Report Ref. **CLI0604/R1/Rev.B**

Noise Impact Assessment of Proposed ASHP Unit Plant

68 King Henry's Road, London NW3 3RR

15 August 2024

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Summary

The residential property at 68 King Henry's Road, London NW3 3RR is proposing to install a single outdoor air source heat pump unit (x1 No. ASHP unit) on the property's flat roof.

Climate Acoustics has been appointed to complete a background noise survey, noise impact assessment, and technical acoustic report showing the proposed ASHP unit's noise impact on the nearest noise-sensitive residential premises.

London Borough of Camden Council has plant noise emission criteria detailed in Section 2 and Section 3.4 of this report. Based on the measured background noise levels at the site and the noise data from the plant technical datasheets, Climate Acoustics have assessed the increase in noise level due to the ASHP unit's operation and have suggested further appropriate mitigation measures to reduce noise emissions.

Appendix A1 of this report shows the noise survey was carried out from Monday 29th July 2024 to Friday 2nd August 2024. The proposed air source heat pump unit is expected to operate 24 hours, Monday to Sunday. *Note: Typically, noise from the plant would be more noticeable during the night when the existing background noise is lower.*

Initial Plant Noise Impact Assessment: The noise impact calculations provided in Section 4.2 of this report shows that further noise and vibration control/ mitigation measures are necessary.

Further Noise & Vibration Control Measures: Further noise and vibration control/ mitigation measures are required to achieve London Borough of Camden Council's noise threshold (Section 3.4).

Section 4.3 of this report shows that one air source heat pump unit must be encased with an acoustic enclosure with the minimum total sound reduction values provided in the table shown in Section 4.3.1 of this report. Section 4.3.2 details that flat roof anti-vibration mounts must also be installed to control re-radiated noise and vibration.

Plant Noise Impact Assessment – With Further Noise & Vibration Control Measures Applied: Section 4.4 of this report shows the plant noise impact assessment with further mitigation applied from Section 4.3. The calculated daytime and night-time noise emission levels to 1 metre from the nearest noise-sensitive residents' window from the proposed fixed plant serving 68 King Henry's Road is equal to or below London Borough of Camden Council noise limits (i.e. equal to or below 32 dB $L_{Ar,Tr,1\text{-}hour(Day)}$ and equal to or below 22 dB $L_{Ar,Tr,15\text{-}min(Night)}$) in accordance with British Standard BS 4142: 2014+A1:2019:

- **Daytime & Night-time Fixed Plant Noise Emission Levels:** Section 4.4.2 and Section 4.4.3 shows the calculated daytime and night-time noise emission levels to 1 metre from the nearest noise-sensitive residents' window with further noise & vibration control/ mitigation measures applied to the plant is equal to and below London Borough of Camden Councils noise limits. **The daytime and night-time noise emission levels equal 22 dB $L_{Aeq,T}$, this is 10 decibels below the daytime noise limit and equal to the night-time noise limit. Under British Standard BS 4142:2014+A1:2019 this *"is an indication of the specific sound source having a low impact"*.**

The nearest residents' window partially open for ventilation offers 10 decibels (dB) attenuation. The predicted internal noise level with the single condenser unit operating is predicted to be **12 dB $L_{Aeq,T}$** during the day and night. These predicted levels with the noise & vibration control measures detailed in Section 4.3 of this report implemented would be expected to comfortably meet the acceptable internal noise levels in bedrooms for resting during the day (35 dB $L_{Aeq,16hour}$) and the night-time for sleeping (30 dB $L_{Aeq,\ 8\ hours}$), as per British Standard BS 8233: 2014 (Section 2 of this report), and ***"complaints are therefore unlikely"***.

Therefore, based on the daytime and night-time British Standard BS 4142 results in Section 4.4 of this report, if the noise and vibration control measures and guidance detailed in Section 4.3 are implemented, London Borough of Camden Council's noise requirements and criteria (Section 2) will be achieved.

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1 Introduction

The residential property at 68 King Henry's Road, London NW3 3RR is proposing to install a single outdoor air source heat pump unit (x1 No. ASHP unit) on the property's flat roof.

Climate Acoustics has been appointed to complete a background noise survey, noise impact assessment, and technical acoustic report showing the proposed ASHP unit's noise impact on the nearest noise-sensitive residential premises.

London Borough of Camden Council has plant noise emission criteria detailed in Section 2 of this report. Based on the measured background noise levels at the site.

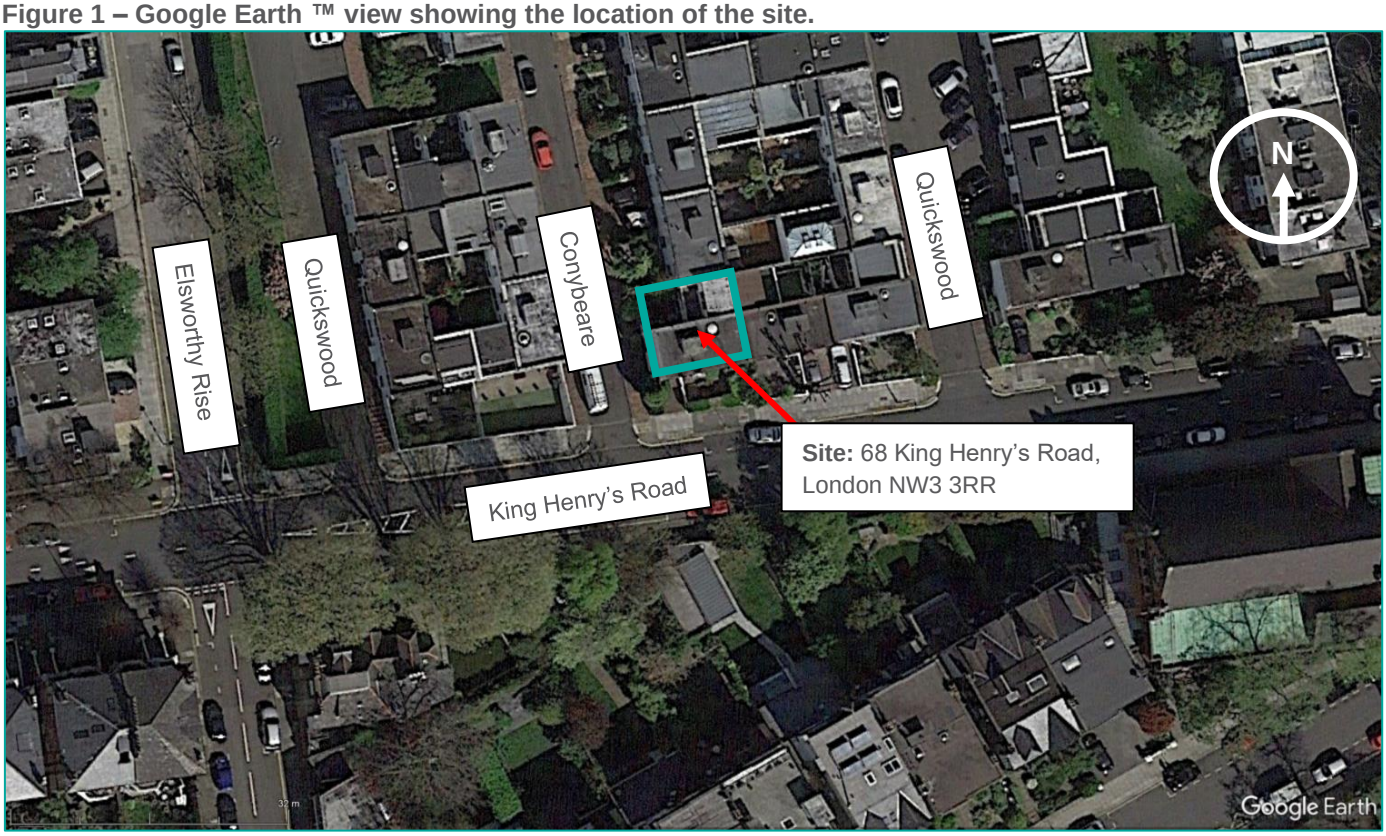
1.1. Site Description

Figure 1 shows where the site is at 68 King Henry's Road, London NW3 3RR is located, highlighted in **green**.

Section 3.2 of this report discusses the site's noise climate. The noise climate is dominated by noise from the surrounding road networks.

Note: The proposed plant units have not yet been installed but are expected to operate 24 hours a day.

Figure 1 – Google Earth ™ view showing the location of the site.



2 Noise Criteria

London Borough of Camden Council's Noise Guidance: For the proposed ASHP Unit, Camden Council has detailed that they have concerns that the noise emitted from the plant will need a comprehensive noise impact assessment and an acoustic report should be submitted, as per London Borough of Camden Council's standard conditions for noise:

London Borough of Camden Council has threshold noise criteria set to control the plant noise to demonstrate that the plant won't cause noise disturbance and harm the local residential environment. Specific noise guidance for the fixed plant is highlighted **bold** below, and reference is made to *'Camden Planning Guidance – Amenity 2021'* and *"Camden Local Plan 2017"*:

Specific Noise Guidance:

"As the proposals involve the installation of new noise generating machinery in a residential area sensitive to noise, it is the thresholds set out in relation to the second point which is relevant in the assessment of the proposals. Table C of Appendix 3 sets out noise levels applicable to plant and machinery and requires noise levels to be 10dB below background levels and no events exceeding 57dBL$_{Amax}$."

Camden Planning Guidance – Amenity 2021:

"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.

6.17 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).

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.

6.29 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."

Camden Local Plan 2017:

Policies A1 & A4 and Appendix C of the London Borough of Camden Local Plan 2017 are referred to here:

"Policy A1 Managing the impact of development

The Council will seek to protect the quality of life of occupiers and neighbours. We will grant permission for development unless this causes unacceptable harm to amenity.

The factors we will consider include:

j. noise and vibration levels;

k. odour, fumes and dust;

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."

Appendix 3: Noise Thresholds

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 57dB L_{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 88dB L_{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.

British Standard BS 8233: 2014: British Standard BS 8233:2014 *'Guidance on Sound Insulation and Noise Reduction for Buildings'* contains guidance for internal design criteria, as shown in the following table.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$

British Standard BS 4142:2014+A1:2019: British Standard BS 4142:2014+A1:2019 *"Methods for Rating and Assessing Industrial and Commercial Sound"* is used to assess the potential for adverse impact due to the agricultural noise sources at the relevant noise-sensitive property. The noise source levels are measured/calculated and compared to the existing background noise level (L_{A90}).

Depending on the noise source characteristics (tonal, intermittent, or impulsive), the noise source is given a rating noise level (penalty additions) and compared to the *'lowest'* background noise level (during operating hours). The significance of the existing noise sources can then be given a likelihood of adverse impact, which follows British Standard BS 4142:2014+A1:2019 advice:

"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

- *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."*

Subjective method

Tonality: *For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.*

Impulsivity: *A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.*

Other sound characteristics: *Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.*

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant, then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency: *When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

3 Existing Noise Climate

3.1. Noise Survey Details

Appendix A1 shows the noise survey details, including personnel, instrumentation used, calibration information, calibration procedure, uncertainty, equipment operation time & dates, and weather conditions.

3.2. Noise Climate

Appendix A3 shows the unattended noise data. The noise climate is dominated by noise from the surrounding road networks. *Note: The proposed plant units have not been installed but are expected to operate 24 hours daily.*

3.3. Background Noise Measurement Results

The current background noise readings were completed at the location shown in Appendix A2. The table below details the average ambient noise levels and the minimum external background noise levels at Location U1, equivalent to the nearest noise-sensitive residents' window(s). The noise survey graph is shown in Appendix A3.

Position	Period	Average Measured Ambient Noise Level, $L_{Aeq,T}$, dB	Minimum Measured Background Noise Level, $L_{A90,T}$, dB
Location U1	Day 0700 to 2300 (16hr)	55	42
	Night 2300 to 0700 (8hr)	45	32

3.4. Plant Noise Criteria/ Threshold

To address potential noise concerns from the proposed air source heat pumps, a noise impact assessment and acoustic report are needed based on the findings of the noise survey in Section 3.3. The minimum background noise levels measured at the nearest residential premises during the day/evening and night are **42 dB $L_{A90,1\text{-hour(day)}}$** and **32 dB $L_{A90,15\text{-minutes(night)}}$**, respectively.

Section 2 of this report shows that the London Borough of Camden Council has local planning policy and guidance for plant noise, as set out below:

"noise levels applicable to plant and machinery and requires noise levels to be 10 dB below background levels and no events exceeding 57dB L_{Amax}"

Therefore, the noise level from the air source heat pump unit(s) will be required to meet a noise emission level of 10dB(A) or greater below the minimum background.

As the minimum measured background noise level at daytime/ evening equals 42 dB $L_{A90,1\text{-hour}}$ and 32 dB $L_{A90,15\text{-minutes}}$ at night at 1 metre from the window to the nearest noise-sensitive premises. **Therefore, the proposed air source heat pump unit(s) will need to achieve a noise emission criteria level equal to or below 32 dB $L_{Aeq,1\text{-hour}}$ during the daytime/ evening and equal to or below 22 dB $L_{Aeq,15\text{-minutes}}$ at night.**

	Day	Night
Maximum noise emission levels at 1 metre from the window to the nearest noise-sensitive premises, $L_{Aeq,T\ (Day/\ Night)}$, dB	32	22

4 Plant Noise Impact Assessment

4.1. Noise Impact Assessment Parameters

The proposed external ASHP unit (x1 No.) will be housed outside on the flat roof of 68 King Henry's Road, London NW3 3RR (location shown in Appendix B2). The unit will operate for 24-hours, Monday to Sunday.

The client proposing the one ASHP unit (x1 No.) confirmed that the selected equipment is as follows:

4.1.1. Proposed Air Source Heat Pump Unit (ASHP Unit) Plant Noise

ASHP unit, flat roof plant [outside]:

- **Air source heat pump unit [ASHP unit] – x1 No.** ***'Samsung, EHS Mono HT Quiet 8kW Air Source Heat Pump, Model No. AE080BXYDEG'***

The table below shows the sound power level (L_w) and sound pressure level (L_p) noise data for the external ASHP unit listed above. Appendix B1.1 details the manufacturers' specifications and technical datasheets. The sound power level and sound pressure level noise data is summarised below:

Sound Power Level and Sound Pressure Level from Air Source Heat Pump:

Plant Make & Model	Heating Mode	Sound Power Level, L_w dB(A)*	Sound Pressure Level at 3 metres, L_p dB(A)**
Samsung, EHS Mono HT Quiet 8kW, Model No. AE080BXYDEG	Normal Mode	**56**	**42**
	Quiet Mode*	**49**	**35**

**** Maximum sound power level dB(A), measured in accordance with EN-12102.***

***** 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.***

4.1.2. Plant Noise Impact Assessment Parameters

To assess the fixed plant's noise impact on the nearest residents' premises, an environmental noise model was completed using **NoiseMap ® Five** noise modelling software. The single ASHP unit (x1 No.) source detailed in Section 4.1.1 and Section 4.1.2 of this report has been given as sound power levels (L_w) based on noise levels from the technical datasheets in Appendix B1.1.

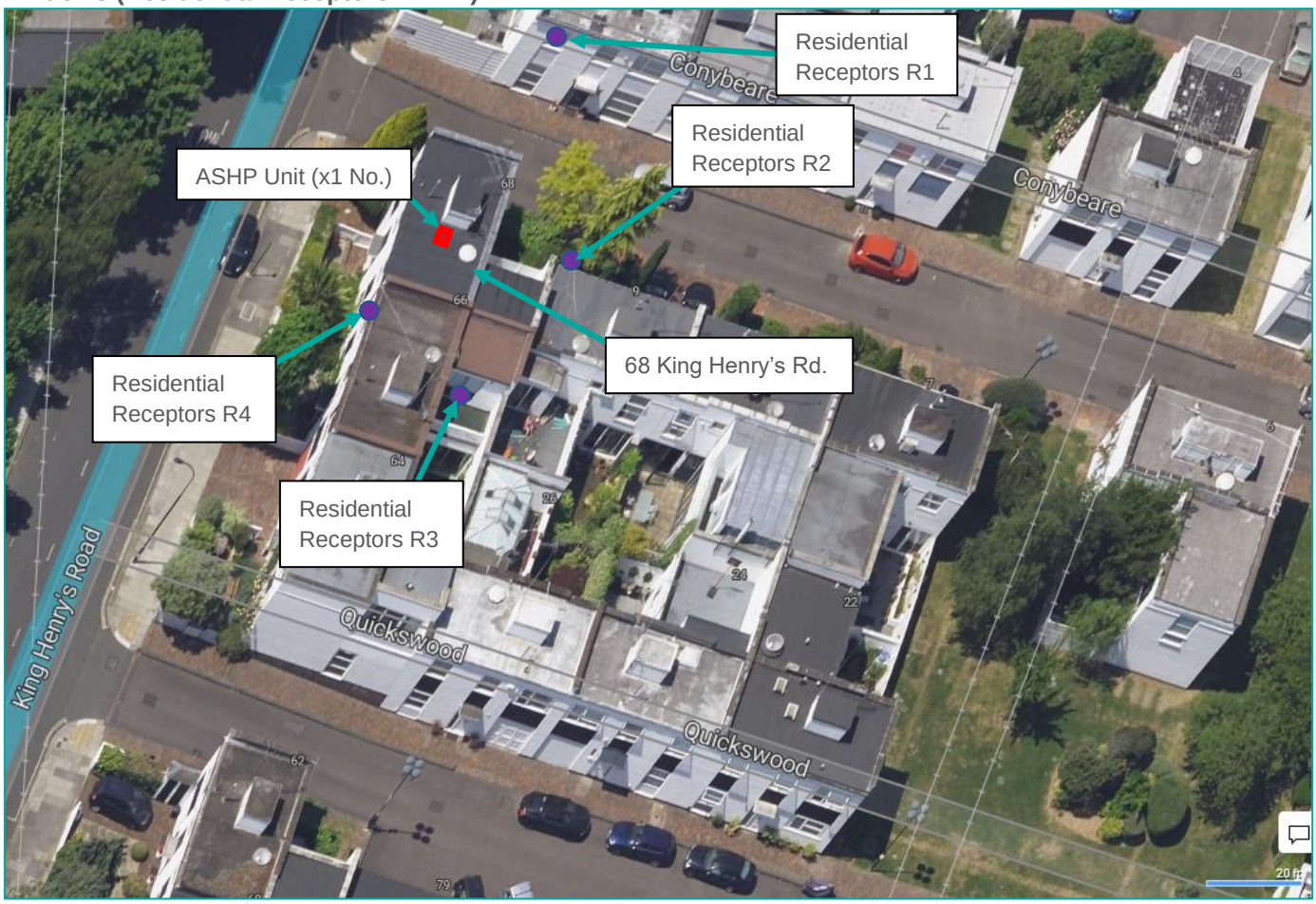
Figure 2 below shows the first-floor windows of the nearest residential premises (Receptors R1 to R4, highlighted in **purple)** closest to the proposed roof plant (highlighted in **red**).

Calculations predicted to the nearest noise-sensitive receptors (R1 to R4) consider the following:

- **British Standard BS 4142: 2014 and British Standard BS 8233: 2014** – British Standards BS 4142:2014+A1:2019 and BS 8233:2014 are considered in calculations given in Section 4.2 and Section 4.4 of this report.
- **Reflections** – A +3 dB addition has been applied in our calculations for reflection to the plant from the flat roof reflective surface and the adjacent existing tank room.
- **Ground absorption** – Based on-site observations, a correction is made for hard ground (+3 dB correction) effect between the source and receiver.

- **Calculation Format** – Calculations using sound pressure levels, which are shown in the Table in Section 4.1.1 of this report and daytime and night-time noise impact calculations are shown in Section 4.2 and Section 4.4.

Figure 2 – Microsoft Bing Maps™ showing the location of the proposed ASHP unit and the nearest residents windows (Residential Receptors R1-R4).

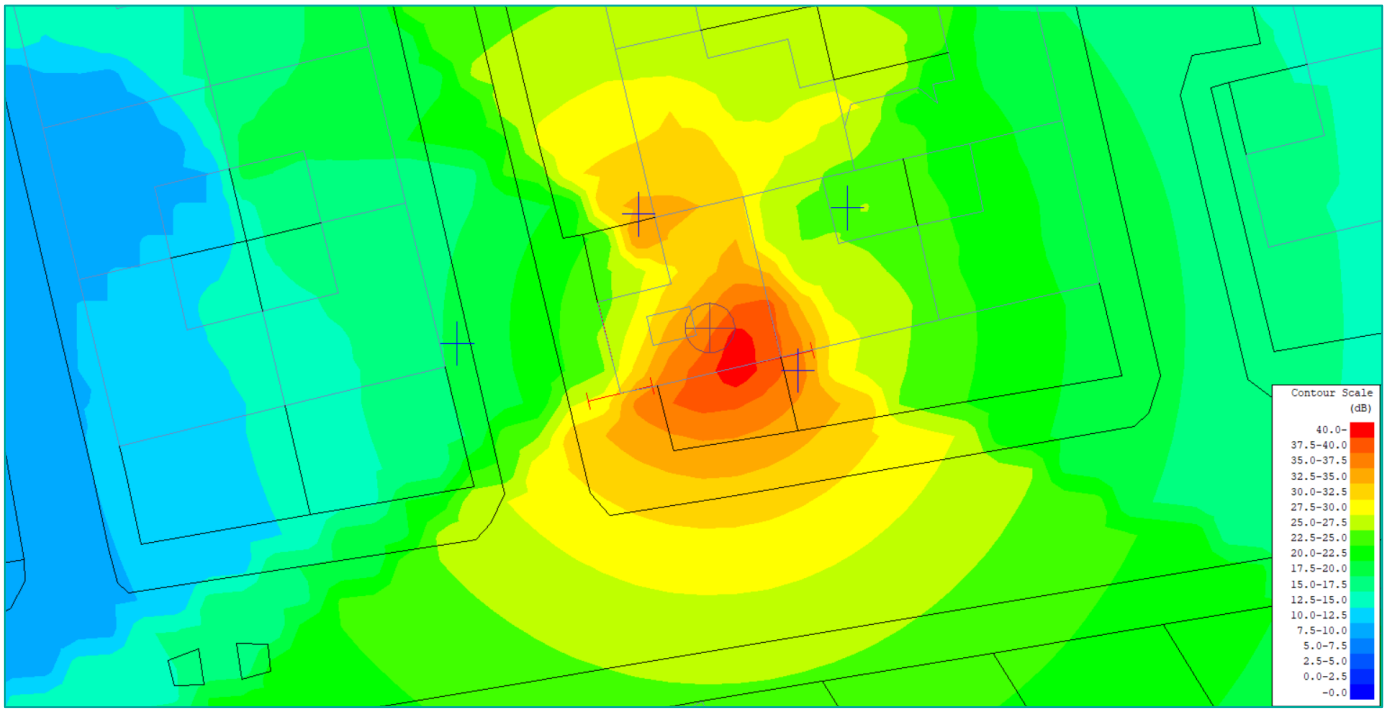


4.2. BS 4142 Plant Noise Impact Assessment of Proposed Plant Noise Sources to the Nearest Residents – Without Noise Mitigation

The table in Section 3.4 of this report shows that the cumulative maximum noise emission levels from the air source heat pump at 1 metre from the nearest noise-sensitive residential windows **will need to achieve a noise emission criteria level equal to or below 32 dB $L_{Aeq,1\text{-}hour}$ during the daytime/ evening and equal to or below 22 dB $L_{Ar,Tr,15\text{-}minutes}$ at night.**

Figure 3 shows the noise impact calculations without mitigation, which indicates that further noise & vibration control measures are necessary for the proposed single ASHP unit (x1 No.). Therefore, to meet the night-time cumulative maximum noise emission level criteria, further noise & vibration control measures for the units are detailed in Section 4.3 of this report below:

Figure 3 – BS 4142:2014 Noise Impact Calculations Without Noise Control/ Mitigation – Daytime/ Night Operating Hours Plant Noise Calculation from Plant Noise Sources to the Nearest Residential Receptors.



Note 1: NoiseMap ® Five Noise Model contour is shown as being 7.5 metres above ground.

Note 2: The contour scale key on the right-hand side is between 0 dB to >40 dB.

4.3. Noise & Vibration Control Measures

Further noise and vibration mitigation is required to control noise emission levels from the ASHP unit noise source to achieve a daytime and night-time noise criteria level equal to or below **32 dB $L_{Ar,Tr,1\text{-}hour(day)}$** & **22 dB $L_{Ar,Tr,15\text{-}min(night)}$**.

Section 4.3.1 of this report shows that the single ASHP unit must be encased in an acoustic louvred enclosure. Section 4.3.2 provides further guidance on vibration isolation for the ASHP unit.

4.3.1. Acoustic Enclosure Applied to ASHP Unit

Noise Control from Enclosure to ASHP Unit:

The single ASHP unit must be encased with a new single-banked acoustic louvred enclosure system, which can fully enclose the ASHP unit to enhance the acoustic performance and reduce the noise output to acceptable levels. The minimum total sound reduction required is detailed in the table below:

	Transmission Loss/ Sound Reduction (dB), Octave Band Centre Frequency (Hz)								Minimum Total Transmission Loss/ Sound Reduction (dB)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Example Attenuation from Acoustic Enclosure*	5*	5*	7*	9*	13*	13*	13*	11*	**9***

**** The example octave band frequencies (63Hz to 8kHz) sound reduction levels provided is guidance only.***

***** The optimised acoustic enclosure requires a minimum total sound reduction of 9 dB; we recommend the client contact their acoustic consultant before purchasing the solution to clarify whether the chosen enclosure's acoustic performance is sufficient.***

The custom-made acoustic louvred enclosure can be obtained from the following suppliers (note: other suppliers are available):

- **Bespoke Acoustic Solutions (BAS).** Example product: **'BAS BA SL150*' Single Bank Louvre (150mm) Acoustic Enclosure*** (BASL150EP-Acoustic-Louvre-Product-Page (bas-ltd.co.uk)).
- **Environmental Equipment Corporation (EEC).** Example product: ***'EEC LA1' Single Bank Louvre (150 mm)' Acoustic Enclosure*** *(products (eec.co.uk)).*
- **Noico.** Example product: **'Noico *Single Bank Louvre Acoustic Enclosure'*** *(*Noico Ltd | Acoustic Enclosures and Acoustic Panelwork).

Important: We recommend that the client contact their acoustic consultant before selecting and purchasing the new acoustic enclosure treatment to clarify if the location and acoustic performance are sufficient.

4.3.2. Vibration Control to Flat Roof-Mounted ASHP Unit (Anti-Vibration)

Re-radiated noise and vibration from the ASHP unit have been considered and prevented by installing anti-vibration mounts in the proposed plant. The system suppliers can advise on an effective anti-vibration mount that will not impact the flat roof element structure.

- **Enclosed Spring Anti-Vibration Mounts. An example of an anti-vibration mount product is 'Christie & Grey, Enclosed Spring Mounts (Model No. ES20 or ES25)'.** We recommend contacting your supplier to confirm the best mounts for this type of equipment and applying them to the flat roof elements.

  Note: An example of the anti-vibration mounts provided is shown in Appendix B1.2 technical datasheet.

4.4. BS 4142 Plant Noise Assessment with Noise & Vibration Mitigation Applied

The proposed air source heat pump unit will apply noise and vibration control measures, as detailed in Section 4.3 of this report. The plant noise impact calculations for daytime and night-time are detailed in Section 4.4.

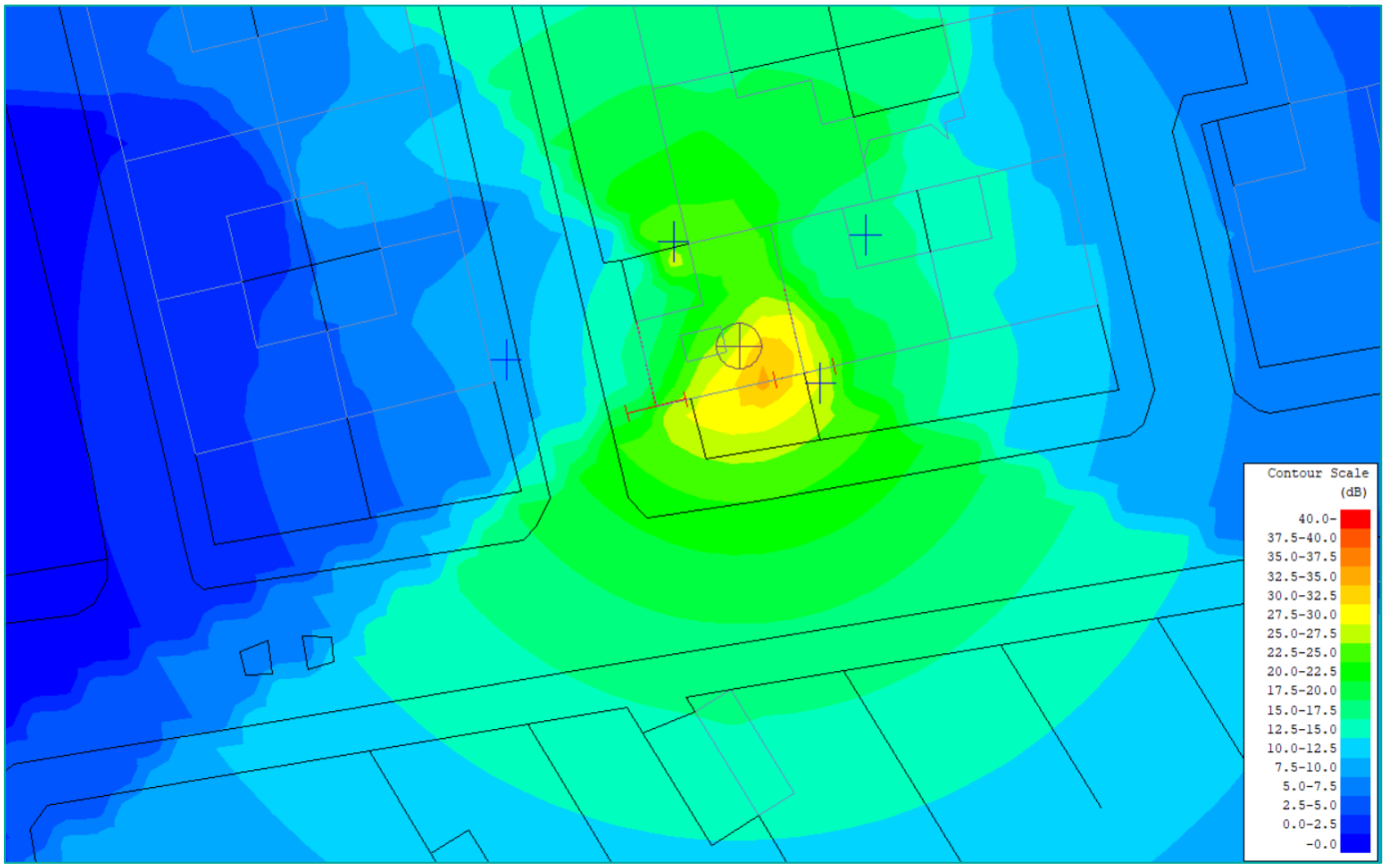
4.4.1. Daytime & Night Plant Noise Model (With Mitigation/ Noise Control Applied)

The NoiseMap® Five noise model in Figure 4 shows predicted daytime and night-time noise levels at the nearest noise-sensitive residential premises (Figure 2), with additional noise and vibration control measures and guidance detailed in Section 4.3.1 and Section 4.3.2.

Daytime & Night NoiseMap® Predicted Sound Pressure Level at the Nearest Residential Receivers:

Residential Receptors (Figure 2)	NoiseMap® Predicted Sound Pressure Level, $L_{Aeq,1\text{-hour(day)}}$, and $L_{Aeq,15\text{-min(night)}}$, dB
	Day/ Night
Receptor R1	9
Receptor R2	19
Receptor R3	12
Receptor R4	22

Figure 4 – BS 4142:2014 Noise Impact Calculations With Noise Control/ Mitigation – Daytime/ Night Operating Hours Plant Noise Calculation from Plant Noise Sources to the Nearest Residential Receptors.



Note 1: NoiseMap ® Five Noise Model contour is shown at 7.5 metres above ground.

Note 2: The contour scale key on the right-hand side is between 0 dB to >40 dB.

4.4.2. Daytime BS 4142 Plant Noise Impact to Nearest Residents Premises – With Mitigation Applied

The noise impact assessment detailed in Section 4.4.1 and Figure 4 of this report shows that the daytime noise levels to 1 metre from the nearest noise-sensitive residents' window equals **22 dB $L_{Aeq,T}$ (Receptor R4)**.

The table below summarises the daytime British Standard BS 4142 noise impact assessment from the plant/ equipment serving the residential with noise & vibration control applied to the unit detailed in Section 4.3 of this report. The noise impact ***"indicates little likelihood of adverse impact"*** on the neighbouring residents.

Daytime BS 4142 Plant Noise Impact to Nearest Residents Premises – With Noise and Vibration Control/ Mitigation Applied:

Daytime Results	Residential Receptor R1	Residential Receptor R2	Residential Receptor R3	Residential Receptor R4
NoiseMap ® Five predicted cumulative daytime sound pressure level(s) to 1-metre from the nearest residents' window(s)	$L_{Aeq,1\text{-hour}}$ = **9 dB**	$L_{Aeq,1\text{-hour}}$ = **19 dB**	$L_{Aeq,1\text{-hour}}$ = **12 dB**	$L_{Aeq,1\text{-hour}}$ = **22 dB**
Residual sound level	$L_{Aeq,1\text{-hour}}$ = **55 dB**	$L_{Aeq,1\text{-hour}}$ = **55 dB**	$L_{Aeq,1\text{-hour}}$ = **55 dB**	$L_{Aeq,1\text{-hour}}$ = **55 dB**
Background sound level (daytime)	$L_{A90,1\text{-hour}}$ = **42 dB**	$L_{A90,1\text{-hour}}$ = **42 dB**	$L_{A90,1\text{-hour}}$ = **42 dB**	$L_{A90,1\text{-hour}}$ = **42 dB**
Reference period of 1-hour is used for assessment on the basis that the source continues to operate during the measurement period				
On time correction [to nearest 0.1 dB as intermediate step in equation (4) calculation]	10log(60/60) = **0 dB**	10log(60/60) = **0 dB**	10log(60/60) = **0 dB**	10log(60/60) = **0 dB**
Specific sound level	$L_{Aeq,1\text{-hour}}$ = [10log ($10^{109} - 10^{5.5}$) – 0] = **9 dB**	$L_{Aeq,1\text{-hour}}$ = [10log ($10^{1.9} - 10^{5.5}$) – 0] = **19 dB**	$L_{Aeq,1\text{-hour}}$ = [10log ($10^{1.2} - 10^{5.5}$) – 0] = **12 dB**	$L_{Aeq,1\text{-hour}}$ = [10log ($10^{2.2} - 10^{5.5}$) – 0] = **22 dB**
Acoustic Feature Correction*	**0 dB***	**0 dB***	**0 dB***	**0 dB***
Rating level	**9 dB $L_{Ar,Tr,1\text{-hour}}$**	**19 dB $L_{Ar,Tr,1\text{-hour}}$**	**12 dB $L_{Ar,Tr,1\text{-hour}}$**	**22 dB $L_{Ar,Tr,1\text{-hour}}$**
Background sound level (daytime)	$L_{A90,1\text{-hour}}$ = **42 dB**	$L_{A90,1\text{-hour}}$ = **42 dB**	$L_{A90,1\text{-hour}}$ = **42 dB**	$L_{A90,1\text{-hour}}$ = **42 dB**
Excess noise over the background sound level	**(9 – 42) dB = -33 dB**	**(19 – 42) dB = -23 dB**	**(12 – 42) dB = -30 dB**	**(22 – 42) dB = -20 dB**
London Borough of Camden Council Criteria Compliance (emission noise does not exceed 10 dB below the minimum L_{A90})	**Yes**	**Yes**	**Yes**	**Yes**
The daytime assessment indicates little likelihood of adverse impact, and this is an indication of the specific sound sources having a *'low impact'* on the nearest residents.				

Note*: *The specific noise levels were calculated without character correction to the ASHP plant/equipment.

4.4.3. Night-time BS 4142 Plant Noise Impact to Nearest Residents Premises – With Mitigation Applied

The noise impact assessment detailed in Section 4.4.1 and Figure 4 of this report shows that the night-time noise levels to 1 metre from the nearest noise-sensitive residents' window equals **22 dB $L_{Aeq,T}$ (Receptor R4)**.

The table below summarises the night-time British Standard BS 4142 noise impact assessment from the plant/ equipment serving the residential with noise & vibration control applied to the unit detailed in Section 4.3 of this report. The noise impact ***"indicates little likelihood of adverse impact"*** on the neighbouring residents.

Night-time BS 4142 Plant Noise Impact to Nearest Residents Premises – With Noise and Vibration Control/ Mitigation Applied:

Night-time Results	Residential Receptor R1	Residential Receptor R2	Residential Receptor R3	Residential Receptor R4
NoiseMap ® Five predicted cumulative night-time sound pressure level(s) to 1-metre from the nearest residents' window(s)	$L_{Aeq,15\text{-}minutes}$ = **9 dB**	$L_{Aeq,15\text{-}minutes}$ = **19 dB**	$L_{Aeq,15\text{-}minutes}$ = **12 dB**	$L_{Aeq,15\text{-}minutes}$ = **22 dB**
Residual sound level	$L_{Aeq,15\text{-}minutes}$ = **45 dB**	$L_{Aeq,15\text{-}minutes}$ = **45 dB**	$L_{Aeq,15\text{-}minutes}$ = **45 dB**	$L_{Aeq,15\text{-}minutes}$ = **45 dB**
Background sound level (night)	$L_{A90,15\text{-}minutes}$ = **32 dB**	$L_{A90,15\text{-}minutes}$ = **32 dB**	$L_{A90,15\text{-}minutes}$ = **32 dB**	$L_{A90,15\text{-}minutes}$ = **32 dB**
Reference period of 15 minutes is used for assessment on the basis that the source continues to operate during the measurement period				
On time correction [to nearest 0.1 dB as intermediate step in equation (4) calculation]	10log(15/15) = **0 dB**	10log(15/15) = **0 dB**	10log(15/15) = **0 dB**	10log(15/15) = **0 dB**
Specific sound level	$L_{Aeq,15\text{-}min}$ = [10log ($10^{0.9} - 10^{4.5}$) – 0] = **9 dB**	$L_{Aeq,15\text{-}min}$ = [10log ($10^{1.9} - 10^{4.5}$) – 0] = **19 dB**	$L_{Aeq,15\text{-}min}$ = [10log ($10^{1.2} - 10^{4.5}$) – 0] = **12 dB**	$L_{Aeq,15\text{-}min}$ = [10log ($10^{2.2} - 10^{4.5}$) – 0] = **22 dB**
Acoustic Feature Correction*	**0 dB***	**0 dB***	**0 dB***	**0 dB***
Rating level	**9 dB $L_{Ar,Tr,15\text{-}min}$**	**19 dB $L_{Ar,Tr,15\text{-}min}$**	**12 dB $L_{Ar,Tr,15\text{-}min}$**	**22 dB $L_{Ar,Tr,15\text{-}min}$**
Background sound level (night-time)	$L_{A90,15\text{-}minutes}$ = **32 dB**	$L_{A90,15\text{-}minutes}$ = **32 dB**	$L_{A90,15\text{-}minutes}$ = **32 dB**	$L_{A90,15\text{-}minutes}$ = **32 dB**
Excess noise over the background sound level	**(9 – 32) dB = -23 dB**	**(19 – 32) dB = -13 dB**	**(12 – 32) dB = -20 dB**	**(22 – 32) dB = -10 dB**
London Borough of Camden Council Criteria Compliance (emission noise does not exceed 10 dB below the minimum L_{A90})	**Yes**	**Yes**	**Yes**	**Yes**
The night-time assessment indicates little likelihood of adverse impact, and this is an indication of the specific sound sources having a *'low impact'* on the nearest residents.				

***Note**: The specific noise levels were calculated with no character correction to the ASHP plant/equipment.*

Therefore, based on the daytime and night-time British Standard BS 4142 results in Section 4.4 of this report, if the noise and vibration control measures and guidance detailed in Section 4.3 are implemented, London Borough of Camden Council's noise requirements and criteria (Section 2) will be achieved.

Appendix A – Noise Survey Details and Result Table & Graph

Appendix A1 – Noise Survey Details

Personnel present:

Alex Hancock (PG Dip (IOA), MIOA) – Climate Acoustics

Instrumentation used and calibration info:

Svantek 971A – Sound Level Meter (**calibration certificates available upon request.)*.

Larson Davis CAL200 – Calibrator (**calibration certificates available upon request.)*.

Climate Acoustics Calibrated Equipment	
Unattended Noise Meter (Svantek 971A) – Location U1 (Figure 5)	
Class 1 Sound Level Meter	Svantek 971A – Serial Number 127611 (Date of Calibration: 15/03/2023*)
Microphone	ACO 7152E – Serial Number 82011 (Date of Calibration: 15/03/2023*)
Preamplifier	Svantek SV 18A – Serial Number 130497 (Date of Calibration: 15/03/2023*)
Calibrator (Larson Davis CAL200)	
Calibrator	Larson Davis – CAL200 - Serial Number 6003 (Date of Calibration: 27/10/2023*)

Calibration procedure:

The calibration procedure before and after the noise survey involved calibrating the Svantek 971A sound level meters using the Larson Davis CAL200. No significant drift was measured before and after the survey (accuracy within ±0.3 dB).

Uncertainty:

For accurate measurements, the noise monitoring equipment is calibrated by traceable lab calibration:

- a Class 1 sound level meter and microphone are calibrated once every two years.
- a Class 1 calibrator is calibrated once every year.

Note: any measurement is taken by a Class 1 sound level meter, a margin on uncertainty of +/- 1.1 decibels typically apply because of the equipment's tolerances. The uncertainty with the noise prediction calculations is limited, as using our experience and factors including distance, line of sight and reflections have been considered.

Equipment operation times and dates:

12 pm on Monday 29th July 2024 to 10:30 am Friday 2nd August 2024.

Weather conditions:

Weather conditions during the operation of noise monitoring equipment.

Date	Temperature (°C)	Weather Conditions	Wind
Monday 29 July 2024	18 to 29 Degrees	Warm/ Hot. Dry. Sunny, Clear.	**Calm to Gentle Breeze (1-5m/s).**
Tuesday 30 July 2024	15 to 31 Degrees	Cool/ Warm/ Hot. Dry. Sunny, Clear/ Passing Clouds/ Overcast.	**Calm to Gentle Breeze (0-4m/s).**
Wednesday 31 July 2024	19 to 29 Degrees	Warm/ Hot. Dry. Sunny/ Partly Sunny, Clear/ Passing Clouds/ Overcast.	**Light Air to Gentle Breeze (2-5m/s).**
Thursday 1 August 2024	18 to 29 Degrees	Warm/ Hot. Dry/ Wet. Sunny/ Partly Sunny, Clear/ Passing Clouds/ Broken Clouds/ Overcast and Occasional Drizzle and Thunderstorms.	**Calm to Gentle Breeze (0-4m/s).**
Friday 2 August 2024	17 to 20 Degrees	Warm/ Hot. Dry. Partly Sunny, Fog/ Low Clouds/ Passing Clouds/ Mostly Cloudy.	**Calm to Light Breeze (0-3m/s).**

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Appendix A2 – Noise Survey Locations

The Google Earth™ image (Figure 5) below shows the unattended sound level meter locations at position U1. A description of each position is provided below:

- **Position U1:** The sound level meter microphone was set up on a tripod at the height of 1.5 metres to the 1st-floor flat roof to the rear of the premises at 68 King Henry's Road and is in 'free field' conditions.

Figure 5 - Noise Measurement Location U1 (Source: Google Earth™)

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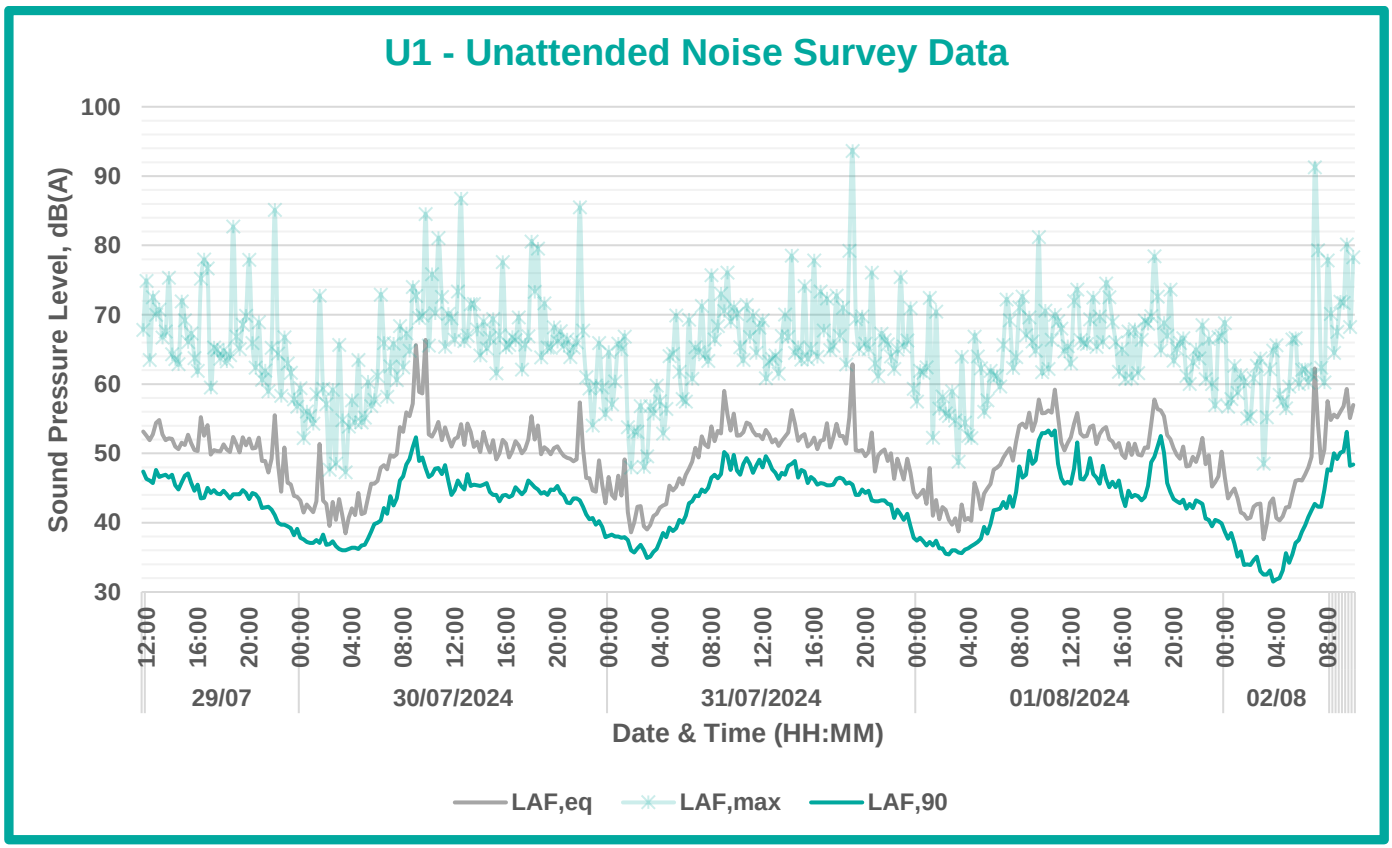
Appendix A3 – Position U1 - Unattended Noise Survey Graph — At Rear Elevation Flat Roof.



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Appendix B – Technical Datasheets

Appendix B1 – Technical Datasheets

Appendix B1.1. Samsung ASHP Unit Technical Datasheets

'Samsung, EHS Mono HT Quiet 8kW Air Source Heat Pump, Model No. AE080BXYDEG'

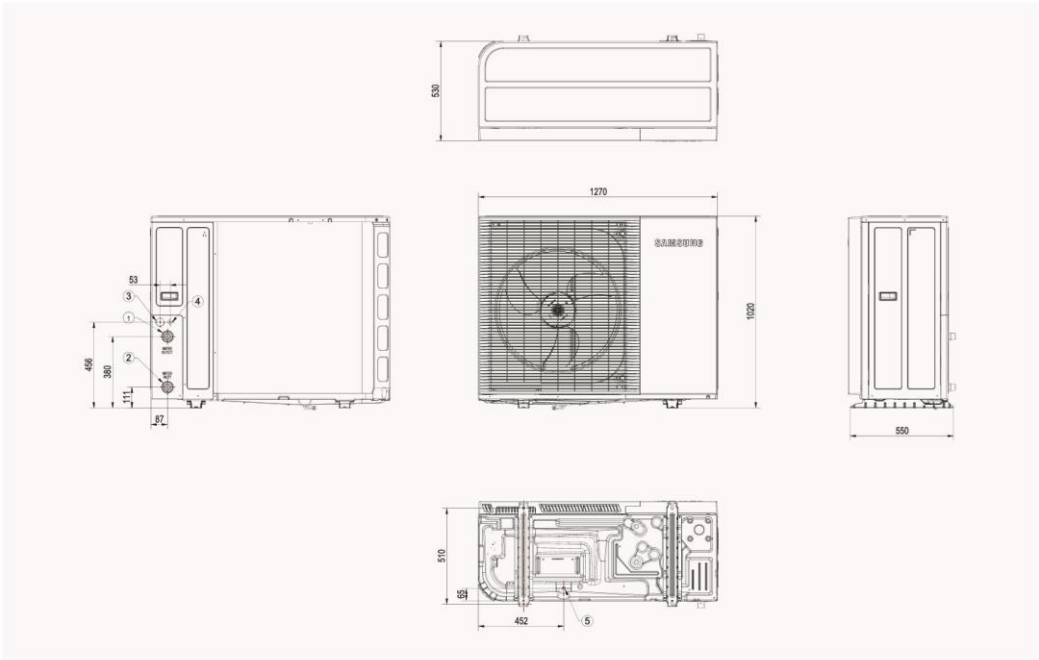
Specifications

			AE080BXYDEG	AE080BXYDGG
Capacity				
Capacity*	Heating (A7/W35)	kW	8.0	8.0
	Cooling (A35/W18)	kW	8.0	8.0
Performance				
Leaving Water Temperature	Heating	°C	15 ~ 70	15 ~ 70
	Cooling	°C	5 ~ 25	5 ~ 25
Efficiency	SCOP Class (35°C)		A+++	A+++
	SCOP Class (55°C)		A++	A++
Sound Pressure**	Normal	dB(A)	42	42
	Quiet Mode	dB(A)	35	35
Operating Temperature Range	Heating	°C	-30 ~ 43	-30 ~ 43
	Cooling	°C	10 ~ 46	10 ~ 46
Electrical Data				
Power Supply		Φ, V	1Φ, 220 ~ 240V	3Φ, 380 ~ 415V
Refrigerant				
Refrigerant Type			R32	R32
Water Pipe	Inlet/Outlet	mm	28/28	28/28
Dimensions				
Net Dimensions	W x H x D	mm	1270 x 1018 x 530	1270 x 1018 x 530

The available line-up, including capacities and models, may vary by region. Features and specifications are subject to change without notice.
* AZW 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].
** 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
+31 (0)8 81 41 61 00
The Netherlands

Datasheet

Samsung EHS Mono
HT Quiet R32
AE**0BXYD*G/EU

	8kW	12kW	14kW	14kW 3 Phase
Product Code	AE080BXYDEG/EU	AE120BXYDEG/EU	AE140BXYDEG/EU	AE140BXYDGG/EU
Heating and Cooling				
Min. heating flow temp	15	15	15	15
Max. heating flow temp	70	70	70	70
Min. cooling flow temp	5	5	5	5
Max. cooling flow temp	25	25	25	25
MCS listed SCOPS				
@ 35°c	4.46	4.75	4.68	4.68
@ 40°c	4.15	4.47	4.41	4.41
@ 45°c	3.84	4.20	4.15	4.15
@ 50°c	3.53	3.92	3.88	3.88
@ 55°c	3.22	3.64	3.61	3.61
MCS Certification #				
w/ MIM-E03EN	011-1W0547_1	011-1W0550_1	011-1W0550_5	011-1W0550_7
w/ 200L climate hub	011-1W0549	011-1W0552_1	011-1W0551_2	-
w/ 260L climate hub	011-1W0548_1	011-1W0551_1	011-1W0551_3	011-1W0551_4
Dimensions				
Height	1000	1000	1000	1000
Width	1270	1270	1270	1270
Depth	530	530	530	530
Additional Data				
Weight	126.0	137.0	137.0	137.0
Min. flow rate	7	7	7	7
Max. flow rate	48	48	58	58
Sound Power Level	56	59	60	60
Refrigerant	R32	R32	R32	R32
Refrigerant charge	2.7	3.3	3.3	3.3

All information correct as of 11/04/23

MIDSUMMER
Delivering tomorrow's energy

Midsummer Energy Ltd, Cambridge Road Industrial Estate, Milton, Cambridgeshire, CB24 6AZ
Email: trade@midsummerenergy.co.uk | Telephone: 01223 851535

The manufacturers' specification and technical datasheet above detail the sound pressure level and sound power level noise data summarised below.

Plant Make & Model	Heating Mode	Sound Power Level, L_w dB(A)*	Sound Pressure Level at 1 metre, L_p dB(A)**
Samsung, EHS Mono HT Quiet 8kW, Model No. AE080BXYDEG	Normal Mode	**56**	**42**
	Quiet Mode*	**49**	**35**

**** Maximum sound power level dB(A), measured in accordance with EN-12102.***

***** 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.***

Appendix B1.2. Enclosed Spring Mounts Technical Datasheets

Enclosed Spring Mountings

Type ES - Enclosed Spring and ECS - Enclosed Captive Spring Mounting

A unique range of mountings designed primarily for building services applications where the control of low frequency vibration and noise emanating from mechanical plant is of paramount importance.

The benefits of a combined rubber and steel housing for the spring have helped establish the ES and ECS mountings as industry standards accepted by specifiers, equipment manufacturers and mechanical services installers alike.

DESIGN FEATURES

- Nitrile rubber (oil resistant) lower spring housing eliminates the possibility of metallic continuity and ensures excellent acoustic performance. Steel reinforced on ECS range.
- Full enclosed captive assembly protects the spring and controls transient motion.
- All steel components are zinc plated.
- Nominal 15, 20, 25 & 50 mm deflection colour coded helical steel springs to BS1726 Class B, laterally stable with 50% overload capacity.
- Simple single screw height adjustment.
- 6 mm thick ribbed rubber seating pads available for ES25 and ECS ranges.
- Colour coded labels for easy identification.
- Stainless Steel variants available.

TYPICAL APPLICATIONS

- Axial and Centrifugal Fans.
- Air Handling Units.
- Chillers and Cooling Towers.
- Rotary and Multi Cylinder Compressors.
- Diesel Generating Sets (ECS only).
- Mechanical Test Rigs.
- Isolation of Sensitive Equipment.

CHRISTIE & GREY Vibration & Shock Control

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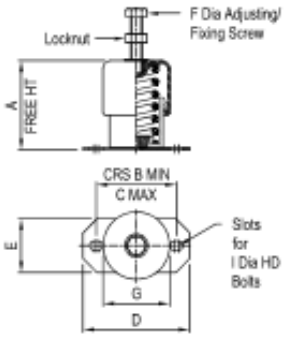
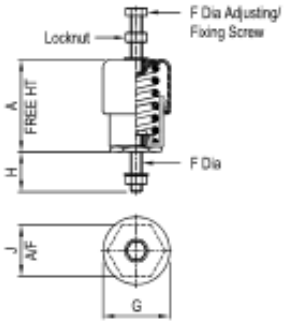
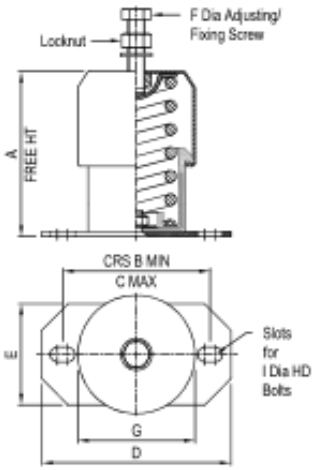
TYPE ES



TYPE ESB



TYPE ECS



TYPE ES, ESB, ES25, ECS25 & ECS50 MOUNTINGS

PART No.	COLOUR CODE	RATED LOAD (kg)	DEFLECTION AT RATED LOAD (mm)	DIMENSIONS (mm)										WT (kg) MAX
				A	B	C	D	E	F	G	H	I	J	
ES20/10	PURPLE	10	20	63	54	60	76	38	M8	48	-	M6	-	0.25
ES20/15	YELLOW	15	20											
ES20/20	GREY	20	20											
ES20/40	GREEN	40	20											
ES20/70	RED	70	20											
ES15/100	BLUE	100	15											
ESB20/10	PURPLE	10	20	65	-	-	-	-	M8	48	26	-	36	0.25
ESB20/15	YELLOW	15	20											
ESB20/20	GREY	20	20											
ESB20/40	GREEN	40	20											
ESB20/70	RED	70	20											
ESB15/100	BLUE	100	15											
ES25/30	YELLOW	30	25	88	85	90	110	70	M10	78	-	M8	-	1.0
ES25/60	GREEN	60	30											
ES25/100	BLUE	100	25											
ES25/160	WHITE	160	25											
ES25/250	RED	250	25											
ECS25/100	WHITE/YELLOW	100	25	127	130	150	180	95	M16	111	-	M12	-	3.0
ECS25/200	WHITE/RED	200	25											
ECS25/300	WHITE/PURPLE	300	25											
ECS25/400	WHITE/GREY	400	25											
ECS25/500	WHITE/ORANGE	500	25											
ECS25/600	WHITE/BROWN	600	25											
ECS25/700	WHITE/BLACK*	700	25											
ECS25/800	WHITE/GOLD	800	25											
ECS25/1000	WHITE/1000	1000	25											
ECS25/1200	WHITE/1200*	1200	25											
ECS25/1400	WHITE/1400*	1400	25											
ECS50/100	BLACK/YELLOW	100	50	155	130	150	180	95	M16	111	-	M12	-	2.8
ECS50/200	BLACK/GREEN	200	50											
ECS50/300	BLACK/BLUE	300	50											
ECS50/400	BLACK/WHITE	400	50											
ECS50/500	BLACK/RED	500	50											

* Internal nested spring.

Seating Pads

Ribbed rubber seating pads can now be fitted as standard, suffix Pt. No. /B e.g. ES25/100/B.

Stainless Steel.

This option is available across the entire range for external and other hostile environments.

When ordering the Pt. No. should be suffixed with /S for Stainless Steel or if fitted with a seating pad /SB e.g. ECS25/500/S or ECS25/500/SB.

ISOLATION EFFICIENCY AT TYPICAL MACHINE SPEEDS

MACHINE SPEEDS (rpm)	EFFICIENCY %		
	15 mm DEFL.	25 mm DEFL.	50 mm DEFL.
300	DO NOT USE	34.0	75.2
500	68.7	83.3	92.3
750	88.1	93.2	96.7
1000	93.7	96.3	98.2
1200	95.7	97.4	98.7
1500	97.3	98.4	99.2
1750	98.0	98.8	99.4
2000	98.5	99.1	99.5

The above figures are theoretical values only based on the vertical natural frequency of the sprung system assuming infinitely stiff structural supports.
The effects of high frequency spring coil resonances on low frequency performance are also ignored.

Spring Deflection

Spring stiffness is linear over its working range therefore the actual deflection for a given load can be calculated as follows:-

$$\text{Actual Deflection (mm)} = \frac{\text{Actual Load (kg)} \times \text{Rated Deflection (mm)}}{\text{Rated Load (kg)}}$$

For full installation instructions please refer to our data sheet DS026.
For more detailed information and technical assistance please contact our Technical Department.

In the interests of continual development, the Company reserves the right to make modifications to these details without notice.

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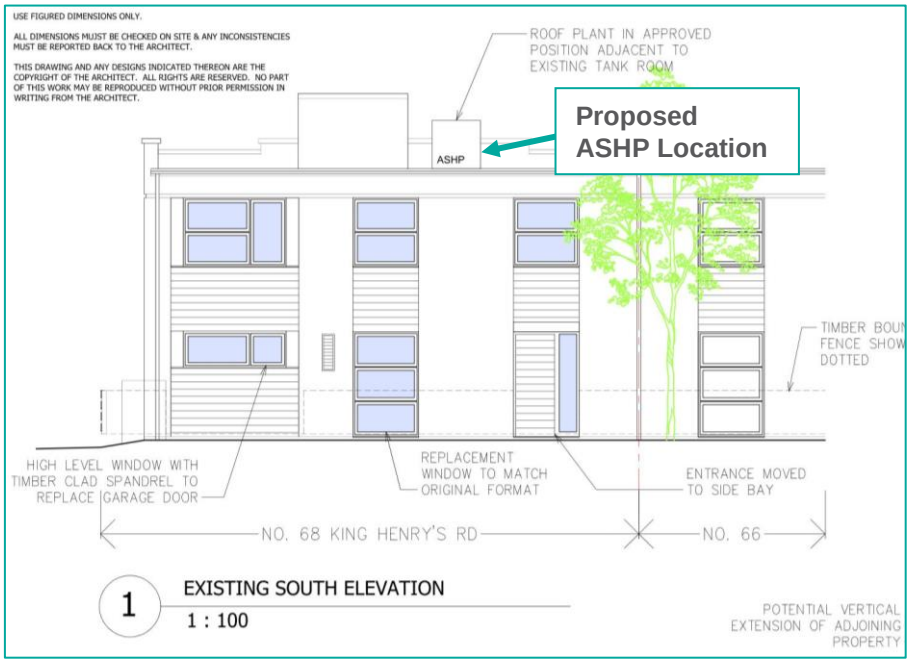
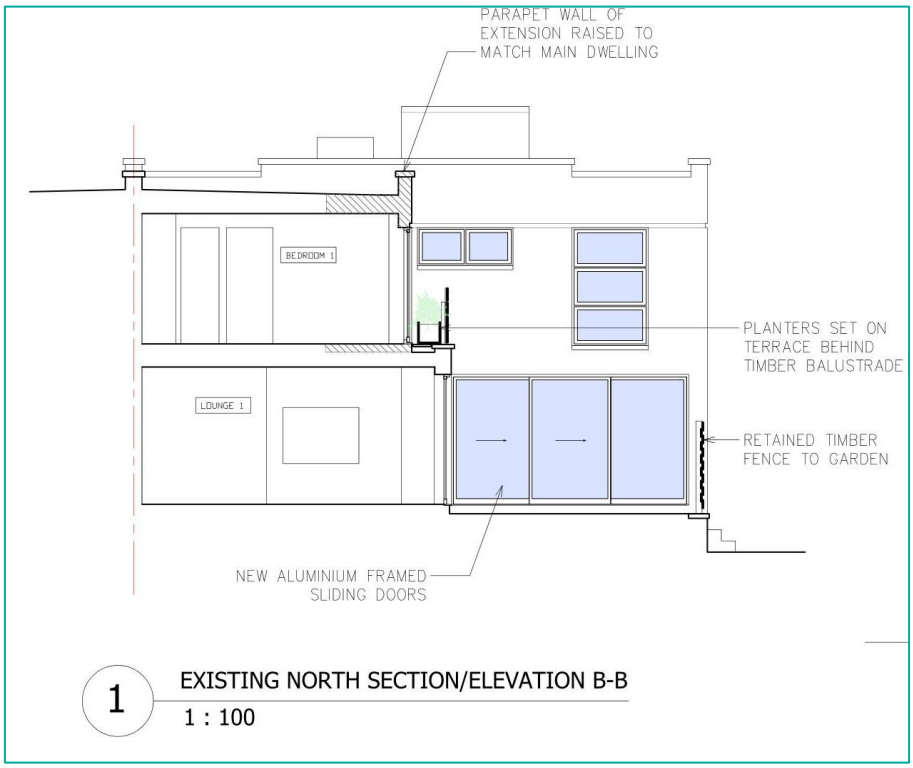
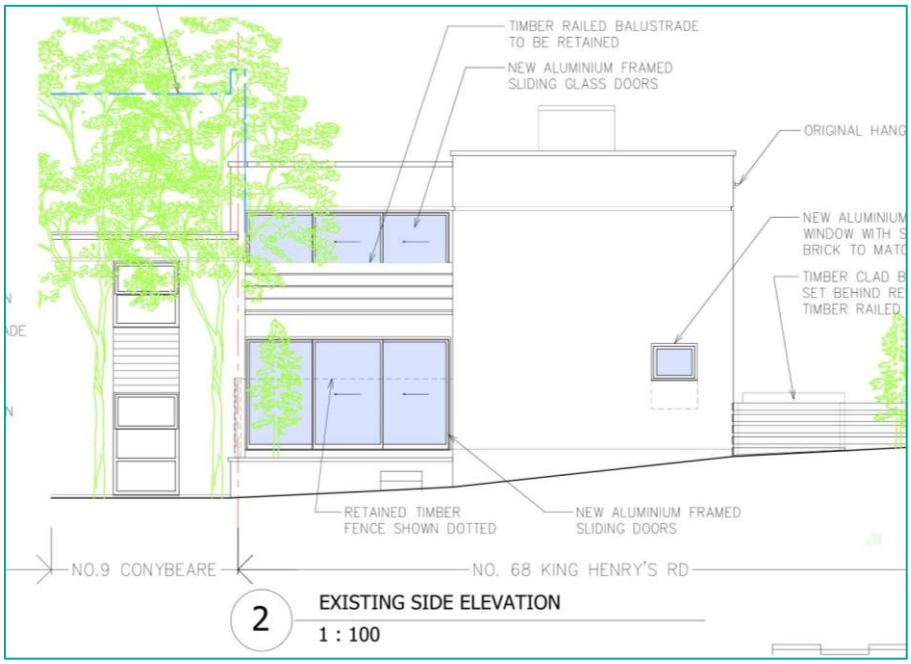
Appendix B2 – Site Drawings

Appendix B2.1. Proposed Elevations







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Appendix B2.2. Proposed Roof Plan