4-6 BEDFORD PLACE, WC1B 5AH

Plant Noise Assessment

Reference: 12365.RP01.PNA.2
Prepared: 21 March 2023
Revision Number: 2

City Planning
2nd Floor West Wing
40-41 Pall Mall
London
SW1Y 5JG

Plant Noise Assessment

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Reference: 12365.RP01.PNA.2
Prepared: 21 March 2023

Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	08 March 2023	Patrick Spiers	Russell Richardson
1	Reassessment for new plant configuration	14 March 2023	Patrick Spiers	Russell Richardson
2	Typographical changes	21 March 2023	Patrick Spiers	Russell Richardson

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.

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Contents

1. INTRODUCTION

It is proposed to locate new items of plant at 4-6 Bedford Place, WC1B 5AH. As part of the planning application, London Borough of Camden requires consideration be given to atmospheric noise emissions from the proposed equipment to the nearest noise-sensitive receptors.

RBA Acoustics has been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emission limits in accordance with Camden's requirements. This report presents the results of the noise measurements, associated criteria and provides the required assessment.

A summary of acoustic terminology is included in Appendix A.

2. SITE DESCRIPTION

The site is shown in relation to its surroundings in the site plan in Figure 1 (Appendix E).

Bedford Place is a long row of terraced properties, to the south of Russell Square. The site is located at the southern end of the road, near to Bloomsbury Square Gardens. Directly to the north is the Pickwick Hall hotel, and to the south are residential properties. Further to the west is the British Museum and to the east is Southampton Row, along which is a mix of commercial and residential premises. The acoustic environment consists mainly of a general urban ambience, with vehicle traffic from the surrounding streets (especially Southampton Row) clearly audible. Vehicle and pedestrian traffic are also fairly consistent along Bloomsbury Place / Great Russell Street.

3. ENVIRONMENTAL NOISE SURVEY

3.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken over the following 24-hour period:

12:45 Tuesday 7 February to 12:45 Wednesday 8 February 2023.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. However, based on observations during the site visits and weather reports for the area, conditions were generally considered suitable for obtaining representative noise measurements, being predominantly dry with little wind.

Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes.

3.2 Measurement Location

To determine the existing noise climate around the site, measurements were undertaken at the following location:

Measurement Position 1 – Rear 2nd Floor Window: The microphone was set up on an A-Frame, approximately 1m from the rear façade of the southern-most window, at 2nd floor level. The acoustic environment consisted mainly of general urban ambience, with vehicle traffic from Southampton Row clearly heard. Plant located on the roof and on the ground at the rear of the Bedford Hotel could also be distinguished.

The measurement position is also illustrated on the site plan attached in Figure 1 and photos in Figure 2 (Appendix E).

3.3 Instrumentation

For information regarding the equipment used for the measurements please refer to Appendix B.

The sound level meter was calibrated both prior to and on completion of the survey with no significant calibration drift observed.

3.4 Results

The noise levels measured are shown as time-histories on the attached Graphs 1-3 (Appendix E).

The lowest L_{A90} and the period averaged L_{Aeq} noise levels measured are summarised in Table 1.

Table 1 – Measured Levels

Measurement Period	Position 1 – Rear 2nd Floor Window	
	Lowest $L_{A90,15min}$ (dB)	L_{Aeq} (dB)
Daytime (07:00 – 23:00)	49	55
Night-time (23:00 – 07:00)	41	51

4. PLANT NOISE CRITERIA

The requirements of London Borough of Camden's Environmental Health Department regarding new building services plant are understood to be as follows.

> *"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)."*

In line with the above requirements, we propose items of mechanical services be designed so that noise emissions from the plant do not exceed the following levels when assessed at the nearest noise sensitive location:

- Daytime (07:00 to 23:00) 39 dBA
- Night-time (23:00 to 07:00) 31 dBA

In line with BS 4142: 2014, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be subtracted from any of the above proposed noise emission limits.

It should be noted that the above requirements are applied at the nearest residential adjacencies and alternative criteria should be incorporated if there are also commercial properties affected by the proposed plant installations.

5. PLANT NOISE ASSESSMENT

This assessment has been based on the information provided to RBA Acoustics by SAV Group and Energylab_ and is described in the following sections.

5.1 Proposed Plant Items

The following plant is proposed for the scheme:

Table 2 – Plant Types

Ref.	Manufacturer/Model/Duty	Plant Type
HRU1	Daikin REYQ12U7Y1B	Heat Recovery Unit
HRU2	Daikin REYQ14U7Y1B	Heat Recovery Unit
HRU3	Daikin REYQ18U7Y1B	Heat Recovery Unit
HP1	Daikin EMRQ8AB	Heat Pump

5.2 Plant Locations

Plant is proposed to be located in two positions along the back fence of the rear garden area of the property, approximately 9m from the rear façade. Table 3 details the units to be located at each position.

Table 3 – Units Located at Proposed Positions

Position	Proposed Units
North Position	2 x HRU1 2 x HP1
South Position	2 x HRU2 1 x HRU3

The equipment positions are indicated on the site plan in Figure 1 and Figure 3 in Appendix E.

5.3 Plant Noise Levels

Information regarding the noise levels of the proposed plant has been provided by the manufacturer of the units. The associated plant noise levels are detailed in Table 4.

Table 4 – Manufacturer's Plant Noise Levels

Unit	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
HRU1	L_P	64	66	61	57	53	52	53	44
HRU2	L_P	62	63	60	59	53	49	48	47
HRU3	L_P	68	64	60	60	55	53	54	45
HP1	L_P	60	62	60	56	52	45	43	37

A review of the octave band data provides no indication of any tonal characteristics associated with the proposed plant.

5.4 Location of the Nearest Noise-Sensitive Receptors

Based on observations made on site and discussions with the design team we understand the nearest noise-sensitive receptors to the proposed plant to be as follows:

Receptor 1 – 3 Bedford Place, 3rd Floor Rear Window

This receptor is located directly south of the site, approximately 11m from the southern-most position at which the proposed plant will be installed. Other floors receive some screening from the garden wall between properties so, while affected, they will not be the most sensitive.
This receptor is also indicative of a similar position at the Pickwick Hotel to the north.

The receptors are shown in the site plan in Figure 1 in Appendix E.

5.5 Calculation of Noise Levels at Nearest Noise-Sensitive Receptors

Our calculation method for predicting noise levels from the proposed externally mounted plant items at the nearest noise-sensitive receptors, based on the information above, is summarised below.

- Source Term SPL
- Distance Attenuation
- Directivity
- Screening

Calculation sheets are attached for further information in Appendix C.

The results of the calculations indicate the following noise levels at the nearest affected residential windows:

Table 5 – Predicted Noise Levels

Operating Period	Noise Level (dB) at Receptor 1 – 3 Bedford Place, Ground Floor Rear Window	
	Prediction	Criterion
Daytime (07:00 – 23:00)	47	39
Night-time (23:00 – 07:00)	47	31

Noise from the proposed plant installations is in exceedance of the normal requirements imposed by London Borough of Camden.

We therefore recommend the following mitigation measures be included in the design and installation.

5.6 Mitigation

Acoustic Enclosures

We understand from Energylab_, the M&E consultants, that a full enclosure is proposed. This should have minimum insertion losses as detailed in Table 6.

Table 6 – Minimum Specification for Acoustic Enclosure

Example Product	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic Enclosure	11	13	19	28	22	30	32	28

Resulting Plant Noise Levels

With the above mitigation measures included, the resultant predicted noise levels are as shown in Table 7

Table 7 – Predicted Noise Levels with Mitigation

Operating Period	Noise Level (dB) at Receptor 1 – 3 Bedford Place, Ground Floor Rear Window	
	Prediction	Criterion
Daytime (07:00 – 23:00)	25	39
Night-time (23:00 – 07:00)	25	31

Noise from the proposed plant with the mitigation measures incorporated is predicted to be within the Local Authority criteria.

6. VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that condensing units / fans / AHUs be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped, and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

7. CONCLUSION

RBA Acoustics has undertaken noise monitoring at 4-6 Bedford Place, WC1B 5AH. The measured noise levels are presented within this report. The resultant noise levels have been used to determine the required criteria for atmospheric noise emissions from the proposed plant installations.

The following mitigation measures are proposed within this report:

- Units should be enclosed in acoustic enclosures capable of achieving at least the reductions presented in Table 6

Provided the above mitigation measures are included in the design and installation, the results of the assessment indicate atmospheric noise emissions from the proposed plant are within the criteria required by London Borough of Camden and, as such, can be considered acceptable in terms of adverse noise impact.

Appendix A – Acoustic Terminology

A-weighting (e.g. dB(A))	A correction applied across the frequency bands to take into account the response of the human ear, and therefore considered to be more representative of the sound levels people hear.
DeciBel (dB)	Unit used for many different acoustic parameters. It is the logarithmic ratio of the level being assessed to a standard reference level.
L_{eq}	The level of a notional steady sound which, over a stated period of time, *T*, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
$L_{Aeq,T}$	The A-weighted level of a notional steady sound which, over a stated period of time, *T*, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
L_{An} (e.g. L_{A10}, L_{A90})	The sound level exceeded for n% of the time. E.g. L_{A10} is the A-weighted level exceeded for 10% of the time and as such can be used to represent a typical maximum level. Similarly, L_{A90} is the level exceeded for 90% of the measurement period and is often used to describe the underlying background noise.
$L_{Amax,T}$	The instantaneous maximum A-weighted sound pressure level which occurred during the measurement period, *T*. It is commonly used to measure the effect of very short duration bursts of noise, e.g. sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the ambient level.
NR	Noise Rating – A single figure term to describe a measured noise level which considers the frequency content of the noise, generally used for internal noise level measurements (particularly mechanical services plant).

Appendix B – Instrumentation

The following equipment was used for the measurements.

Table B1– Equipment Calibration Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1407794	4712332270	9 December 2023
Norsonic Pre Amplifier	1209	23229		
Norsonic ½" Microphone	1225	468970		3 December 2023
Norsonic Sound Calibrator	1255	125525795	Cal 022-2021-14778	8 December 2023

Appendix C – Plant Calculations & Data Sheets

Table C1 – Example Calculation, South Box

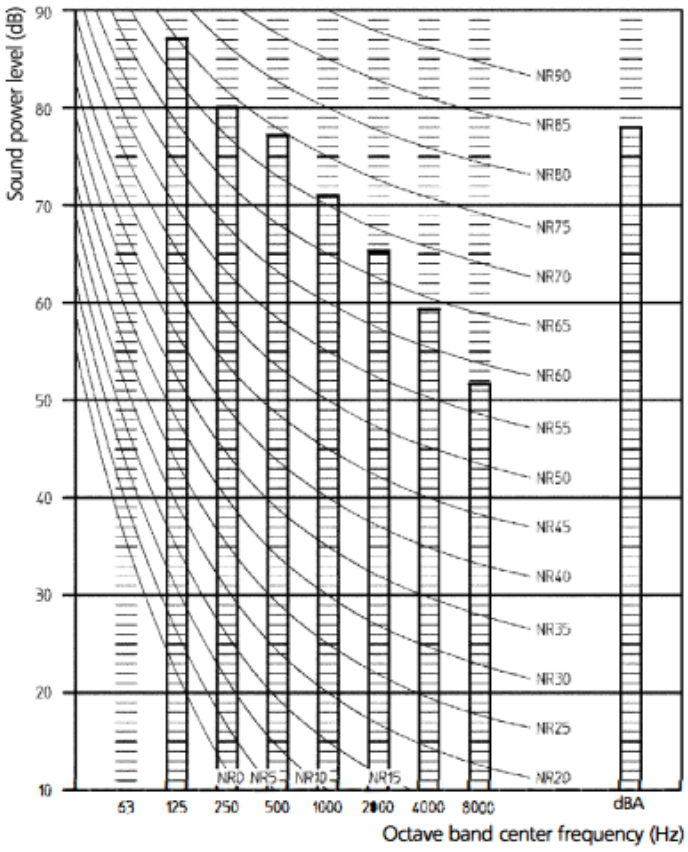
Parameter	Octave-band Noise Levels (dB) at Octave-band Centre Frequency (Hz)								dBA
	63	125	250	500	1000	2000	4000	8000	
HRU2 L_P	62.0	63.0	60.0	59.0	53.0	49.0	48.0	47.0	60.0
HRU2 L_P	62.0	63.0	60.0	59.0	53.0	49.0	48.0	47.0	60.0
HRU3 L_P	68.0	64.0	60.	60.0	55.0	53.0	54.0	45.0	62.0
Enclosure insertion losses	-3.0	-4.0	-6.0	-10.0	-12.0	-13.0	-13.0	-14.0	-19.6
Distance losses @ 9.5m	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-27.8
Barrier attenuation	-7.6	-9.4	-11.8	-14.6	-17.6	-20.0	-20.0	-20.0	-26.1
Noise level at receiver	**38.3**	**33.9**	**26.1**	**18.7**	**8.1**	**1.7**	**1.9**	**-3.6**	**22.5**

Table C2 – Summary Noise Levels

Position / Unit		Received noise level (dB) at 1m from Receptor 1
North Position	HRU1 L_P	22
	HRU1 L_P	
	HP1 L_P	
	HP1 L_P	
South Position	HRU2 L_P	20
	HRU2 L_P	
	HRU3 L_P	
Total Received Level		25

Daikin EMRQ8AB Sound Power Data

EMRQ8AB

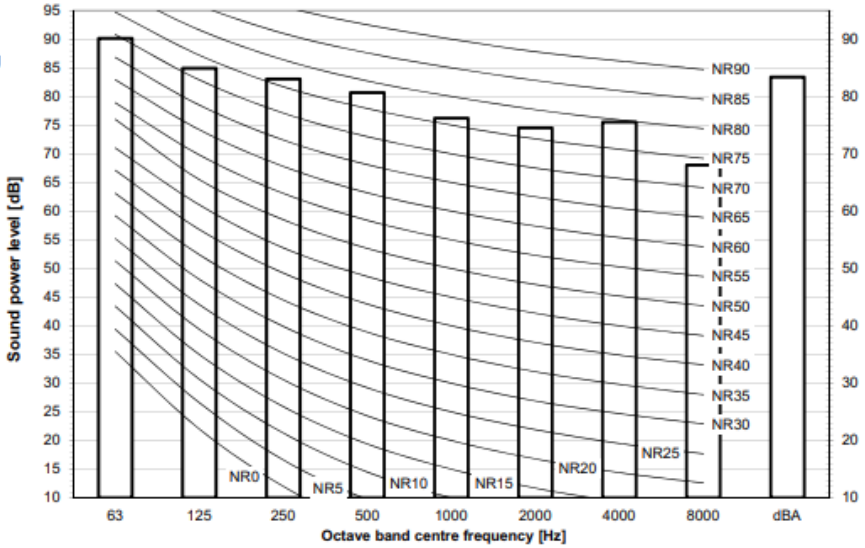


NOTES

1 dBA = A-weighted sound power level (A-scale according to IEC)
2 Reference acoustic intensity 0dB = 10E-6μW/m²
3 Measured according to ISO 3744

Daikin REYQ12U7Y1B Sound Power Spectrum Data

REYQ12U
RXYQQ12U
RXYQ12U
RYYQ12U
RYMQ12U

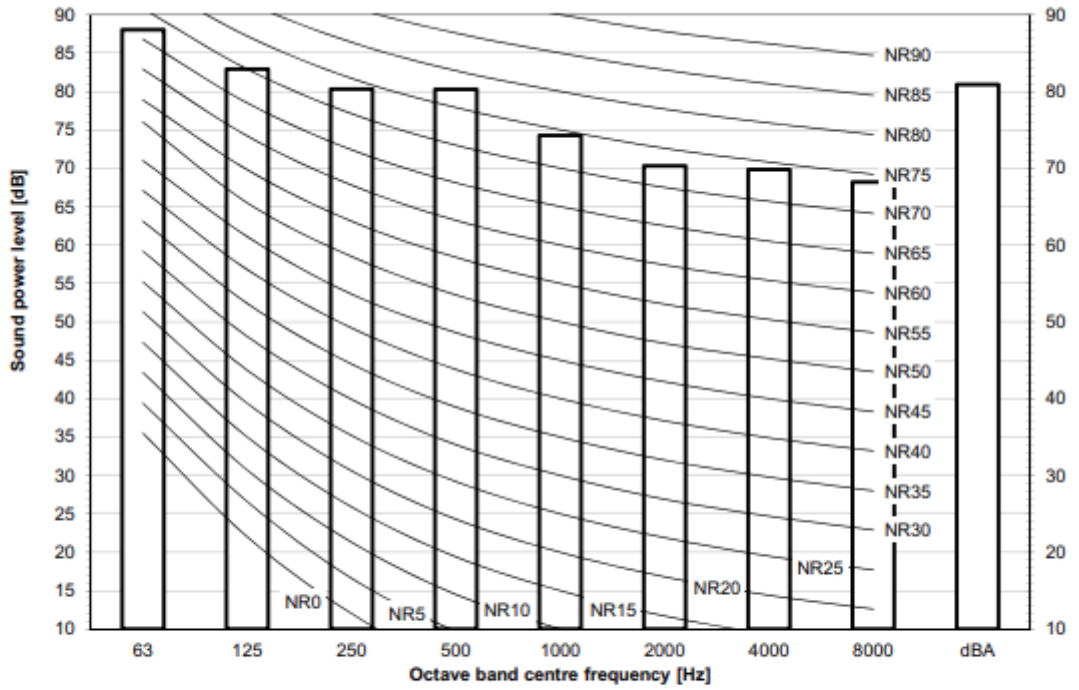


Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6μW/m²
Measured according to ISO 3744

3D119530

Daikin REYQ14U7Y1B Sound Power Spectrum Data

REYQ14U
RXYQQ14U
RXYQ14U
RYYQ14U
RYMQ14U

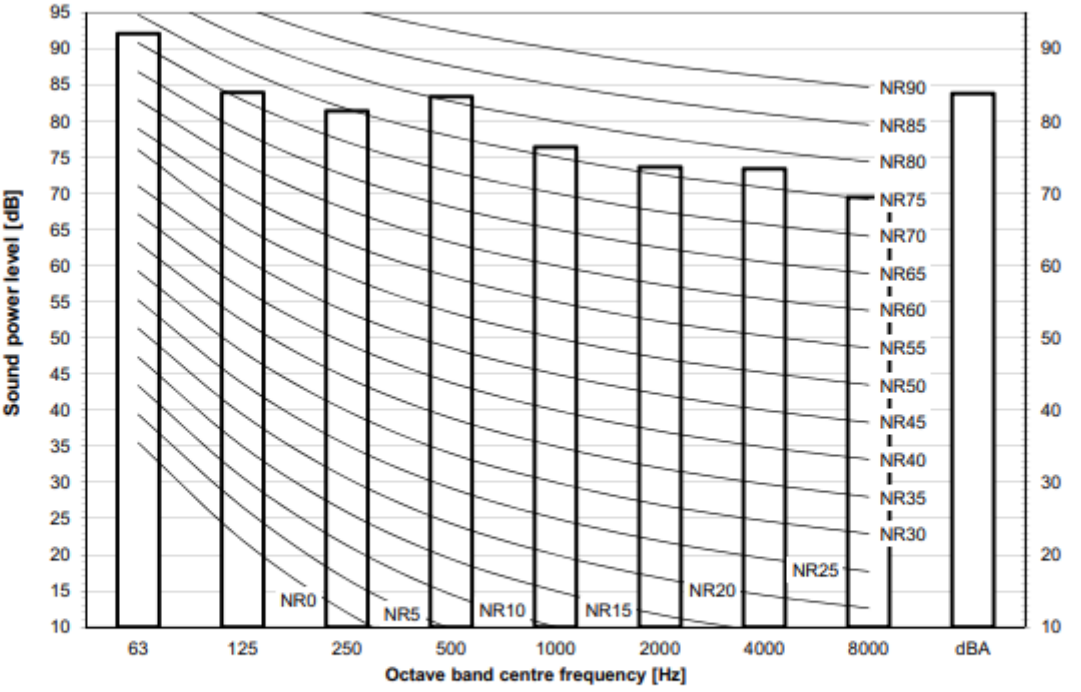


Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119531

Daikin REYQ18U7Y1B Sound Power Spectrum Data

REYQ18U
RXYQQ18U
RXYQ18U
RYYQ18U
RYMQ18U



Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119533

Appendix D – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation for more than 3 days)
4 – Serious (e.g. fracture, hospitalisation for more than 24 hours, incapacitation for more than 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiplying the two scores and is then used to determine the course of action.

Table D1 – Risk Ratings

Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional, reasonable, practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Table D2 – Risk Assessment

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Mineral wool within drywalls and linings	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
Vibration Isolators	Injury to hands	Contractors	3	3	9	Care needs to be taken during adjustment. Follow manufacturers guidance	1	3	3
Acoustic Enclosures	Strain of neck, limbs or back.	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Acoustic Enclosures	Skin & respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3

L: Likelihood S: Severity R: Rating

Appendix E – Graphs and Site Plans

4-6 Bedford Place - City Planning

L_{Aeq} Time History

Position 1 - Rear 2nd Floor Window, Tuesday 7th to Wednesday 8th January 2023

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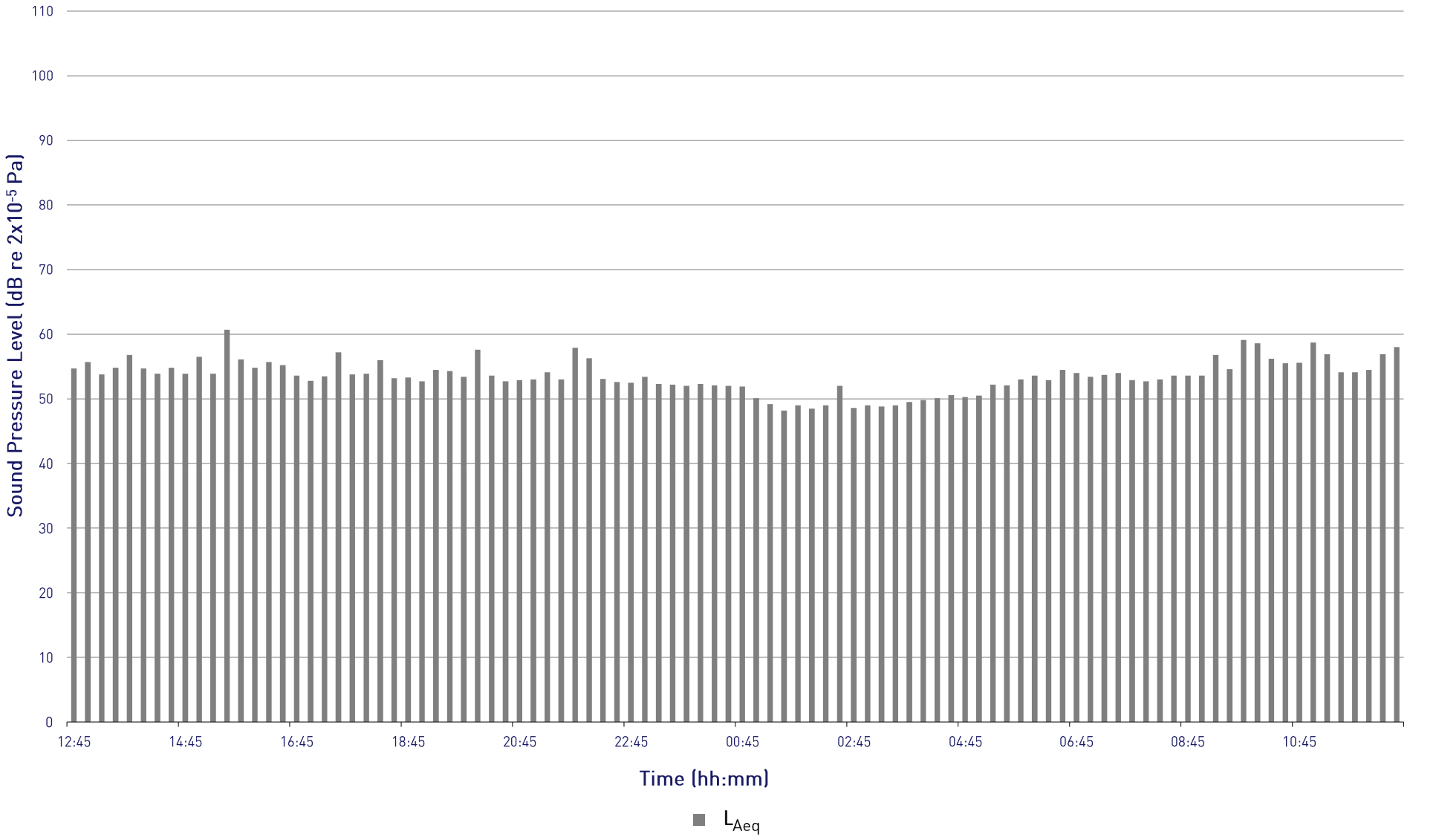
Graph 1



4-6 Bedford Place - City Planning

$L_{Amax,f}$ and L_{A90} Time History

Position 1 - Rear 2nd Floor Window, Tuesday 7th to Wednesday 8th January 2023

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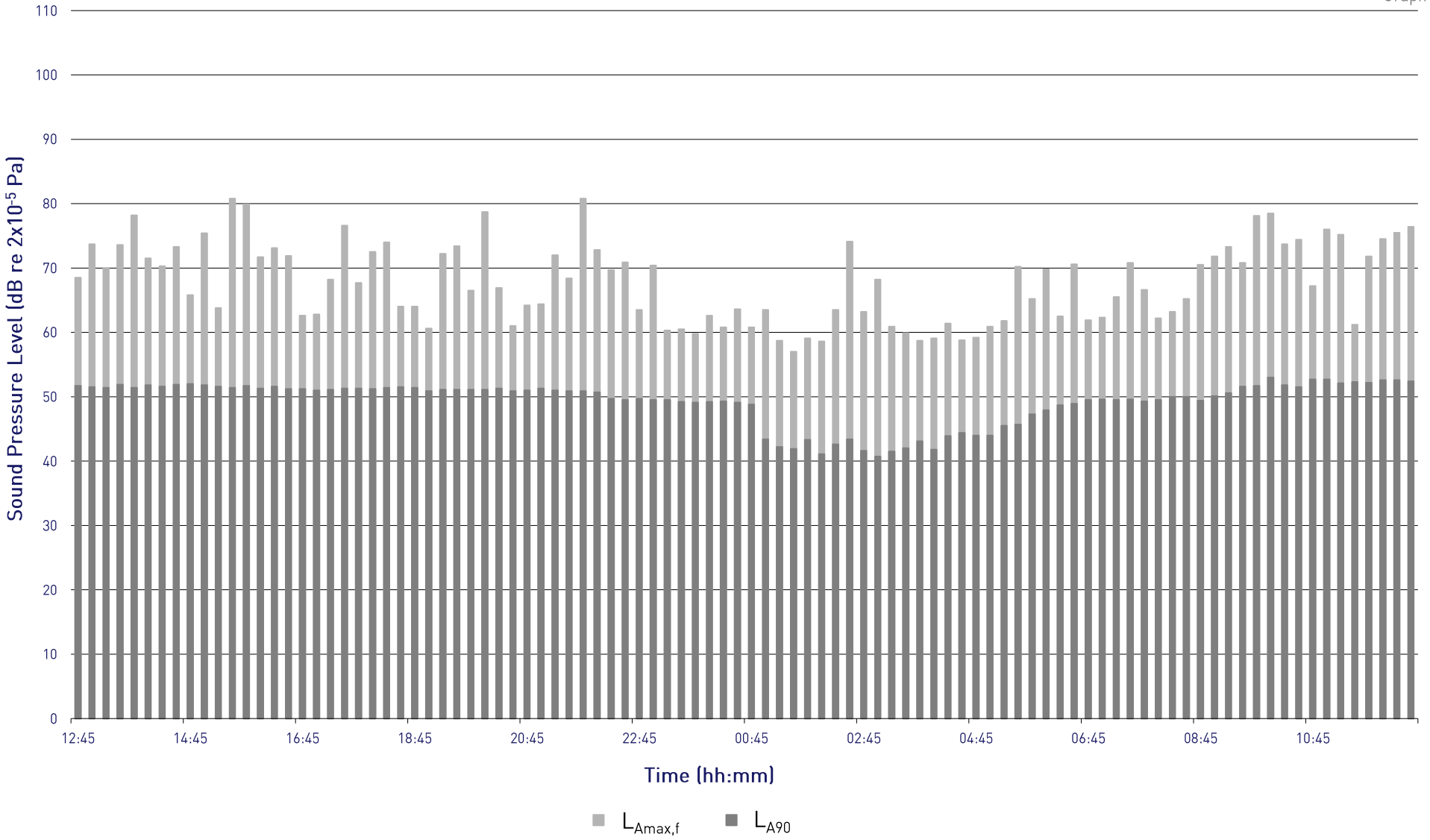
Graph 2



4-6 Bedford Place - City Planning

$L_{A90,15\ minutes}$ Histogram

Position 1 - Rear 2nd Floor Window, Tuesday 7th to Wednesday 8th January 2023

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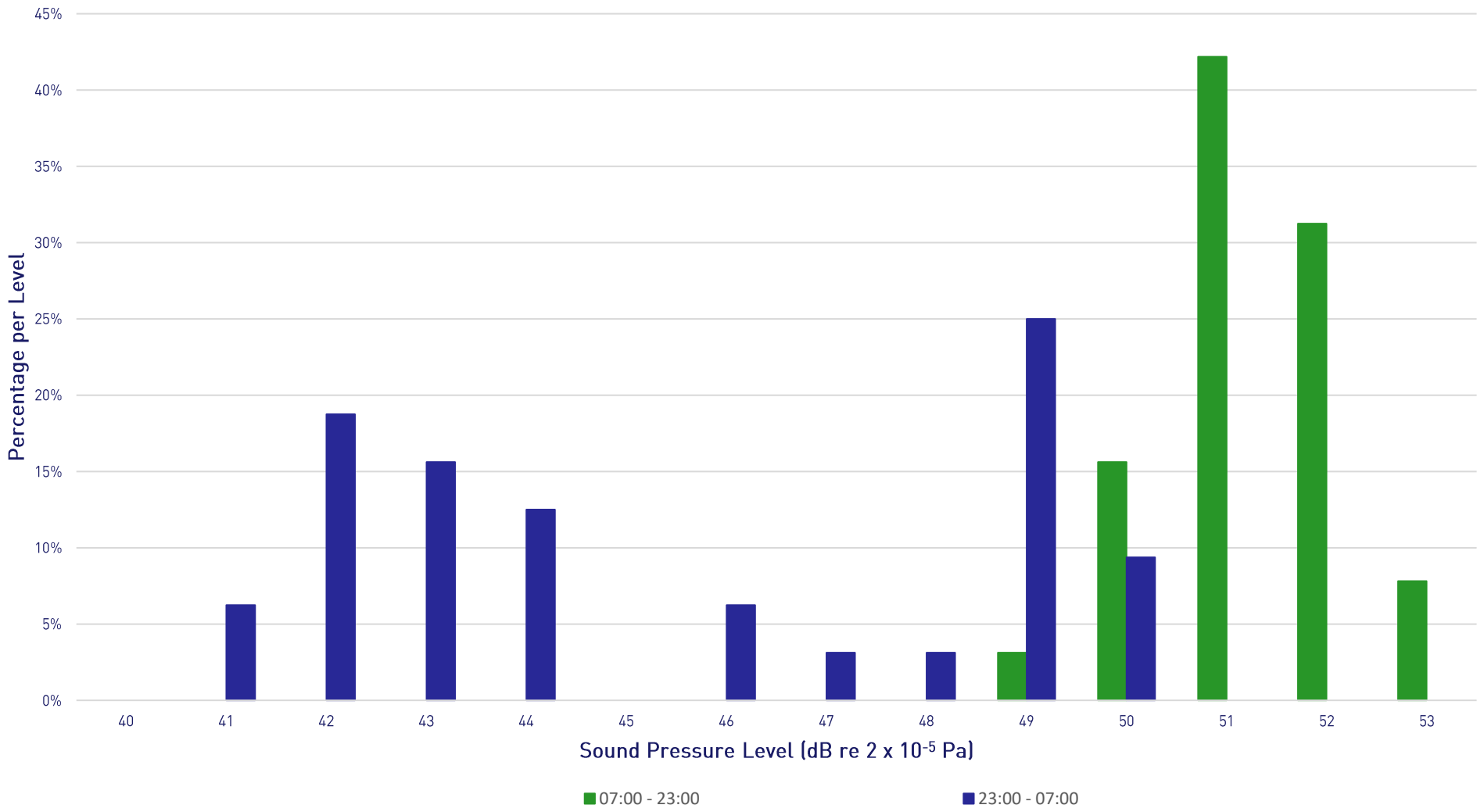
Graph 3



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Site & Surrounds; Measurement, Receptor & Plant Locations

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Figure 1

21 March 2023

Not to Scale

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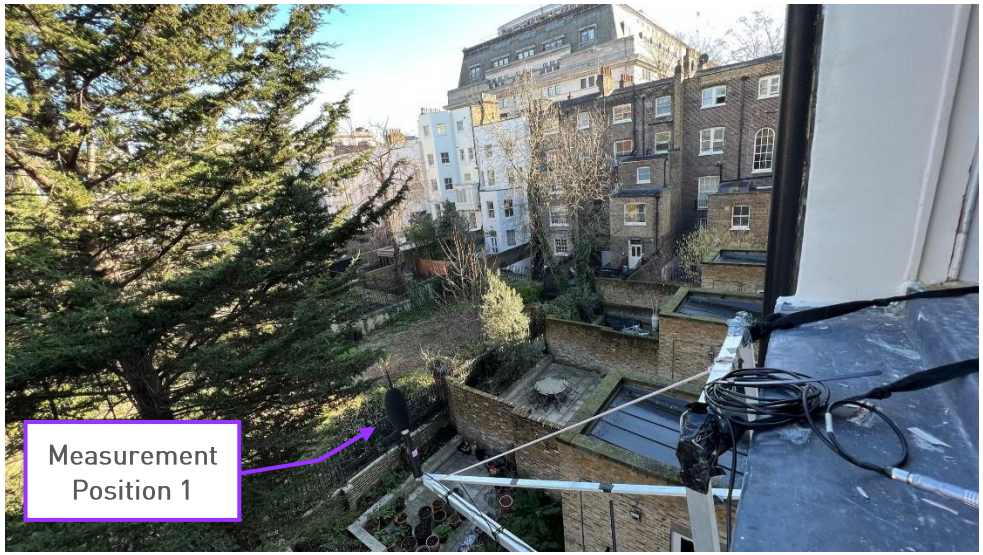

4-6 Bedford Place, WC1B 5AH

Photos of Measurement Position

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Figure 2

21 March 2023

Not to Scale

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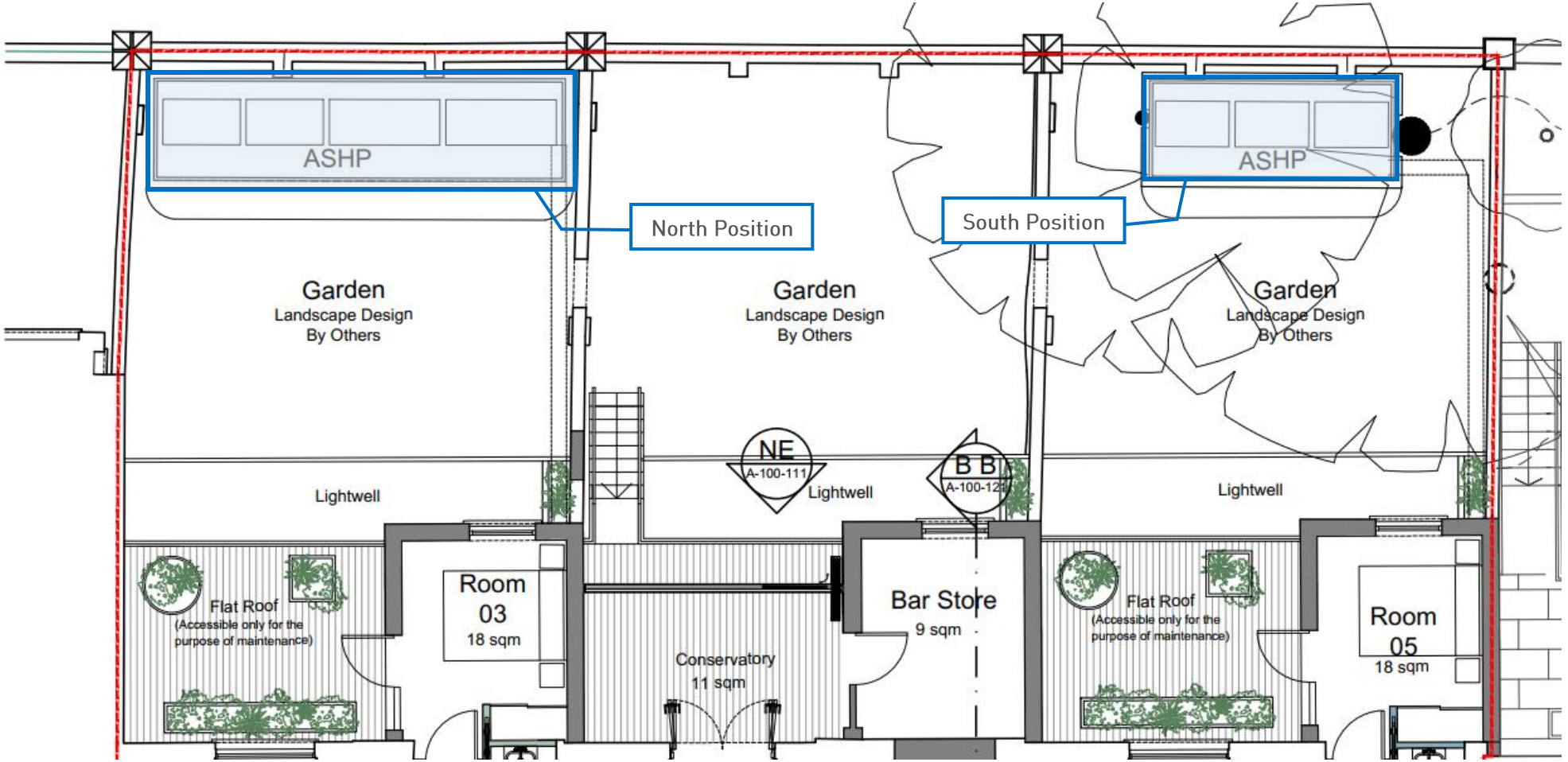

4-6 Bedford Place, WC1B 5AH

Proposed Plant Locations

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Figure 3

21 March 2023

Not to Scale

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