# TECHNICAL NOTE

Ref: QA 24148

Project: Birbeck College

Date: 30 09 2024

Subject: Roof Mounted Condenser

The attached report prepared by NOICO dated 12 January 2024 assessed noise emissions from a proposed Mitsubishi PURY-EP1000YSNW condenser unit to neighbouring properties in accordance with Westminster City Council guidance.

The report concludes based upon a source sound power level of 87dBA a minimum further 14dBA of noise reduction is recommended.

It is proposed that a Daikin REYA28A outdoor condenser unit will be installed as an alternative to the Mitsubishi unit originally proposed. Both condenser units have identical sound power levels of 87dBA.

To achieve the sound reduction required it is proposed to install the Daikin condenser within an acoustic enclosure, supplied by Ambient Acoustics Ltd.

The following tables assesses the sound reduction achieved by the proposed acoustic enclosure for the Daikin condenser.

| | Octvave Band Centre Frequency (Hz) | | | | | | | dBA |
|---|---|---|---|---|---|---|---|---|
| | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| Source Lw (dB) | 71 | 76 | 83 | 80 | 77 | 76 | 68 | 87 |
| Acoustic Enclosure Reduction (dB) | 9 | 14 | 20 | 30 | 30 | 27 | 20 | |
| Resultant Lw (dB) | 62 | 62 | 63 | 50 | 47 | 49 | 48 | 67 |

The above table demonstrates the proposed enclosure should reduce the condenser noise levels by 20dBA, exceeding the minimum requirement of 14dBA.

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**REPORT No. 2312006-8_v1**

# Birkbeck, University of London

Malet Street, Bloomsbury
London
WC1E 7HX

# ENVIRONMENTAL NOISE SURVEY & NOISE IMPACT ASSESSMENT REPORT

**REPORT v1 PREPARED: 12 January 2024**

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**Checked by:**

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## 1.0 Introduction

1.1 Birkbeck, University of London has commissioned Noico Ltd to conduct an environmental noise survey and plant noise impact assessment at Birkbeck, University of London, Malet Street, Bloomsbury, London WC1E 7HX in relation to proposals to renovate the teaching areas of the campus' central block. The renovations will necessitate an external air-conditioning condenser to be installed at roof level.

1.2 The purpose of the survey is to obtain statistical noise data and to determine the background noise levels at the site. Based on the noise survey data, noise criteria are to be established for limiting noise emissions from the proposed mechanical plant installations which will serve the premises. The noise criteria are to be set in accordance with the requirements of the local planning authority (London Borough of Camden Council) for residential receptors.

1.3 The Birkbeck College central block comprises multiple, interconnected, multistorey buildings along Malet Street, the most northwest of which comprises the development site. As part of the development plans, new items of mechanical plant are to be installed externally at roof level. The external air-conditioning condenser will be installed in the southeast corner of the roof.

1.4 From our observations, the site is surrounded by buildings of mixed use. To the north, the site is bound by Byng Place apartments, a four-storey block of residential flats. University of London buildings surround the development site to the east and south, whereas, College Hall—a six-storey block of residential apartments—is the nearest noise sensitive property to the west of the site.

## 2.0 Instrumentation

2.1 For unattended measurements, a precision grade Norsonic 140 'Type 1' integrating sound level meter (SLM) was used. It was equipped with a Norsonic omnidirectional measurement microphone and windshield. For the unattended measurements the microphone was fitted with an outdoor weather protection kit (Nor-1212) and separated from the SLM via a LEMO audio cable. The instrument was powered by an external battery and stored in a weatherproof case.

2.2 Microphone sensitivity was checked prior and subsequent to use, with no calibration drift recorded.

2.3 Equipment serial numbers and calibration certification can be found in the table below.

| Equipment Combination Code | Equipment Type | Serial number | Calibration Certificate | Calibration Date / Calibration Expiry |
|---|---|---|---|---|
| **140 Blue** | Norsonic Type 140 Sound Level Meter | 1402898 | 39863 | Tested: 05/01/2022 |
| | Norsonic Type 1225 Microphone | 264811 | 39862 | |
| | Norsonic Type 1209 Preamplifier | 12537 | 39863 | |
| **Field Calibrator** | Norsonic Type 1251 Calibrator | 28311 | STD179950 | Tested: 25/07/2022 |

Table-1: Equipment list including calibration certification

## 3.0 Survey details

3.1 Unattended monitoring location: Existing items of mechanical plant were audible to the south of the proposed mechanical plant installation location so a location at roof level to the north of the teaching block was identified for unattended background noise monitoring which was less affected by mechanical plant noise. The sound level meter was positioned as close to the west site boundary as practically possible so the position is thought to accurately represent the sonic environment that exists at the nearest neighbouring properties. The microphone was attached to a metal handrail surrounding the roof, approximately 1.5 metres above roof level.

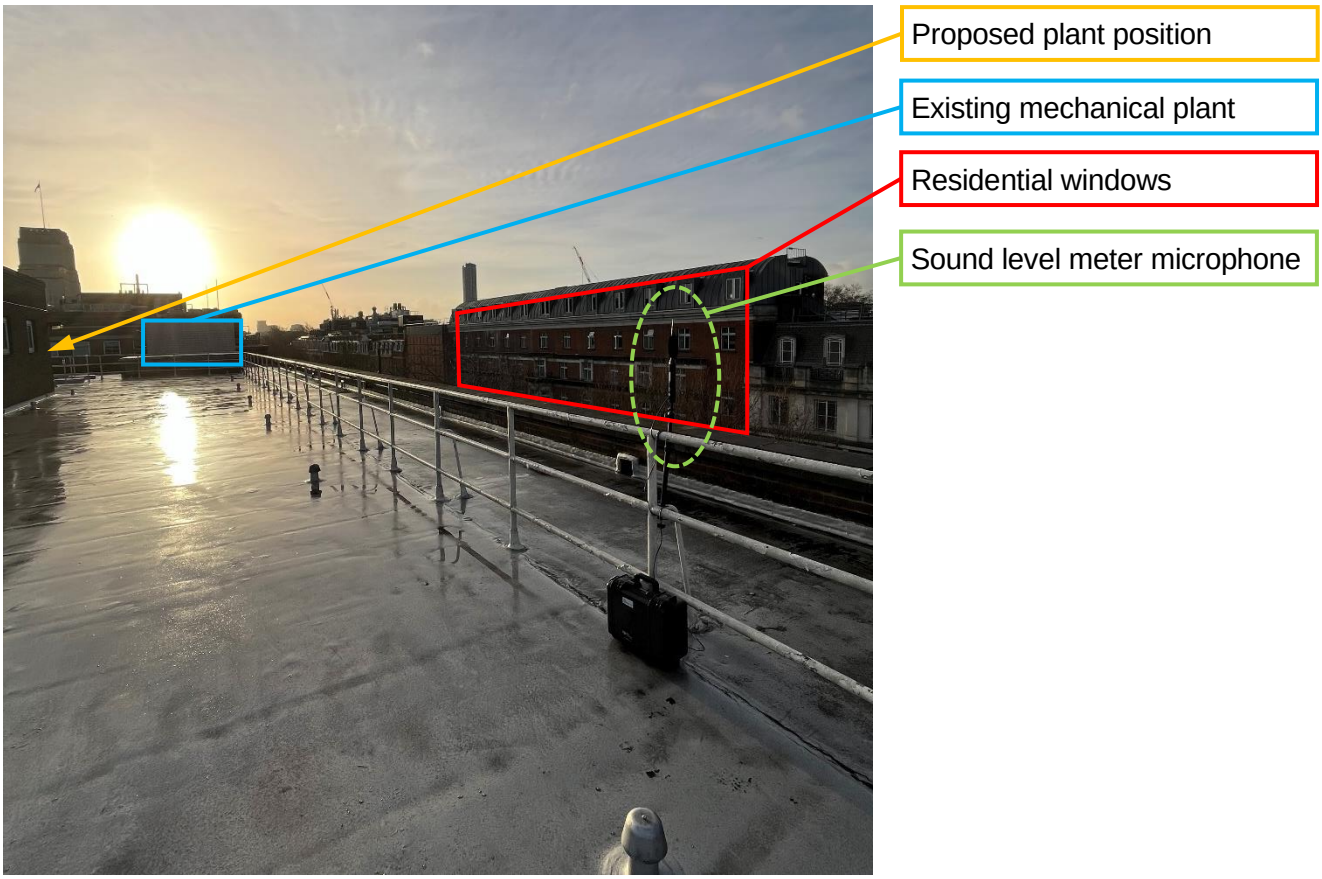


Figure-1: Photograph of unattended monitoring location and survey equipment setup.

3.2 Period: Noise monitoring was carried out continuously from approximately 09:15 hours on 12th December 2023 through to 09:00 hours on 19th December 2023. The instrument was set up to monitor noise levels continuously, with a 'fast' time weighting, and store data in fifteen-minute intervals.

3.3 Weather: The prevailing weather condition throughout the majority of the entire survey period was satisfactory for noise monitoring, being dry, mild and with little to moderate breeze. Windspeed, although not recorded, was considered to be less than 5 m/s throughout the survey period.

3.4 Site Noise Characteristics: The ambient noise level was characterised by road traffic noise, in particular along Malet Street itself to the west and Byng Place to the north, as shown in figure A2 and A3. It is thought that no other unusual events occurred during the survey period. The data is considered a true representation of the area's background noise level.

## 4.0 Survey Results

4.1 The results of the background noise level monitoring survey are presented in graphical and numerical format in the attached appendices, showing the recorded values of $L_{Aeq,T}$ and $L_{A90,T}$. See appendix-1 for a glossary of terminology.

4.2 With reference to the measured data, the minimum background noise level, 'typical' background noise level and equivalent noise level for each measurement period are detailed in table-4. Statistical analysis of the $L_{A90,15min}$ values, shown in figure-2, is used to determine the typical background noise level referred to in BS 4142:2014 +A1:2019 *Methods for Rating and Assessing Industrial and Commercial Sound*.

| Monitoring period | Minimum background level | Typical background level | Equivalent level |
|---|---|---|---|
| **Daytime (07:00–19:00)** | 48.7 dB | 52 dB | 54.2 dB $L_{Aeq,12hr}$ |
| **Evening (19:00–23:00)** | 48.3 dB | 51 dB | 53.1 dB $L_{Aeq,4hr}$ |
| **Night time (23:00–07:00)** | 46.5 dB | 50 dB | 51.0 dB $L_{Aeq,8hr}$ |

Table-2: Survey results summary for environmental noise monitoring.

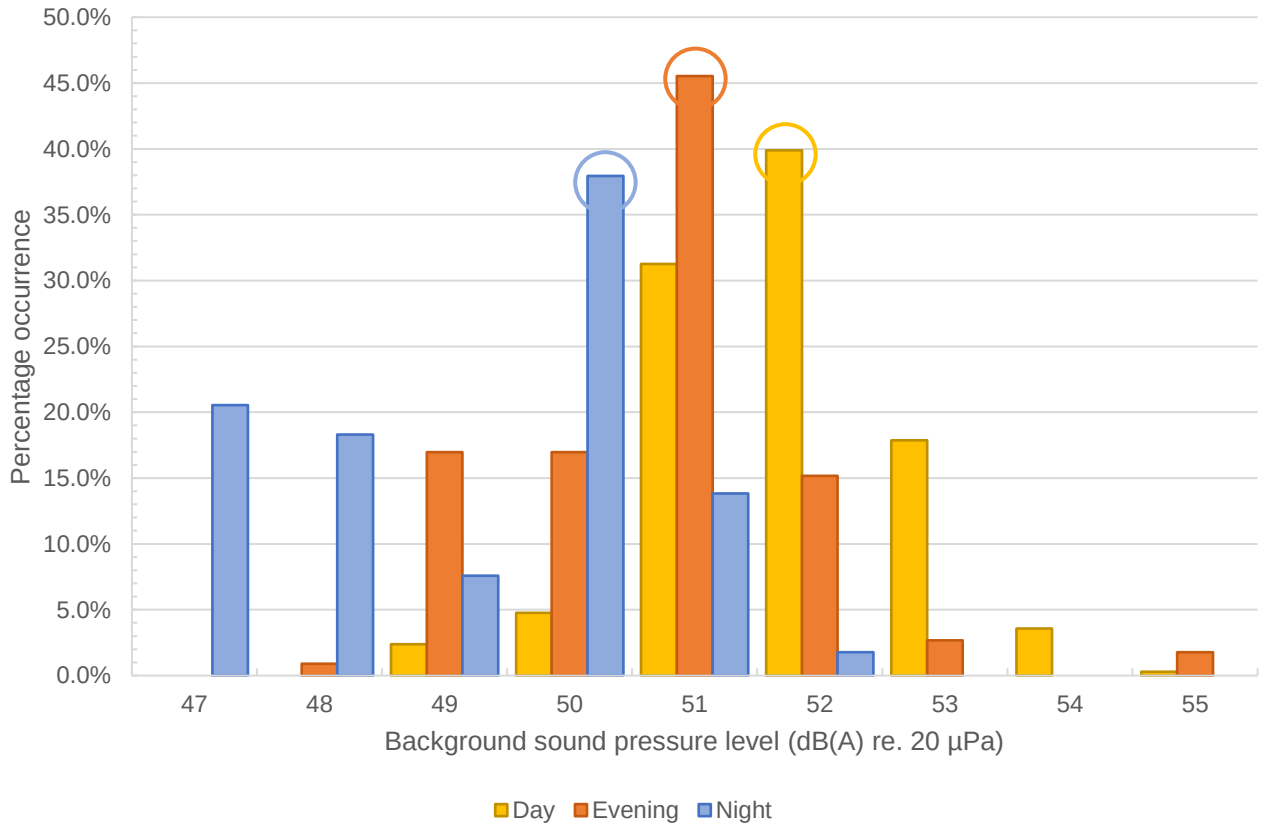


Figure-2: Statistical analysis of $L_{A90,15min}$ values to determine a representative 'typical' background sound level in accordance with BS4142 methodology.

## 5.0 Council planning noise criteria

5.1 Criteria for mechanical services noise emission are normally based upon the prevailing level of background noise in the period of concern and may be set against this to a level as normally defined by the local planning authority.

5.2 London Borough of Camden Council has advised the following condition pertaining to noise in their Local Plan 2017:

> *"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 Camden Local Plan | Appendices 347 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)."*

5.3 To conform to the above criteria, and in accordance with the typical background noise levels measured during the survey (summarised in table-2 above), noise from the plant installations should not exceed the following values. Note, values have been rounded to the nearest whole number for practical purposes.

| Operation period | Design noise criterion |
|---|---|
| Daytime (07:00 to 19:00 hours) | 42 dB $L_{Aeq,Tr}$ |
| Evening (19:00 to 23:00 hours) | 41 dB $L_{Aeq,Tr}$ |
| Night time (23:00 to 07:00 hours) | 40 dB $L_{Aeq,Tr}$ |

Table-3: Design noise level criteria specification for residential premises.

5.4 These levels must be achieved cumulatively with all plant operating, and as measured at 1 metre from the window of the nearest affected residential property. Should the proposed equipment emit sound that is tonal in character, a penalty of 5 dBA shall be applied to the design noise criteria specified in table-3.

## 6.0 BS 8233 noise level criteria

6.1 It is understood that the reference in the planning conditions, as set out by the local planning authority, to the "nearest noise sensitive properties" is primarily aimed at residential premises. For commercial premises, design noise criteria will be determined in accordance with applicable industry standards and best practice guidelines.

6.2 The British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings* provides guidance on noise levels appropriate for various types of space. To maintain good working conditions and a suitable level of speech privacy, design ranges are specified in the standard which can be applied to control mechanical services noise in commercial settings such as offices. Table-4 details the recommended indoor ambient noise levels for open-plan offices and executive office spaces. The lower end of the design range is adopted as a suitable criterion for external noise sources

6.3 It is generally accepted that the sound reduction performance of a partially open window forming part of a building envelope is approximately 10 dBA. Therefore, a 10 dBA correction is applied to the indoor ambient noise limits above to obtain a design noise criterion to be achieved externally at a distance of 1 metre from the nearest noise affected window.

| Room uses | Indoor ambient noise level criterion | External noise criterion |
|---|---|---|
| Open-plan office | 45–50 dB $L_{Aeq,T}$ | 55 dB $L_{Aeq,T}$ |
| Executive office | 35–40 dB $L_{Aeq,T}$ | 45 dB $L_{Aeq,T}$ |
| Library | 45–50 dB $L_{Aeq,T}$ | 55 dB $L_{Aeq,T}$ |
| Staff/training room | 35–45 dB $L_{Aeq,T}$ | 45 dB $L_{Aeq,T}$ |

Table-4: Excerpt from BS 8233:2014. Indoor ambient noise levels in spaces when they are unoccupied and privacy is also Important

## 7.0 Plant noise assessment

7.1 Plant details and location: It is proposed that 1-no. Mitsubishi PURY-EP1000YSNW-A2 air-conditioning condenser is to be installed at the premises. The condenser will be positioned at roof level in the southeast corner of the building.

7.2 The plant in question is detailed in table-5 below, together with the manufacturers certified noise data. It should be noted the plant will have the capacity to operate 24-hours a day, in line with the heating requirements of the premises, however, it is unlikely the equipment will run during the night as the teaching areas are not in use. The equipment will operate continuously and there is no evidence of tonal features from the data received from the manufacturers.

| PURY-EP1000YSNW operating modes | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz | dBA |
|---|---|---|---|---|---|---|---|---|---|
| **Cooling SPL** | 80 | 71 | 69 | 65 | 59 | 57 | 54 | 48 | 67 |
| **Cooling low noise SPL** | 71 | 63 | 60 | 51 | 48 | 46 | 43 | 37 | 56 |
| **Cooling SWL** | | | | | | | | | 85 |
| **Heating SPL** | 69 | 67 | 69 | 66 | 60 | 60 | 56 | 52 | 67 |
| **Heating low noise SPL** | 66 | 64 | 55 | 53 | 51 | 45 | 48 | 44 | 56 |
| **Heating SWL** | | | | | | | | | 87 |

Table-5: Manufacturers certified sound pressure level (SPL) and sound power level (SWL) data.

7.3 Residential noise sensitive receptors (NSR): From observations made on site, the nearest noise sensitive residential properties to the proposed mechanical plant are apartments within College Hall to the west. East facing windows at fifth and sixth-floor levels will have direct view of the installation approximately 50 metres away.

7.4 University NSRs: The university rooms closest to the installation are those at fourth-floor level directly below the air-conditioning condenser. Windows serving this space are approximately 3 metres from the plant, however, the roof edge will screen the plant from view providing an acoustic barrier loss.

7.5 Plant noise emissions have been assessed to east-facing, fifth-floor windows of residential flats within College Hall (residential NSR 1), and to a position 1 metre from adjacent university room windows (University NSR 1).

7.6 Noise assessment calculations: Our calculations, predicting the resultant noise level at 1 metre from the nearest noise sensitive windows of the locations identified above, are detailed as follows for the most stringent plant operation periods.

7.6.1

| **Residential NSR 1** | **Noise impact assessment calculation** |
|---|---|
| PURY-EP1000YSNW heating SWL | 87 dB $L_{wA}$ |
| Conformal-area distance loss at 49 metres (hemi-spherical propagation) | -43 dB |
| Façade reflection | +3 dBA |
| **Noise rating level at receptor** | **47 dB $L_{Aeq,Tr}$** |
| Typical background noise level (night) | 50 dB $L_{A90,15min}$ |
| **Level exceeding background noise level** | **-3 dBA** |
| Planning noise criteria (night) | 40 dB $L_{Aeq,Tr}$ |
| **Level exceeding planning noise criteria** | **7 dBA** |

Table-6: Noise impact assessment calculation for residential noise sensitive receptor (NSR) 1.

7.6.2

| **University NSR 1** | **Noise impact assessment calculation** |
|---|---|
| PURY-EP1000YSNW heating SWL | 87 dB $L_{wA}$ |
| Conformal-area distance loss at 3 metres (hemi-spherical propagation) | -23 dBA |
| Barrier loss (partial line-of-sight) | -5 dBA |
| **Noise rating level at receptor** | **59 dB $L_{Aeq,T}$** |
| BS8233 external noise limit (executive office) | 45 dB $L_{Aeq,T}$ |
| **Level exceeding BS8233 guidance** | **14 dBA** |

Table-7: Noise impact assessment calculation for the nearest noise sensitive university receptor 1.

7.7 The results of the assessments indicate that the noise rating level at the nearest residential receptor may exceed the design noise criteria during daytime plant operation by 7 dBA. It should be noted that the noise rating level is 3 dBA below the typical background noise level—an indication of 'low adverse impact'—therefore, complaints are unlikely.

7.8 The assessments of noise impact to the nearest university room windows conclude the IANL limit for an executive office may be exceeded by 14 dBA. Hence, noise control measures will be required in order to satisfy the requirements of the local planning authority.

## 8.0 Noise mitigation measures

8.1 The following measures are aimed at reducing noise emissions from the proposed mechanical plant by a minimum of 14 dBA in order to satisfy the requirements of the local planning authority and maintain suitable internal conditions for ideal communication, study and concentration.

8.2 A solid acoustic panel-work screen should be formed around the ASHP installation on all four sides. The screen should be at least 300 mm taller than the top of the air-source heat pump(s), to screen the plant from view from all adjacent noise sensitive receptors. The internal faces of the panels must be absorptive with a fibre wool infill of density greater than 45 kg/m$^3$.

8.3 The following component performances would achieve the required noise reduction in the arrangement described above.

| **Item** | **63 Hz** | **125 Hz** | **250 Hz** | **500 Hz** | **1 kHz** | **2 kHz** | **4 kHz** | **8 kHz** |
|---|---|---|---|---|---|---|---|---|
| **50mm thick acoustic panel – Sound reduction index** | 19 | 19 | 25 | 31 | 40 | 42 | 45 | 41 |

Table-9: Acoustic component performance specification.

## 9.0 Conclusion

9.1 An unattended background noise level monitoring survey has been carried out at Birkbeck, University of London, Malet Street, Bloomsbury, London WC1E 7HX in relation to proposals to renovate the teaching areas of the campus' central block.

9.2 Based upon the survey results, knowledge of the local authority's planning policies and relevant environmental design standards, criteria applicable to noise from the mechanical services plant have been established.

9.3 A noise impact assessment, in line with BS 4142, has been carried out on the proposed mechanical plant installations; it is determined that the residential design noise criteria will be exceeded by a maximum of 7 dBA. In addition, the noise impact assessment to adjacent university rooms concludes that the resulting indoor ambient noise levels may exceed industry standard guidelines by 14 dBA.

9.4 Recommendations have been given for suitable noise mitigation measures which if implemented in full will achieve the design noise criteria, and as such meet the planning noise requirements of the local planning authority.

## Appendix 1 - Glossary of Terms

| | |
|---|---|
| Decibel, dB | A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (Lp) the reference quantity is $2x10^{-5}$ N/m$^2$. The sound pressure level existing when microphone measured pressure is $2x10^{-5}$ N/m$^2$ is 0 dB, the threshold of hearing. |
| L | Instantaneous value of Sound Pressure Level (Lp). |
| Frequency | Is related to sound pitch; frequency equals the ratio between velocity of sound and wavelength. |
| A-weighting | Arithmetic corrections applied to values of Lp according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source. |
| $L_{eq,T}$ | Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of Lp actually measured. |
| $L_{Aeq,T}$ | Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of Lp actually measured. |
| $L_{n,T}$ | Lp which was exceeded for n% of time, T. |
| $L_{An,T}$ | Level in dBA which was exceeded for n% of time, T. |
| $L_{max,T}$ | The instantaneous maximum sound pressure level which occurred during time, T. |
| $L_{Amax,T}$ | The instantaneous maximum A weighted sound pressure level which occurred during time, T. |
| Background Noise Level | The value of $L_{A90,T}$, ref. BS4142:2014. |
| Traffic Noise Level | The value of $L_{A10,T}$. |
| Specific Noise Level | The value of $L_{Aeq,T}$ at the assessment position produced by the specific noise source, ref. BS4142:2014. |
| Rating Level | The specific noise level, corrected to account for any characteristic features of the noise, by adding a 5 dBA penalty for any tonal, impulsive or irregular qualities, ref. BS4142:2014. |
| Specific Noise Source | The noise source under consideration when assessing the likelihood of complaint. |
| Assessment Position | Unless otherwise noted, is a point at 1 m from the façade of the nearest affected sensitive property. |

## Appendix 2 - Environmental noise monitoring Data

| Date | LAeq | LA90 |
|---|---|---|
| (2023/12/12 09:15:51.00) | 57.9 | 53 |
| (2023/12/12 09:30:01.00) | 53.6 | 52.5 |
| (2023/12/12 09:45:01.00) | 57.1 | 52.8 |
| (2023/12/12 10:00:01.00) | 54.2 | 52.7 |
| (2023/12/12 10:15:01.00) | 56.7 | 54.8 |
| (2023/12/12 10:30:01.00) | 56.6 | 54.4 |
| (2023/12/12 10:45:01.00) | 54.6 | 52.9 |
| (2023/12/12 11:00:01.00) | 54.6 | 53.3 |
| (2023/12/12 11:15:01.00) | 58.3 | 53.5 |
| (2023/12/12 11:30:01.00) | 54.6 | 53.1 |
| (2023/12/12 11:45:01.00) | 54.5 | 53 |
| (2023/12/12 12:00:01.00) | 54.8 | 53.5 |
| (2023/12/12 12:15:01.00) | 54.3 | 53.3 |
| (2023/12/12 12:30:01.00) | 55.8 | 53.6 |
| (2023/12/12 12:45:01.00) | 54.2 | 53.4 |
| (2023/12/12 13:00:02.00) | 54.7 | 53.6 |
| (2023/12/12 13:15:02.00) | 54.6 | 53.2 |
| (2023/12/12 13:30:01.00) | 55.3 | 53.7 |
| (2023/12/12 13:45:02.00) | 56 | 53.9 |
| (2023/12/12 14:00:01.00) | 56.1 | 54.4 |
| (2023/12/12 14:15:01.00) | 54.6 | 53.3 |
| (2023/12/12 14:30:02.00) | 54.6 | 53.3 |
| (2023/12/12 14:45:02.00) | 54.2 | 53 |
| (2023/12/12 15:00:02.00) | 57.1 | 53.2 |
| (2023/12/12 15:15:02.00) | 54.4 | 52.8 |
| (2023/12/12 15:30:01.00) | 53.9 | 53 |
| (2023/12/12 15:45:01.00) | 54.5 | 53 |
| (2023/12/12 16:00:01.00) | 55.6 | 53.2 |
| (2023/12/12 16:15:02.00) | 55 | 52.9 |
| (2023/12/12 16:30:01.00) | 54.3 | 52.5 |
| (2023/12/12 16:45:01.00) | 53.8 | 52.7 |
| (2023/12/12 17:00:01.00) | 53.8 | 52.4 |
| (2023/12/12 17:15:01.00) | 56.2 | 52.9 |
| (2023/12/12 17:30:01.00) | 53.8 | 52.2 |
| (2023/12/12 17:45:01.00) | 54 | 52.4 |
| (2023/12/12 18:00:01.00) | 57.7 | 52.5 |
| (2023/12/12 18:15:01.00) | 53.1 | 52.1 |
| (2023/12/12 18:30:01.00) | 52.9 | 52 |
| (2023/12/12 18:45:01.00) | 53.3 | 52 |
| (2023/12/12 19:00:01.00) | 54 | 51.8 |
| (2023/12/12 19:15:01.00) | 53.7 | 51.8 |
| (2023/12/12 19:30:01.00) | 52.7 | 51.7 |
| (2023/12/12 19:45:01.00) | 52.7 | 51.6 |
| (2023/12/12 20:00:01.00) | 52.8 | 51.5 |
| (2023/12/12 20:15:01.00) | 52.4 | 51.2 |
| (2023/12/12 20:30:01.00) | 54.1 | 51.4 |
| (2023/12/12 20:45:01.00) | 52.2 | 51 |
| (2023/12/12 21:00:01.00) | 54.4 | 51.2 |
| (2023/12/12 21:15:01.00) | 52.3 | 50.9 |
| (2023/12/12 21:30:01.00) | 51.7 | 50.8 |
| (2023/12/12 21:45:01.00) | 51.7 | 50.8 |
| (2023/12/12 22:00:01.00) | 53 | 50.8 |
| (2023/12/12 22:15:01.00) | 51.7 | 50.7 |
| (2023/12/12 22:30:01.00) | 51.3 | 50.4 |
| (2023/12/12 22:45:01.00) | 51.5 | 50.4 |
| (2023/12/12 23:00:01.00) | 51 | 50.1 |
| (2023/12/12 23:15:01.00) | 50.6 | 47.9 |
| (2023/12/12 23:30:01.00) | 49 | 47.9 |
| (2023/12/12 23:45:01.00) | 49 | 47.6 |
| (2023/12/13 00:00:02.00) | 49 | 47.6 |
| (2023/12/13 00:15:01.00) | 49.1 | 47.3 |
| (2023/12/13 00:30:01.00) | 48.4 | 47 |
| (2023/12/13 00:45:01.00) | 48.1 | 46.9 |
| (2023/12/13 01:00:01.00) | 49.4 | 47 |
| (2023/12/13 01:15:01.00) | 50.2 | 49.3 |
| (2023/12/13 01:30:01.00) | 49.4 | 47.2 |
| (2023/12/13 01:45:01.00) | 49.8 | 48.6 |
| (2023/12/13 02:00:01.00) | 50.5 | 49.3 |
| (2023/12/13 02:15:01.00) | 50.3 | 49.5 |
| (2023/12/13 02:30:01.00) | 50 | 48.7 |
| (2023/12/13 02:45:01.00) | 49.3 | 47.5 |
| (2023/12/13 03:00:01.00) | 48.1 | 47.1 |
| (2023/12/13 03:15:01.00) | 48 | 47.1 |
| (2023/12/13 03:30:01.00) | 50.9 | 47.2 |
| (2023/12/13 03:45:01.00) | 48 | 46.9 |
| (2023/12/13 04:00:01.00) | 52.7 | 49.5 |
| (2023/12/13 04:15:01.00) | 48.4 | 46.9 |
| (2023/12/13 04:30:01.00) | 50.3 | 47.6 |
| (2023/12/13 04:45:01.00) | 52.7 | 47.8 |
| (2023/12/13 05:00:01.00) | 50.7 | 49.7 |
| (2023/12/13 05:15:02.00) | 51.6 | 48.3 |
| (2023/12/13 05:30:02.00) | 50.6 | 48.2 |
| (2023/12/13 05:45:01.00) | 52.4 | 50.8 |
| (2023/12/13 06:00:01.00) | 51 | 48.5 |
| (2023/12/13 06:15:02.00) | 49.4 | 48 |
| (2023/12/13 06:30:02.00) | 50.5 | 48.6 |
| (2023/12/13 06:45:02.00) | 53.3 | 49.5 |
| (2023/12/13 07:00:01.00) | 51.3 | 48.8 |
| (2023/12/13 07:15:02.00) | 53.4 | 49.6 |
| (2023/12/13 07:30:01.00) | 53.5 | 49.9 |
| (2023/12/13 07:45:02.00) | 51.6 | 49.4 |
| (2023/12/13 08:00:01.00) | 52.3 | 50.3 |
| (2023/12/13 08:15:01.00) | 54 | 51.2 |

| | | |
|---|---|---|
| (2023/12/13 08:30:01.00) | 55.7 | 50.9 |
| (2023/12/13 08:45:01.00) | 55.7 | 51.8 |
| (2023/12/13 09:00:01.00) | 55.6 | 51.2 |
| (2023/12/13 09:15:01.00) | 55.7 | 52.3 |
| (2023/12/13 09:30:01.00) | 54.3 | 51.8 |
| (2023/12/13 09:45:01.00) | 53 | 51.8 |
| (2023/12/13 10:00:01.00) | 54 | 52 |
| (2023/12/13 10:15:01.00) | 54.3 | 51.7 |
| (2023/12/13 10:30:01.00) | 57.2 | 54.3 |
| (2023/12/13 10:45:01.00) | 53 | 51.5 |
| (2023/12/13 11:00:01.00) | 54.3 | 52.1 |
| (2023/12/13 11:15:01.00) | 54.4 | 51 |
| (2023/12/13 11:30:01.00) | 53 | 51.2 |
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| (2023/12/16 15:45:01.00) | 53.1 | 51.7 |
| (2023/12/16 16:00:01.00) | 53 | 51.4 |
| (2023/12/16 16:15:01.00) | 52.6 | 51.4 |
| (2023/12/16 16:30:01.00) | 57.2 | 51.5 |
| (2023/12/16 16:45:01.00) | 52.5 | 51.5 |
| (2023/12/16 17:00:01.00) | 53 | 51.6 |
| (2023/12/16 17:15:01.00) | 52.9 | 51.7 |
| (2023/12/16 17:30:01.00) | 53.3 | 51.8 |
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| (2023/12/16 20:00:01.00) | 53.9 | 51.5 |
| (2023/12/16 20:15:02.00) | 52.6 | 51.4 |
| (2023/12/16 20:30:02.00) | 54 | 51.4 |
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| (2023/12/16 21:15:02.00) | 52.3 | 51.3 |
| (2023/12/16 21:30:02.00) | 53.5 | 51.1 |
| (2023/12/16 21:45:01.00) | 52.4 | 51.1 |
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| (2023/12/16 22:30:01.00) | 52.4 | 51.1 |
| (2023/12/16 22:45:02.00) | 52.3 | 51.3 |
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| (2023/12/16 23:15:01.00) | 53.1 | 51.1 |
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| (2023/12/17 07:30:01.00) | 51.6 | 50.7 |
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| (2023/12/17 14:00:01.00) | 52.3 | 51.1 |
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| (2023/12/17 14:45:02.00) | 53.6 | 51.4 |
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| (2023/12/17 16:00:02.00) | 53.6 | 51.4 |
| (2023/12/17 16:15:02.00) | 52.8 | 51.4 |
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| (2023/12/17 18:00:01.00) | 52.6 | 51.4 |
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| (2023/12/17 19:30:01.00) | 52.9 | 51.2 |
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| (2023/12/17 20:00:02.00) | 52.8 | 51.2 |
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| (2023/12/17 20:45:02.00) | 53.1 | 51.1 |
| (2023/12/17 21:00:01.00) | 53.3 | 51 |
| (2023/12/17 21:15:01.00) | 52.5 | 51.2 |
| (2023/12/17 21:30:01.00) | 53.7 | 51.3 |
| (2023/12/17 21:45:01.00) | 52.4 | 50.8 |
| (2023/12/17 22:00:02.00) | 52.7 | 50.8 |
| (2023/12/17 22:15:02.00) | 52.2 | 50.6 |
| (2023/12/17 22:30:02.00) | 53.6 | 50.6 |
| (2023/12/17 22:45:01.00) | 52.6 | 50.6 |
| (2023/12/17 23:00:01.00) | 52.6 | 50.5 |
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| (2023/12/18 00:30:01.00) | 51.6 | 50.2 |
| (2023/12/18 00:45:01.00) | 51.2 | 50.2 |
| (2023/12/18 01:00:01.00) | 50.9 | 49.9 |
| (2023/12/18 01:15:01.00) | 51 | 50 |
| (2023/12/18 01:30:01.00) | 51.1 | 50.1 |
| (2023/12/18 01:45:01.00) | 50.7 | 49.9 |
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| (2023/12/18 02:30:01.00) | 51 | 49.9 |
| (2023/12/18 02:45:01.00) | 50.7 | 49.9 |
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| (2023/12/18 03:15:01.00) | 51 | 50.1 |
| (2023/12/18 03:30:01.00) | 50.7 | 49.8 |
| (2023/12/18 03:45:01.00) | 50.7 | 49.9 |
| (2023/12/18 04:00:01.00) | 50.8 | 50 |
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| (2023/12/18 04:30:01.00) | 51 | 50.1 |
| (2023/12/18 04:45:01.00) | 51.3 | 50.1 |
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| (2023/12/18 05:15:02.00) | 53.2 | 50.4 |
| (2023/12/18 05:30:02.00) | 52.3 | 50.5 |
| (2023/12/18 05:45:01.00) | 51.8 | 50.4 |
| (2023/12/18 06:00:01.00) | 54.3 | 52.3 |
| (2023/12/18 06:15:02.00) | 52.3 | 51.1 |
| (2023/12/18 06:30:01.00) | 53.4 | 51.6 |
| (2023/12/18 06:45:01.00) | 52.8 | 51.5 |
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| (2023/12/18 07:15:01.00) | 54.3 | 51.8 |
| (2023/12/18 07:30:01.00) | 52.9 | 51.5 |
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| (2023/12/18 09:45:01.00) | 55.8 | 52.9 |
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| (2023/12/18 10:15:01.00) | 55.6 | 52.8 |
| (2023/12/18 10:30:02.00) | 57 | 53.4 |
| (2023/12/18 10:45:02.00) | 55.7 | 53.6 |
| (2023/12/18 11:00:01.00) | 58.4 | 54.2 |
| (2023/12/18 11:15:01.00) | 56.4 | 53 |
| (2023/12/18 11:30:01.00) | 55.7 | 52.8 |
| (2023/12/18 11:45:01.00) | 54.3 | 52.9 |
| (2023/12/18 12:00:01.00) | 56.4 | 53.1 |
| (2023/12/18 12:15:01.00) | 55.3 | 53 |
| (2023/12/18 12:30:01.00) | 58.2 | 53.6 |
| (2023/12/18 12:45:01.00) | 55.4 | 52.8 |
| (2023/12/18 13:00:02.00) | 55.6 | 53.1 |
| (2023/12/18 13:15:02.00) | 56.2 | 53 |
| (2023/12/18 13:30:01.00) | 54.8 | 52.8 |
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| (2023/12/18 14:00:02.00) | 54.4 | 52.7 |
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| (2023/12/18 14:30:01.00) | 55 | 53.1 |
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| (2023/12/18 15:30:01.00) | 54.9 | 52.1 |
| (2023/12/18 15:45:02.00) | 54.5 | 52.2 |
| (2023/12/18 16:00:02.00) | 54.7 | 52.2 |
| (2023/12/18 16:15:01.00) | 54 | 52.3 |
| (2023/12/18 16:30:01.00) | 53.2 | 52.1 |
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| (2023/12/18 17:00:01.00) | 55 | 52.4 |
| (2023/12/18 17:15:02.00) | 56 | 52.1 |
| (2023/12/18 17:30:01.00) | 53.8 | 52.1 |
| (2023/12/18 17:45:02.00) | 54.1 | 52 |
| (2023/12/18 18:00:01.00) | 54.4 | 51.8 |
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| (2023/12/18 19:30:01.00) | 52.3 | 51.1 |
| (2023/12/18 19:45:01.00) | 53.1 | 51.5 |
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| (2023/12/18 20:15:01.00) | 53.3 | 51.1 |
| (2023/12/18 20:30:02.00) | 52.6 | 51.4 |
| (2023/12/18 20:45:02.00) | 53.7 | 51.2 |
| (2023/12/18 21:00:01.00) | 52.2 | 51 |
| (2023/12/18 21:15:01.00) | 54.4 | 51 |
| (2023/12/18 21:30:02.00) | 52.9 | 50.9 |
| (2023/12/18 21:45:02.00) | 52.5 | 50.9 |
| (2023/12/18 22:00:02.00) | 52 | 51 |
| (2023/12/18 22:15:02.00) | 52.1 | 50.8 |
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| (2023/12/19 01:45:01.00) | 51 | 50.2 |
| (2023/12/19 02:00:01.00) | 51.9 | 50.1 |
| (2023/12/19 02:15:01.00) | 51.7 | 50.1 |
| (2023/12/19 02:30:01.00) | 51.1 | 50.2 |
| (2023/12/19 02:45:01.00) | 51.1 | 50.3 |
| (2023/12/19 03:00:01.00) | 51 | 50.2 |
| (2023/12/19 03:15:01.00) | 51.2 | 49.9 |
| (2023/12/19 03:30:01.00) | 51.7 | 50 |
| (2023/12/19 03:45:01.00) | 51.2 | 49.9 |
| (2023/12/19 04:00:01.00) | 51.1 | 50.1 |
| (2023/12/19 04:15:01.00) | 51 | 50 |
| (2023/12/19 04:30:01.00) | 51.7 | 50.2 |
| (2023/12/19 04:45:01.00) | 52.9 | 50.4 |
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| (2023/12/19 05:30:01.00) | 51.8 | 50.5 |
| (2023/12/19 05:45:01.00) | 51.5 | 50.3 |
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| (2023/12/19 07:15:01.00) | 53.4 | 51.7 |
| (2023/12/19 07:30:01.00) | 53.1 | 51.7 |
| (2023/12/19 07:45:01.00) | 54.3 | 52 |
| (2023/12/19 08:00:01.00) | 54.2 | 52.1 |
| (2023/12/19 08:15:01.00) | 54.5 | 52.5 |

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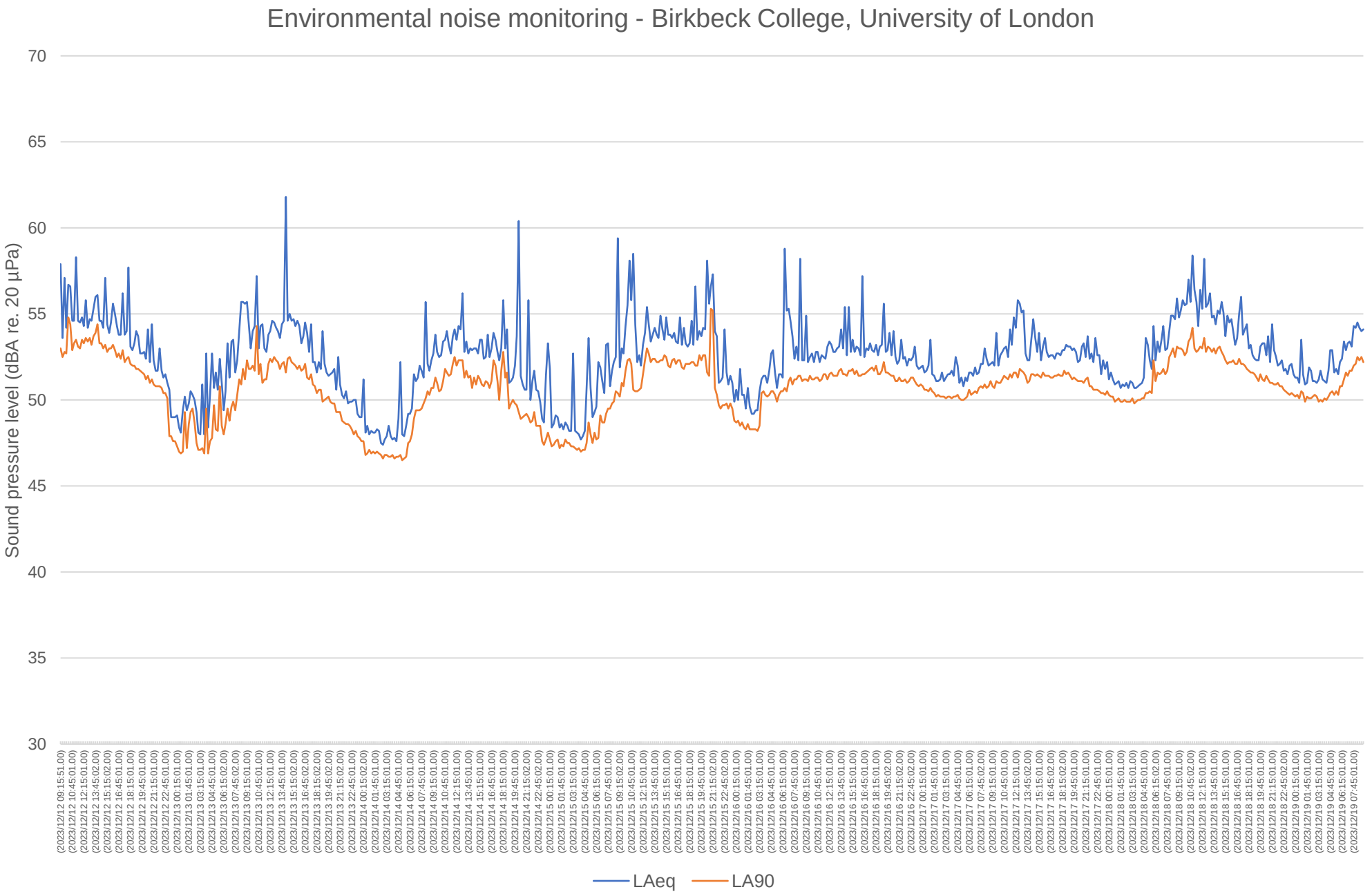
| (2023/12/19 08:30:01.00) | 54.2 | 52.3 |
| (2023/12/19 08:45:01.00) | 54 | 52.5 |
| (2023/12/19 09:00:01.00) | 54.1 | 52.2 |

Table-A1: Tabulated results of environmental sound monitoring.

**Figure A1**


Environmental noise monitoring - Birkbeck College, University of London
Sound pressure level (dBA re. 20 µPa)
70
65
60
55
50
45
40
35
30
LAeq
LA90

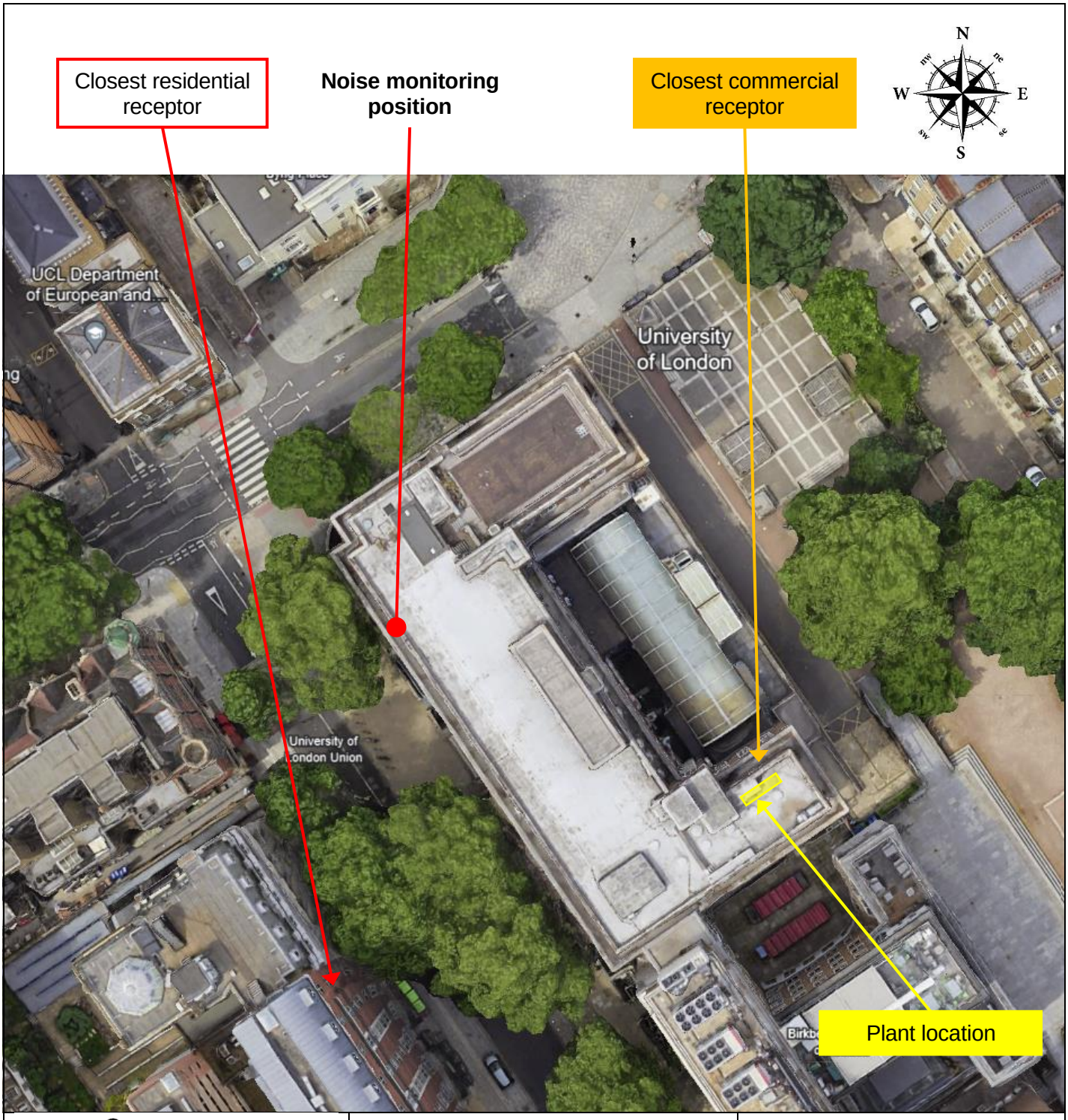
## Figure A2


| | |
|---|---|
| Project: Birkbeck College, University of London | Title: OS Map |
| Dwg No: 2312006-8_v1 drg 01 | Date: 12 January 2024 |

NOICO NOISE CONTROL

Landmark House, Station Road, Hook, Hampshire, RG27 9HA
Tel: 01256 766207

## Figure A3




| | | |
|---|---|---|
| NOICO NOISE CONTROL | Project: Birkbeck College, University of London | Title: Satellite – Unattended monitoring position |
| | Dwg No: 2312006-8_v1 drg 02 | Date: 12 January 2024 |

Landmark House, Station Road, Hook, Hampshire, RG27 9HA
Tel: 01256 766207