5 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4000Hz (4kHz). This is roughly equal to the range of frequencies on a piano.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.

A.2 – Subjective Changes in Noise Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – Noise Survey Methodology

B.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meter was calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter has been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of a BS EN 60942:2003 Class 1 device.

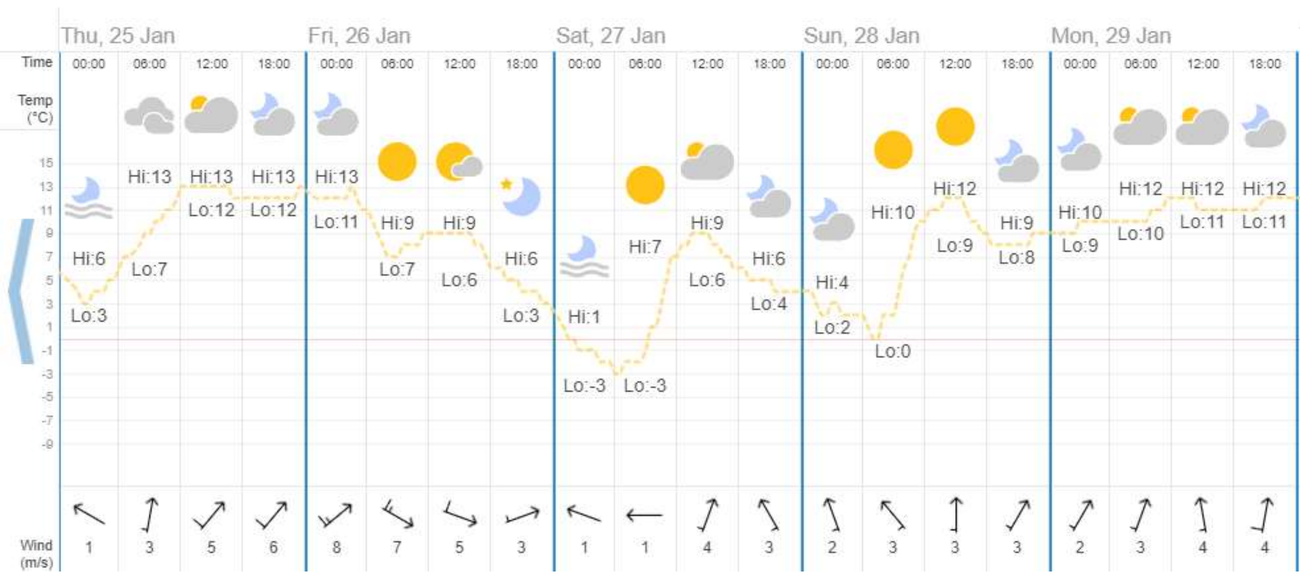
Table B.1 – Equipment used for the noise survey

Name	Serial Number	Last Calibrated	Calibration Due
Svantek 971A Class 1 sound level meter	113251	April-22	April-24
Svantek SV 18A Preamp	113765	April-22	April-24
ACO 7152 Class 1 Microphone	19148	April-22	April-24
Cirrus CRL511E Class 1 Acoustic Calibrator	035235	May-23	May-24

B.2 – Meteorological Conditions

During the survey, weather conditions were generally dry and mild with some wet periods, and wind speeds less than 8 ms^{-1} (the microphone was fitted with a weather protection kit/windshield). These weather conditions are suitable for the measurement of environmental noise in accordance with BS 7445 '*Description and Measurement of Environmental Noise*'. The weather data below has been sourced from; https://www.timeanddate.com/weather/uk/london/historic?month=1&year=2024.

Figure B.1 – Meteorological conditions during the survey

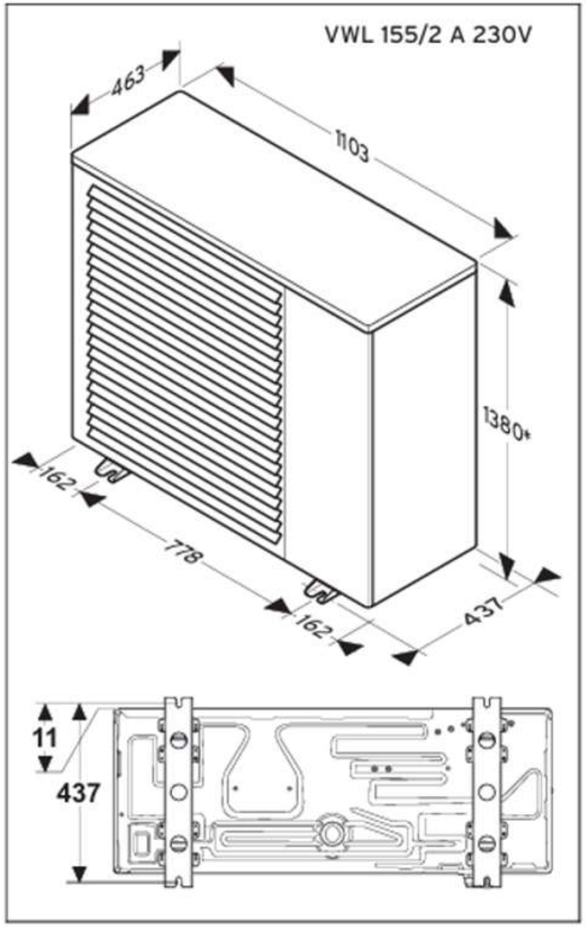


B.3 – Photos

Figure B.2 – Photographs of the monitoring position

Appendix C - Manufacturer Noise Data

Figure C.1 – Manufacturer noise data



Specifications

Technical data	Unit	15kW
Product dimensions (W x D x H)	mm	1,103 x 463 x 1380
Net weight	kg	165
Maximum start-up current	A	25
Sound power level for A7W55 according to EN 12102 and EN ISO 9614-1	dB(A)	66
Maximum DHW flow temperature	°C	63
ErP rating (@ 35°C)	band	A++
ErP rating (@ 55°C)	band	A+
MCS SCoP performance table		
35°C		3.28
40°C		3.15
45°C		3.01
50°C		3.01

Appendix E – Calculations

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package that implements a wide range of national and international standards, guidelines, and calculation algorithms, including those set out in ISO 9613-2:1996.

All of the objects within the model (buildings, roads, barriers, foliage, etc) have been imported from OpenStreetMap. The heights of the buildings and roads have been based upon Google Earth Pro, using the 3D view to be able to measure the elevation heights at the tops of objects, and then inserting this manually into the model. Where OpenStreetMap contains little or inaccurate information, the objects have been drawn manually. The scaled site plan, floor plan, and elevation for the proposed development have been accounted for in the model.

The noise model has been used to predict the resulting L_{Aeq} noise emissions from the proposed plant.

The noise model has assumed:

- downwind propagation, i.e., a wind direction that assists the propagation of sound from source to receptor, as a worst-case;
- a maximum reflection factor of two where buildings and barriers are assumed to have a ‘smooth’ reflective façade, as a worst-case;
- a ground absorption factor of 0 to represent hard, reflective ground as a worst-case, with a factor of 0.5 for mixed areas.
- receptor heights on the façade at ground floor (1.5m), 1st floor (4.5m) and 2nd floor (7.5m), window heights, placed at 1m outside of elevations which contain windows. The plot shows the worst affected floor level;
- the map of noise emissions is provided at a height of 7.5m, which is equivalent to the height of the worst affected receptor window, at the rear of 131 Haverstock Hill;
- atmospheric sound absorption based upon a temperature of 10^{o}C and a humidity level of 70%, as per Table 2 of ISO 9613-2:1996.

The images on the following pages contain the results of the mapping.

Figure D.1 – 3D view of the model setup

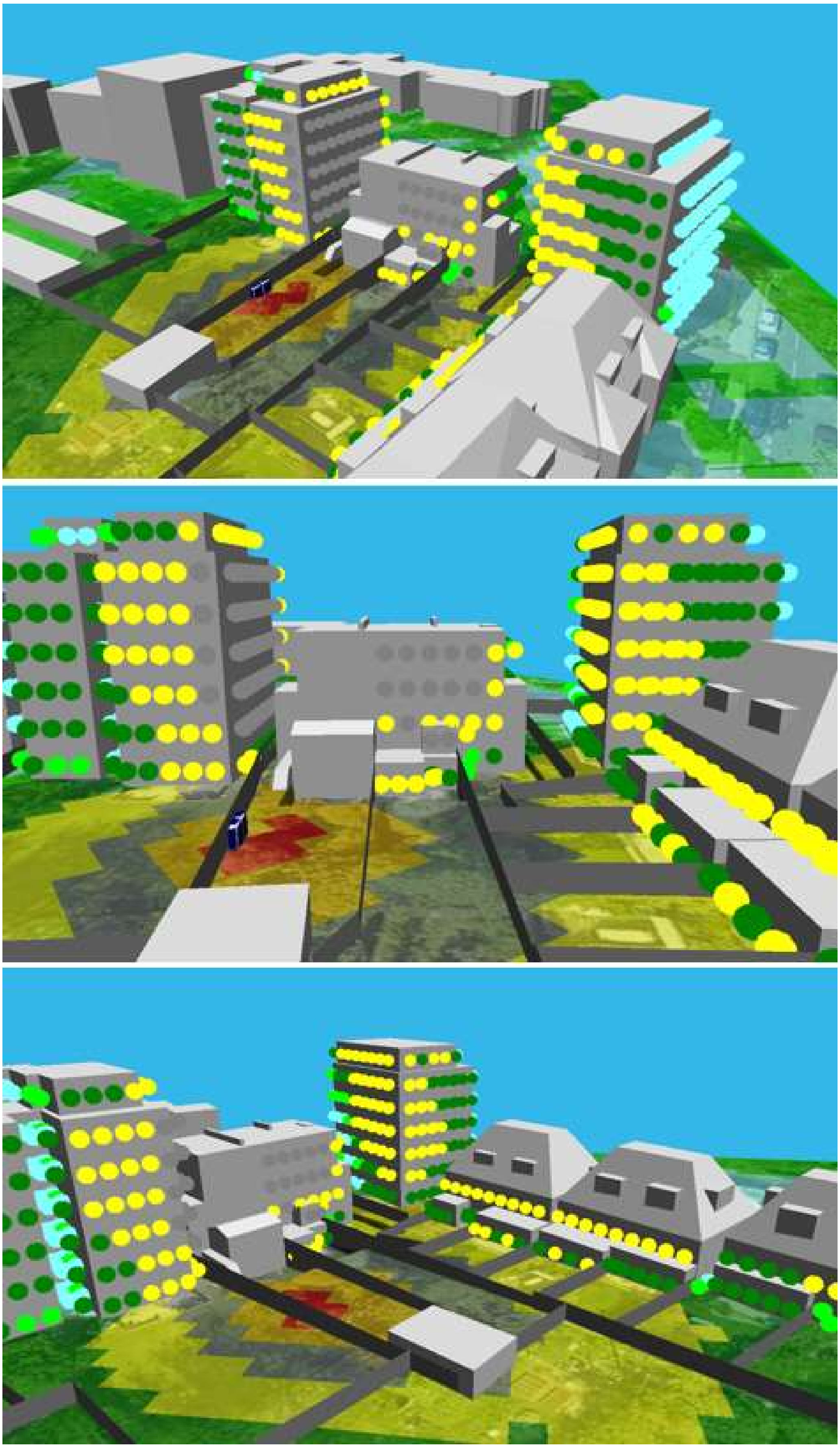
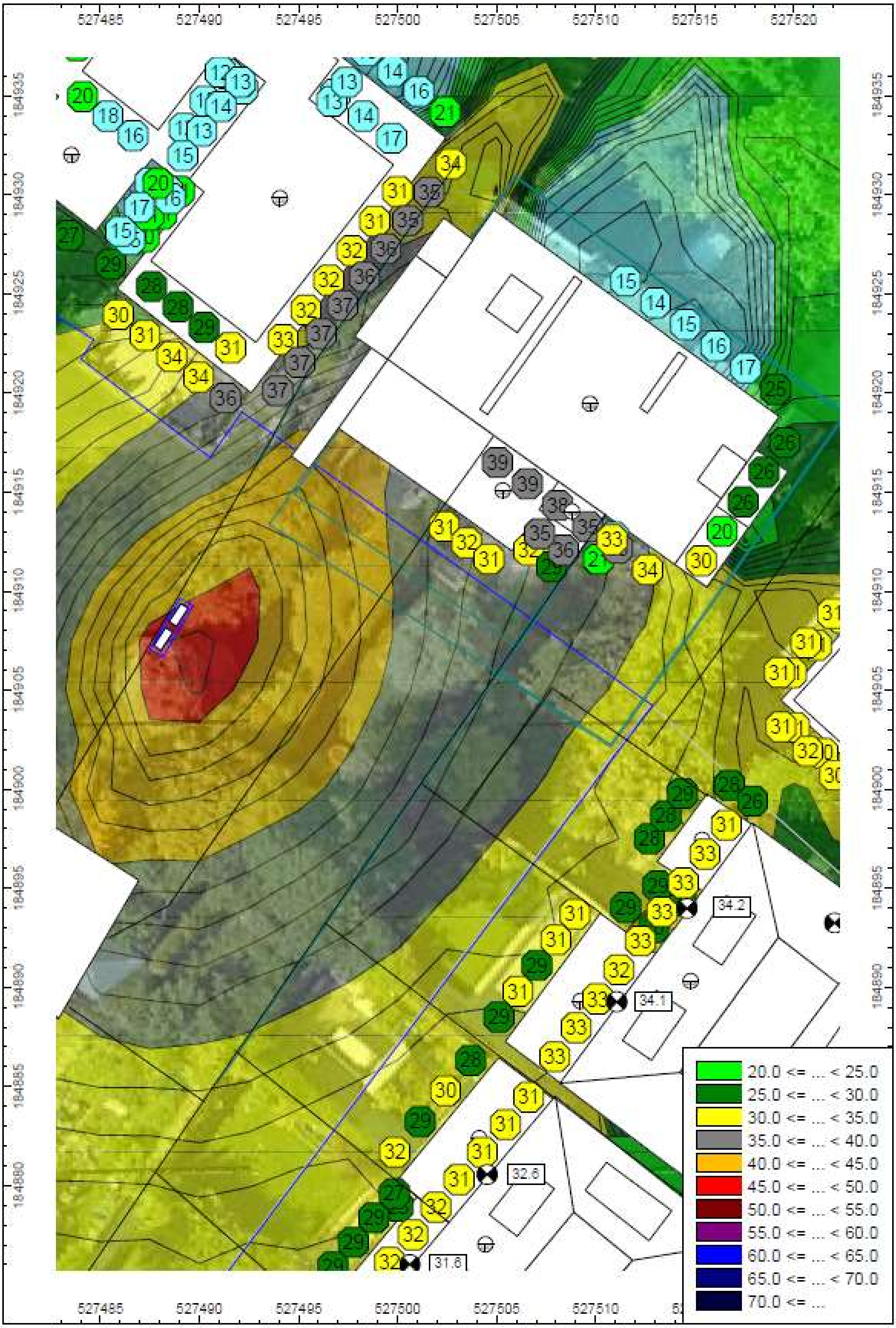


Figure D.2 – Predicted specific noise levels (dB L_{Aeq})



Appendix E – Acoustic Enclosure

A specialist acoustic enclosure is usually metal clad with an inner layer of acoustically absorbent insulation – with a staggered air path (louvres placed to the side of the fan opening, rather than directly in front). These enclosures are typically capable of achieving noise reductions of anywhere between 15 and 26 dB(A).

A suitable enclosure could be sourced from Environ [5], who produce domestic acoustic enclosures for condensers that are able to achieve a sound transmission loss of 22 dB(A) (albeit typically closer to 18 – 22 dB(A), depending on the frequency spectrum of the noise source). The manufacturer claimed transmission losses from Environ (based upon an environlite ELV1.1.25AC product or similar) are shown in Table E.1 below. The enclosures look like those in Figure E.1.

Table E.1 – Transmission loss of an *Environ* acoustic enclosure

	Transmission Loss						
	dB at Octave Band Centre Frequencies, Hz						
	63	125	250	500	1 k	2 k	4 k
environlite ELV1.1.25AC acoustic enclosure	11	13	19	28	34	36	36

Figure E.1 – *Environ* acoustic enclosure

Other manufacturers [6] [7] are available who may be able to supply enclosures that achieve a similar loss (Environ data has been presented as it is more publicly available, and the design of these enclosures included a staggered/dog leg type air path through the sides of the enclosure which theoretically make them perform better than other enclosures where the air intake is in front out the fan outlet).

5 - https://www.environ.co.uk/domestic/
6 - https://www.soundplanning.co.uk/special-enclosures/ashp-vertical-enclosures/
7 - https://www.silent-mode.net/blog/acoustic-enclosure-for-mitsubishi-city-vrf-unit#/

Figure E.2 – *Environ* acoustic enclosure – acoustic data

Environ Technologies Ltd
Regus House, 1010 Cambourne Business Park
Cambourne, Cambridgeshire, UK, CB23 6DP
Tel: +44 (0)870 383 3344
Fax: +44 (0)1223 598001
www.environ.co.uk

ENVIRON SYSTEM ACOUSTICAL DATA

Noise Measurement Information:

Test: Environ Lite Acoustic Enclosure

Test Standard:

BS EN ISO 140-3 Acoustics - Measurement of Sound Insulation in Buildings and of Building Elements - Part 1: Airborne Sound Insulation

Sound Level Measuring Equipment:

Norsonic 830 RTA Precision Sound Analyser Type 1
CEL 284/2 Acoustic Calibrator Type 1
JBL Loudspeaker driven by CEL Loudspeaker driven by 830 White Noise Source

Transmission Loss Data:

Transmission Loss — Environ ELV1.1.25AC Acoustic Enclosure							
Octave Frequency in Hertz (dB ref 2 x 10^{-5} Pascal's)							
63	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**
11	13	19	28	34	36	36	37
Summary Transmission Loss Equates to an Overall Reduction of 22 dB(A)							

Support Information:

Monitoring was carried out using the BS3740 technique, insofar as measurements were taken in each quadrant and the results averaged. Internal Test Room: W 6m x D 16m x H 5m. Background noise in the semi-reverberant test room was such as not to interfere with the practical measurements

IMPORTANT NOTE: acoustic performance based on accuracy of equipment noise & ventilation data

Environ acoustic enclosure designs are protected under patent

Appendix F - Author Qualifications

This report has been compiled by Patrick Shuttleworth, acoustic consultant at ParkerJones Acoustics. Patrick holds the following qualifications:

- MIOA (Member of the Institute of Acoustics).
- BSc in Audio and Music Technology from the University of the West of England – 1st Class.

Patrick has worked as an acoustic consultant for various companies since 2011.

This report has been approved by Chris Parker-Jones, the director and primary acoustic consultant at ParkerJones Acoustics. Chris holds the following qualifications:

- MIOA (Member of the Institute of Acoustics).
- BSc in Music Systems Engineering from the University of the West of England – 1st Class.
- MSc in Sound and Vibration Studies from the University of Southampton – Distinction.

Chris has worked as an acoustic consultant for various companies since 2011.

ParkerJones Acoustics Limited

Bristol	**London**	**Glasgow**	+44 (0)800 830 3338	Registered in England and Wales
11 Bankside Road	29 Lincoln's Inn Fields	126 West Regent Street	+44 (0)117 914 6558	Company No. 12235614
Brislington	Holborn	Glasgow	info@parkerjonesacoustics.com	
Bristol	London	G2 2RQ	**www.parkerjonesacoustics.com**	
BS4 4LB	WC2A 3EE			