Dudley Court, Endell Street, London

BS 4142 Noise Impact Assessment

30th May 2025

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Table of Contents

Appendices

1. Executive Summary

Introduction

This executive summary outlines the findings from a detailed noise impact assessment undertaken by Heyda Ltd for FLOH Consulting Limited at Dudley Court, Endell Street, London, WC2H 9RF. The study was initiated to assess the noise impact from the proposed rooftop air source heat pump plant items, which are intended to supply heating and hot water to the existing residential development, ensuring adherence to both national and local planning policies. The evaluation was conducted following the guidelines of British Standard 4142:2014 for Rating and Assessing Industrial and Commercial Sound.

Objective

The objective of this assessment was to evaluate the potential noise impact from the operation of new external plant equipment on the nearest noise-sensitive receptors. The aim is to confirm compliance with the specific noise criteria established by the London Borough of Camden, thereby ensuring that the proposed development does not lead to unacceptable noise impacts on the nearest noise-sensitive receptors.

Assessment Methodology

The methodology employed in this assessment included:

- An initial site appraisal and desk study to identify potential noise sources and sensitive receptor locations.
- Detailed environmental sound surveys to establish baseline sound levels at locations representative of the nearest noise-sensitive receptors.
- Quantitative analysis using sound level measurements and predictive calculations to assess the noise impact of the new external plant.
- Application of BS 4142 correction features for tonality, impulsivity, and intermittency, to accurately characterize the sound environment and assess the rating level of site operations.
- Quantitative analysis of the predicted plant noise levels inside the top floor apartments of Dudley Court, taking into account of the anticipated sound insulation performance of the existing roof.

Findings

The assessment has identified effective measures to mitigate the noise impact of the new external plant on the surrounding environment. Key findings include:

- The proposed ASHP units and associated mitigation treatments are expected to comply with local planning requirements for noise impact..
- Predicted noise levels indicate that the operation of the external plant will have no more than a low impact on the surrounding residential area, aligning with the acceptable thresholds defined by the London Borough of Camden and BS 4142:2014.

- No adverse internal noise impacts are anticipated within the top floor apartments due to airborne sound transmission from the rooftop plant.

Conclusion

The comprehensive noise impact assessment conducted in line with BS 4142:2014+A1 demonstrates that the proposed new external plant is expected to satisfy the relevant local authority noise criteria. The findings affirm that the proposed development can be accomplished without resulting in an unacceptable noise impact on nearby noise-sensitive receptors. As such, the development is considered acoustically suitable and should not be refused on noise grounds.

2. Introduction

Heyda Ltd has been commissioned by FLOH Consulting Limited to conduct a detailed noise impact assessment for the proposed new external plant noise sources at Dudley Court, Endell Street, London, WC2H 9RF.

The proposals comprise the installation of 2 no. air source heat pumps at the existing rooftop of Dudley Court.

The site falls under the jurisdiction of the London Borough of Camden and is situated in an urban area, surrounded by residential and commercial uses. The nearest noise-sensitive receptors are west facing windows of the neighbouring Travelodge Hotel.

The objective of this report is to provide a comprehensive BS 4142 noise impact assessment in compliance with both national and local planning policies. This entails:

- Reviewing relevant policy, standards, and guidelines.
- Defining the external plant noise criteria specifically for this project.
- Describing the site location and the existing noise climate.
- Offering both qualitative and quantitative analysis of baseline sound conditions.
- Assessing the noise impact of the proposed new external plant noise sources on existing receptors. Assessment to each of the proposed dwellings is not considered necessary in this instance.
- Drawing conclusions and offering recommendations for compliance.

Given the report's technical nature, a glossary of terms is included in Appendix A to aid understanding for all readers.

3. Policy, Standards and Guidance Documents

3.1. Document Summary

This section outlines the core policy documents, standards, and guidelines that have been instrumental in shaping the noise assessment strategy for the project. These documents provide the foundation for our methodology, ensuring that our analysis aligns with current best practices and regulatory expectations.

- **National Planning Policy Framework (2023):** Sets out the government's planning policies for England and how these are expected to be applied, emphasising the importance of avoiding and mitigating adverse impacts of noise.
- **Noise Policy Statement for England (2010):** Provides the overarching policy framework aimed at improving the acoustic environment and managing noise within the context of sustainable development.
- **Planning Practice Guidance – Noise (2019):** Offers detailed guidance on how noise impacts should be assessed and managed, facilitating decision-making in the planning system.
- **Policy A4 and Appendix 3 - Camden Council's Local Plan (2017):** Policy A4 ensures noise and vibration from developments are controlled to protect residents' health and quality of life. Appendix 3 sets specific noise limits, requiring assessments and mitigation measures to prevent adverse impacts on noise-sensitive areas.
- **British Standard 4142:2014** – Method for Rating and Assessing Industrial and Commercial Sound: The key technical standard used for evaluating the potential impact of sound from industrial and commercial sources on noise-sensitive receptors, guiding the assessment of sound levels and mitigation measures.

Further details on these documents are presented in Appendix B.

4. Site Location and Proposals

4.1. Site Description

The site is situated at Dudley Court, Endell Street, London, WC2H 9RF, and falls within the London Borough of Camden

The surrounding context is as follows:

- **North:** Oasis Sports Centre, commercial office buildings (Berkshire House and 175 The Place) and LSE's High Holborn Residence
- **East:** Travelodge Hotel and Short's Gardens (comprising primarily of commercial uses)
- **South:** Short's Gardens (comprising primarily of commercial uses)
- **West:** Endell Street (comprising of residential and commercial uses)

Figure 1 illustrates the positioning of the proposed development (whole site in red; proposed rooftop plant area in orange) relative to the nearest existing noise-sensitive receptors (highlighted in blue).

Figure 1: Site Location and Nearest Noise Sensitive Receptors

The nearest noise-sensitive receptors considered in this assessment are as follows:

- **R1:** Travelodge Hotel
- **R2:** LSE's High Holborn Residence
- **R3:** Residential flats at Betterton St
- **R4:** Residential uses at Endell Street / Short's Gardens
- **R5:** Residential flats at Drury Lane

4.2. Proposed Development

The proposed development involves the installation of two air source heat pumps (ASHPs) at Dudley Court, to be situated at rooftop level in the eastern corner of the existing building, as shown in Figure 1. The ASHPs will be housed within a fully enclosed structure featuring acoustically-rated louvred walls, a solid roof and a solid floor, designed to minimise noise emissions to surrounding receptors. The enclosure will be raised by approximately 0.3 metres above the existing roof level to reduce potential noise airborne noise transmission through the roof structure into the residential units directly below. Each unit will discharge through an attenuated duct outlet. Figures 2 to 4 present the proposed general arrangement and elevation drawings, illustrating the location of the ASHPs and their enclosure.

Figure 2: Proposed GA Layout Illustrating Location of ASHPs on Rooftop Level

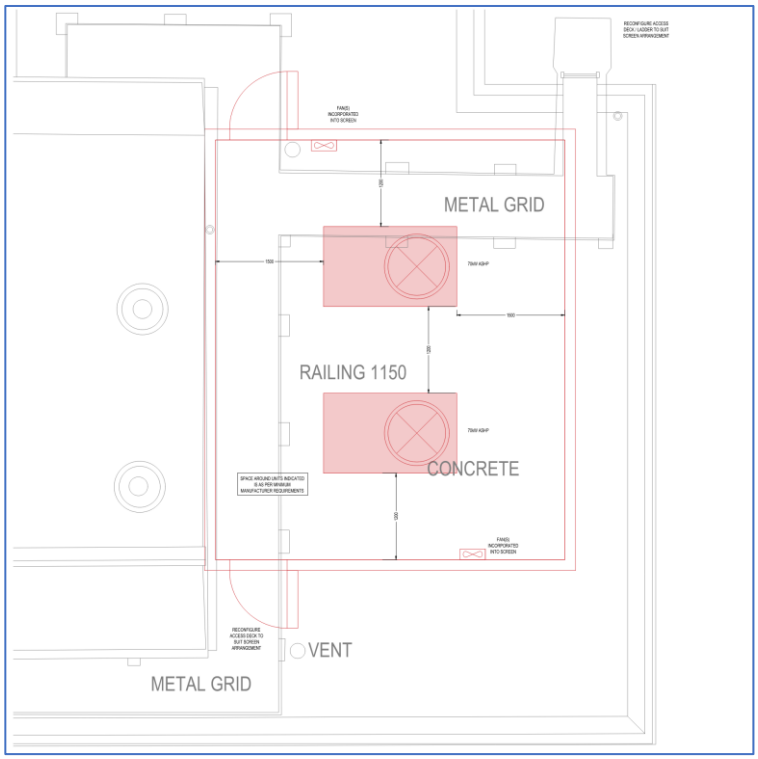


Figure 3: Elevations Illustrating Location of ASHPs and Enclosure

Figure 4: Elevations Illustrating Location of ASHPs and a Section Through the Enclosure

5. Initial Appraisal

5.1. Introduction

Commencing the BS 4142 assessment involves an initial appraisal to gauge the context for evaluation. Ondrej Suska BEng AMIOA, an experienced assessor, has undertaken this critical first step.

5.2. Desk Study

A desk study of the application site and local context has been carried out to inform the survey and assessment, as follows.

5.2.1. Determining Assessment Locations

Utilising a variety of mapping tools and site plans, we have pinpointed the locations of existing noise-sensitive receptors surrounding the site to ensure a focused and accurate assessment.

5.2.2. Background Sound Determination

An evaluation of potential sound sources around the proposed development suggests that road traffic from nearby residential roads and existing building services plant noise will contribute to the ambient and background sound.

A tailored methodology has been developed to accurately capture representative background sound levels at the nearest existing noise-sensitive receptors, employing long-term unattended monitoring to ensure a full picture of the fluctuating background noise levels is established.

5.2.3. Specific Sound Level Determination

We have predicted the specific sound levels at the locations of the nearest existing noise-sensitive receptors by calculation, in accordance with the ISO 9613-2 calculation methodology, using the proposed layouts and manufacturer plant noise data.

5.2.4. Hours of Use

Operational hours for the proposed plant are likely to vary depending on the external temperature, however it is understood that they will only operate during the daytime period (07:00 – 23:00), with no night-time operation anticipated.

5.2.5. Context and Sensitivity of the Assessment Locations

The receptors are residential dwellings and hotel rooms in urban locations and are therefore considered to be sensitive. Existing sources of noise are likely to provide a continuous low level background sound level with a spectrum not dissimilar to that of an ASHP unit, and therefore the proposals are not expected to result noise which is significantly different in character to other sounds that are otherwise audible in the location (provided the noise level is not too high).

6. Sound Measurements

6.1. Sound Survey Overview

An environmental sound survey has been undertaken by Heyda Ltd to determine the prevailing sound levels in the vicinity of the nearest existing noise-sensitive receptors. This survey consisted of long-term unattended measurements at one position.

The measurements were carried out between 18th and 19th March 2025.

6.2. Survey Methodology

The environmental sound survey was undertaken using suitable measurement instrumentation configured to log sound pressure levels in each octave frequency band every 100 ms. The sound data was then analysed to determine the following parameters for each relevant time interval (T):

- **dB $L_{Aeq,T}$**: The A-weighted equivalent continuous sound pressure level over the measurement period, T. This parameter represents the average sound level during the period.
- **dB $L_{A90,T}$**: The A-weighted sound pressure level exceeded for 90% of the measurement period, T, often referred to as the "background sound level".

Environmental sound measurements were taken at the positions shown in Table 1 and Figure 5. Photographs of the monitoring position are presented in Appendix C.

Table 1: Sound Measurement Positions

Position reference	Position description	Microphone height above local ground level	Condition
MP1	On the rooftop of Dudley Court	1.5m above rooftop level.	Free-field

Figure 5: Sound Measurement Position

6.3. Measurement Equipment

All acoustic measurement equipment used during the sound survey conformed to Type 1 specification of British Standard 6167. Details of the sound measurement instrumentation used are shown in Table 2.

The meter had been calibrated by a UKAS accredited laboratory within the previous 24 months. The calibration level was also checked at the start and end of the survey using a field calibrator (which had been suitably calibrated by an accredited laboratory).

No significant drift in the calibration over the course of the survey (≤0.1 dB). The calibrator used had itself been calibrated by a UKAS accredited calibration laboratory within the twelve months preceding the measurements.

The microphone was fitted with protective windshield for the measurements.

Table 2: Sound Measurement Equipment

Item	Manufacturer/Model Type	Serial Number
Sound Level Meter	Norsonic Nor140	1406432
Preamplifier	Norsonic 1209	21316
Microphone	Norsonic 1225	215502
Calibrator	NTi Audio CAL200	21547

6.4. Observations

The sources of sound that contributed to environmental sound climate were noted during our time on site and are as follows:

- Screened road traffic noise from the surrounding road network
- Pedestrian activity
- External plant noise associated with neighbouring buildings

6.5. Weather Conditions

The weather conditions during the survey were observed and noted as being suitable for environmental sound measurement, being dry with only light winds.

6.6. Measurement Results

Table 3 presents the measurement results obtained during the survey at the unattended measurement position. A full time-history graph is provided in Appendix D.

Table 3: Summary of Measured Sound Levels at MP1

Survey Date	Period (T)	Equivalent continuous SPL $L_{Aeq,T}$ (dB)	Typical background sound level $L_{A90,T}$ (dB)
18/03/2025 - 19/03/2025	Daytime (07:00 – 23:00)	53	48
	Night-time (23:00 – 07:00)	51	46

In accordance with BS4142:2014+A1 guidance, the typical L_{A90} sound levels presented above have been derived following a detailed statistical analysis of the measured sound levels over the relevant daytime and night-time periods. The typical background noise level is not, by definition, the lowest.

7. Noise Impact Assessment

7.1. Assessment Criteria

This assessment is carried out to confirm that the proposed development aligns with both National and Local Policy regarding noise impacts from new sources of external plant.

The guiding principle that should inform local policy from national planning policies, specifically the NPPF paragraph 191, is to minimise adverse noise impacts and avoid significant adverse impacts on health and quality of life. The Noise Policy Statement for England (NPSE) further elaborates on this by setting out aims to avoid significant adverse noise impacts, and mitigate/minimise adverse noise impacts within the framework of sustainable development.

The commercial/industrial sound from new plant installations is assessed in accordance with BS 4142:2014, which determines the noise impact based on the margin by which the specific sound source's rating level exceeds the background sound level, considering the sound's context:

- A margin of about +10 dB or more may indicate a significant adverse impact.
- A margin of around +5 dB may signify an adverse impact.
- A rating level at or below the background sound level suggests a low impact.

Consequently, the typical target for the rating level of new external plant to achieve a level equal to or below the existing typical background sound level. However, in accordance with the requirements of Camden Council, in this instance a Rating Level of 10 dB below background has been considered as the design criterion.

Based on a combination of the measured background sound levels and the stated requirements of Camden Council, the limiting criteria in Table 4 have been derived for this plant noise impact assessment.

Table 4: Plant Noise Criteria at the Nearest Existing Noise Sensitive Receptors

Receptor	Period (T)	Typical background sound level $L_{A90,T}$ (dB)	Limiting Rating Level Criteria for Normally Operating Plant $L_{Ar,Tr}$ (dB)
All existing residential receptors	Daytime (07:00 – 23:00)	48	38
	Night-time (23:00 – 07:00)	46	36

Achieving the rating level thresholds in Table 4 is expected to ensure that the noise results in no more than a low impact at the nearest existing noise-sensitive receptors, in accordance with BS 4142, and is not expected to contribute to any increase in background noise levels.

7.2. Proposed Plant

The current selection for the 2 no. proposed external ASHP units are Tyneham Heat Pumps (70kW). The manufacturer sound data for these units is presented in Table 5.

Table 5: ASHP Unit Sound Level Data

Unit Type, Make and Model	Parameter	Octave Band Centre Frequency, Hz							dBA
		63	125	250	500	1000	2000	4000	
		Sound level (dB)							
ASHP (Tyneham AHP 60 70kW)	Sound Power	87	83	79	78	78	79	70	83

7.3. Proposed Noise Control Strategies

The ASHPs will be housed within a fully enclosed structure featuring louvred walls, a solid roof, and a solid floor, designed to minimise noise emissions to surrounding receptors. Each ASHP unit will also discharge through a roof-mounted attenuated outlet.

The acoustic performance for the enclosure elements and the ASHP discharge attenuators are outlined in Tables 6 and 7 below:

Table 6: Sound Insulation Performance of Proposed Enclosure

Element Type	Octave Band Centre Frequency, Hz							Weighted Sound Reduction Index dB R_w (C_{tr})
	63	125	250	500	1000	2000	4000	
	Sound Reduction Index dB R							
Louvred walls of the enclosure (300mm deep acoustic louvres)	5	7	13	13	18	21	20	18 (-3)
Solid floor/roof of enclosure	13	17	21	26	25	27	42	27 (-3)

Table 7: Insertion Losses of Proposed Discharge Attenuator

Element Type	Octave Band Centre Frequency, Hz						
	63	125	250	500	1000	2000	4000
	Insertion Loss, dB						
1200mm long ASHP discharge circular attenuator	6	9	14	22	29	28	26

7.4. Determining the Specific Sound Level

The specific sound levels have been determined at the location of the nearest existing noise-sensitive residential receptors. Predictions have been carried out at the worst-affected windows/façades of the nearest noise-sensitive receptors, to assess the absolute worst-case operational sound levels from the proposed plant.

Manufacturer sound power data for the air source heat pumps (ASHPs) was used as the basis for the noise assessment. A noise model was developed in a modelling software Cadna/A, using the ISO 9613-2 calculation methodology to predict sound propagation to surrounding receptors.

Initially, the internal reverberant level (L_{prev}) within the enclosure was calculated. This calculation accounted for the internal dimensions of the enclosure, the combined sound power levels of both ASHP units, and an assumed mid-frequency reverberation time (T_{mf}) of 0.5 seconds. The calculated resulting internal reverberant levels are presented in Table 8.

Table 8: Calculated L_{prev} Inside the Enclosure (Both ASHPs Operating)

Parameter	Octave Band Centre Frequency, Hz								dBA
	63	125	250	500	1000	2000	4000	8000	
	Sound level (dB)								
Internal Reverberant Level (L_{prev})	82	78	74	73	72	72	62	55	78

Noise breakout through the enclosure was modelled using area sources representing the various enclosure elements. Each element was assigned the calculated internal reverberant level, accounting for the sound insulation performance of the proposed enclosure performance (refer to Table 6).

In the absence of specific sound data for the ASHP discharge outlets, a conservative (worst-case) approach was adopted: the sound power level of each discharge outlet was assumed to be equal to the total sound power level of each ASHP unit. Two point sources were introduced into the noise model, positioned 0.6 metres above the enclosure roof, representing the discharge outlets. Each point source was assigned a sound power level of 83 dBA, with corresponding attenuator insertion losses (Table 7) and the appropriate end-reflection losses applied.

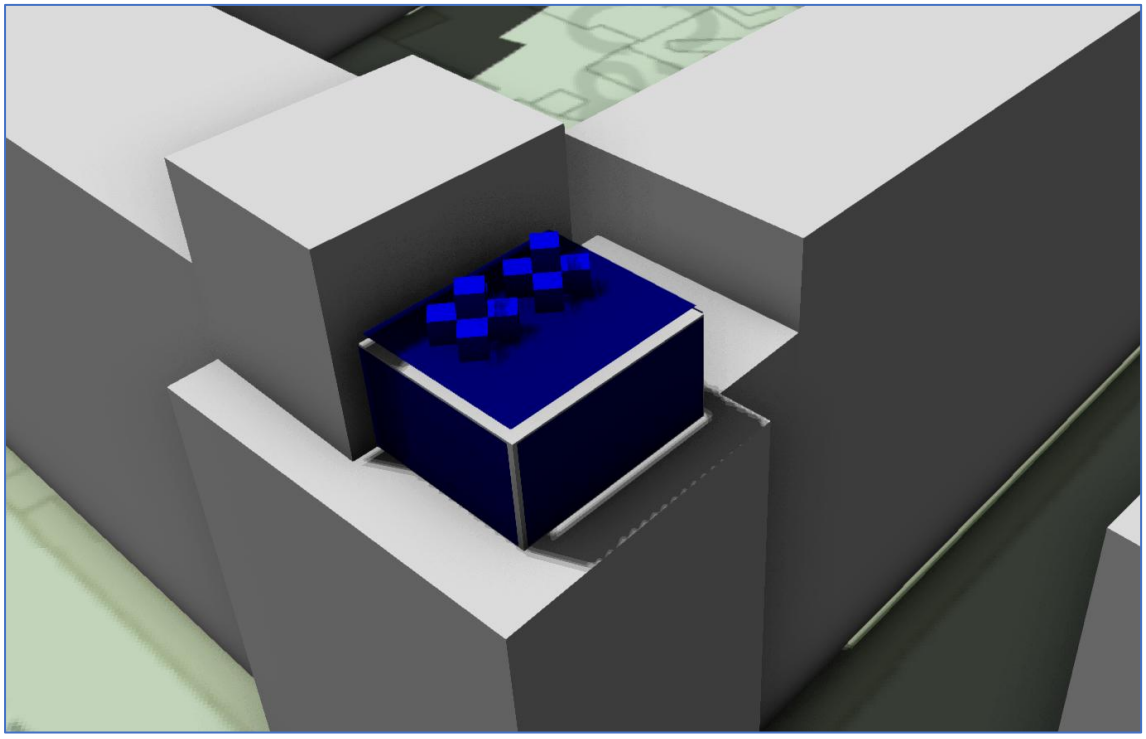
Subsequently, cumulative noise emissions were calculated at the location of the nearest noise-sensitive receptor, identified as the south-western façades of the neighbouring Travelodge Hotel.

The ASHP units may operate continuously at maximum duty during daytime hours; therefore, no correction for operational duration has been applied. As the units will not operate during the night-time period, night-time noise predictions have not been undertaken.

The noise model incorporates the built form of the existing surrounding buildings to account for shielding and reflection effects.

For reference, Figure 6 below provides a 3D screenshot from the noise model, illustrating the location of the various sources.

Figure 6: Noise Modelling 3D Screenshot



7.5. Noise Impact Assessment

7.5.1. Specific Sound Level Results

The assessment of the proposed layout and the manufacturer sound data has been undertaken to determine the specific noise levels at the nearest existing noise sensitive receptors. The results of the modelling are presented in Table 9, representative of noise levels at the worst-affected window of each respective receptor.

Table 9: Predicted Specific Noise Levels at the Nearest Noise Sensitive Receptors

Receptor	Predicted Specific Plant Noise Level dB
	Daytime (07:00 to 23:00) $L_{Aeq,1hour}$
R1 - Travelodge Hotel	38
R2 - LSE's High Holborn Residence	28
R3 - Residential flats at Betterton St	29
R4 - Residential uses at Endell Street / Short's Gardens	22
R5 - Residential flats at Drury Lane	19

7.5.2. Feature Correction Applicability

Following BS 4142's subjective methodology, the identified specific sound levels have been adjusted for characteristic features:

- **Tonality:** The manufacturer data for the proposed ASHP units does not show a tonality, and typically ASHP units should not operate with a tonal noise output unless they require maintenance. Therefore, no tonality correction has been applied.
- **Impulsivity:** The ASHP units are not expected to produce impulsive sound emissions and therefore not correction is applied.
- **Intermittency:** The ASHPs unit may switch on and slowly run up and down depending on the external/internal temperatures. However it is unlikely that there will be distinguishable and regular on/off conditions and so no intermittency correction has been applied.

7.5.3. BS 4142 Noise Impact Assessment

The noise impact analysis, combining specific sound levels with feature corrections, generates the rating levels for comparison against background sound levels. This comparative analysis aims to ascertain the potential noise impact on adjacent receptors. The analysis has been carried out for the daytime periods only.

Table 10: Predicted Specific and Rating Levels for Typical Operations

Location	Period	Typical Background Sound Level, $L_{A90,T}$, dB	LPA Limiting Rating Level Criteria for Plant $L_{Ar,Tr}$ (dB)	Predicted Specific Sound Level dB $L_{Aeq,1hour}$	Predicted Rating Level dB $L_{Ar,1hour}$	Rating against Typical Background Sound Level (dB)	Rating against Limiting Criteria (dB)
R1	Daytime (07:00 – 23:00)	48	38	38	38	-10	0
R2	Daytime (07:00 – 23:00)	48	38	28	28	-20	-10
R3	Daytime (07:00 – 23:00)	48	38	29	29	-19	-9
R4	Daytime (07:00 – 23:00)	48	38	22	22	-26	-16
R5	Daytime (07:00 – 23:00)	48	38	19	19	-29	-19

The assessment reveals that the predicted rating level is expected to be between -10 dB and -29 dB below the existing background sound levels at the locations of the nearest existing noise-sensitive receptors. As such, the proposals are deemed to satisfy the requirements of Camden Council without any additional mitigation measures.

Given the context, a low impact is considered to appropriately characterise the noise experienced as a result of the operation of the proposed plant in the worst-case.

7.5.4. Uncertainty

This assessment, adhering to industry best practices, is based on environmental sound data captured using Class 1 monitoring equipment. The sound emission propagation has been calculated in accordance general best practice, BS 4142 and ISO 9613 standards, leveraging open-source mapping data, site observations, and measured site sound levels. The analysis considers the equipment operating at maximum capacity at each receptor location and is therefore considered an accurate representation of the worst-case noise impacts.

Thus, the uncertainty associated with this assessment is considered low, reflecting a robust and reliable predictive model.

8. Noise Transmission Through the Roof

This section presents an assessment of potential noise transmission from the proposed rooftop air source heat pumps (ASHPs) into the top floor residential apartment directly below.

To assess potential noise transmission into the top floor residential unit beneath the proposed plant items, the noise model developed for the assessment of off-site noise impacts was used to estimate sound levels incident on the roof area directly below and surrounding the enclosure housing the ASHPs.

Based on this exercise, the worst-case predicted daytime noise levels incident on the roof directly below the enclosure are expected to not exceed 53 dB L_{Aeq}, as outlined below:

Table 11: Roof-incident Sound Pressure Levels

Parameter	Octave Band Centre Frequency, Hz								dBA
	63	125	250	500	1000	2000	4000	8000	
	Sound level (dB)								
Sound Pressure Level	45	47	46	46	48	48	25	13	53

The subsequent noise transfer assessment was based on the following key assumptions:

- **Room dimensions:** Assumed 15m² floor area for a typical living room and 10m² floor area for a typical bedroom. Floor to ceiling height was assumed to be 2.4m.
- **Roof specification:** The existing roof is understood to be constructed using 150-200mm concrete slab, 50mm void and plasterboard ceiling.
- **Reverberation times:** Reverberation times were assumed to be 0.6 seconds for a typical living room and 0.4 seconds for a typical bedroom.

In addition to the above, based on the roof specification information provided by the client, we have predicted that the existing roof structure is likely to be capable of achieving the following sound insulation performance:

Table 12: Estimated Existing External Roof Sound Insulation Performance

Element Type	Octave Band Centre Frequency, Hz							$R_w + C_{tr}$ (dB)
	63	125	250	500	1000	2000	4000	
	Sound Reduction Index, R (dB)							
External Roof Structure	30	33	44	50	57	65	71	53 (-7)

Based on the predicted noise levels incident on the roof structure, the estimated sound insulation performance of the existing roof structure and the assumptions outlined above, the resultant internal noise level from the proposed plant has been estimated within the top floor apartment. The results of the assessment are shown in Table 13.

Table 13: Predicted Roof-incident and Internal Ambient Noise Level from the Proposed Plant

Room	Period	Predicted External Roof-incident Noise Level	Predicted Internal Ambient Noise Level
		Equivalent continuous SPL $L_{Aeq,T}$ (dB)	Equivalent continuous SPL $L_{Aeq,T}$ (dB)
Bedroom	Daytime	53	**7**
Living Room	Daytime	53	**6**

As may be seen with reference to Table 13, our assessment indicates that the predicted internal ambient noise levels from the proposed plant are expected to be 6 and 7 dBA in a typical living room and bedroom, respectively, during daytime hours.

These predictions are well below the internal ambient noise level guidelines contained in BS 8233:2014, which recommends that internal ambient noise levels in habitable rooms should not exceed 35 dB $L_{Aeq,16hr}$ during the daytime period (07:00 to 23:00).

Based on all of the above, the assessment demonstrates that internal noise levels are expected to remain comfortably below the applicable BS 8233 criteria. On this basis, no specific mitigation is considered necessary to address internal noise transfer from the ASHPs to the top floor apartment.

In addition to airborne noise considerations, in order to mitigate vibration-induced noise transfer into the residential unit directly below, it is advised that all plant mountings, fixings, hangers, etc., be selected by the relevant subcontractor in line with the guidance provided in CIBSE Design Guide B4 (2016).

9. Conclusion

Heyda Ltd has been commissioned by FLOH Consulting Limited to perform a detailed noise impact assessment for the proposed new external plant noise sources at Dudley Court, Endell Street, London. This assessment critically examines the potential noise impact of the proposed external plant on the nearest existing noise-sensitive receptors, in the context of both national and local planning policies.

Adhering to the methodology prescribed by British Standard 4142:2014 for Rating and Assessing Industrial and Commercial Sound, this report undertakes an exhaustive evaluation incorporating environmental sound measurements and predictive noise modelling. This approach facilitates a comprehensive assessment of the noise emissions from the proposed external items of plant, factoring in corrections for any distinctive acoustic features such as tonality, impulsivity, and intermittency as specified by BS 4142, thus offering a refined analysis of the acoustic environment.

Our findings indicate that the proposals are anticipated to achieve compliance with the established noise criteria derived from the London Borough of Camden's policies and BS 4142 standards, without the need of incorporating additional mitigation measures. Specifically, the predicted noise levels at the nearest existing noise-sensitive receptors are expected to exhibit no more than a low impact (or LOAEL), aligning with the local authority's criteria.

In addition to assessing off-site impacts, the potential for noise transmission into the top floor apartment directly beneath the proposed rooftop ASHPs has also been evaluated. Based on the predicted roof incident noise levels and the estimated sound insulation performance of the existing roof structure, internal noise levels within the affected apartment are expected to remain comfortably within the relevant BS 8233:2014 daytime criteria. As such, no adverse impact on internal acoustic conditions is anticipated and no additional mitigation measures are deemed to be required.

In conclusion, the noise impact assessment for the proposed external plant at Dudley Court demonstrates that the project is capable of complying with the relevant noise impact criteria, thereby avoiding an unacceptable noise impact on the nearby existing noise-sensitive receptors. This compliance underpins our professional opinion that the installation and operation of the external plant should not be restricted based on noise impact considerations.

Appendix A - Glossary of Acoustic Terminology

Sound is the vibration of particles in a medium, such as air, which may be detected by the human ear. This sound is defined as noise when it is audible and unwanted or undesirable to a listener.

The vibration, or oscillation, of particles about an equilibrium position results in local pressure fluctuations from the normal pressure. These local pressure fluctuations are described as sound pressure, and the number of oscillations per second is described as the frequency.

The human ear responds to an incredibly large range of sound pressure, from 0.00002 Pa to 200 Pa, and the perceived loudness is proportional to the logarithm of the sound pressure squared. For this reason, sound is measured in terms of a logarithmic parameter, the sound pressure level, to approximate the response of the ear. Sound pressure levels are quantified in decibels (dB) relative to the threshold of hearing.

The human ear responds to a wide range of sound frequencies, from the lowest perceptible bass note, around 20 Hz, to the highest perceptible treble note, around 20,000 Hz. The ear does not respond equally to each frequency and is most sensitive to sound within the mid-frequency range of around 600 to 8000 Hz.

The response of the ear to each frequency also varies with the sound pressure level. For very loud sounds the difference in perceived loudness between each frequency is less pronounced than for low level sound.

Acousticians measure sound pressure levels using sound level meters, which incorporate a microphone.

A sound level meter approximates the response of the human ear to sound by using frequency filters. For typical environment sounds, the A-weighting filter is used to approximate the response of the ear at typical sound pressure levels. The sound pressure level, adjusted to approximate the response of the ear, is quantified in A-weighted decibels, dB(A) or dB LpA.

In a typical environment, the A-weighted sound pressure level will vary with time. For this reason, acousticians use statistical measurement parameters to describe the sound environment. The most common measurement parameters are as follows:

- dB $L_{Aeq,T}$: Equivalent continuous A-weighted sound pressure level. This is the energy-average sound pressure level during a measurement period, T.
- dB $L_{AFmax,T}$: Maximum A-weighted sound pressure level. This is the maximum sound pressure level during a measurement period, T, and measured in a way that approximates the time-response of the ear.
- dB $L_{A90,T}$: 90th percentile A-weighted sound pressure level. This is the sound pressure level exceeded for 90% of the measurement period, T, commonly referred to as the background sound level.

Sound pressure levels in typical environments are presented in Table A1. Further definitions of acoustic parameters are presented in Table A2.

Table A1: Sound pressure levels within typical environments

Sound Pressure Level, dB	Typical Environment or Description
0	Threshold of hearing
15 to 25	A recording studio
25 to 35	A hotel bedroom at night
35 to 45	An unoccupied office
45 to 55	Quiet residential street
55 to 65	Normal conversation, 1 m away TV programme, listener position
65 to 75	Raised voices, 1 m away Urban high street traffic
75 to 85	Busy motorway traffic, on hard shoulder Typical small plant room
85 to 95	High-speed hand-dryer, operator position Inside London underground (average)
95 to 105	Pneumatic hammer, operator position Concert orchestra
105 to 115	Typical nightclub Untreated generator plantroom
115 to 140	Aircraft take-off, close proximity Threshold of pain

Table A2: Definitions of Acoustic Terminology and Parameters

Wording	Description
Ambient sound level	The total sound pressure level in a given position from all surrounding sources of noise, both near and far. Normally expressed as an equivalent continuous A-weighted sound pressure level, dB $L_{Aeq,T}$.
A-weighting	The process of weighting the observed sound pressure level at each frequency band, to approximate the sensitivity of the human ear to sounds of different frequencies. A-weighted sound pressure levels are expressed as dB(A) or dB L_{Ap}.
Decibel	A logarithmic value quantifying the sound pressure at a specified position or sound power. relative to a reference sound pressure or sound power (20 µPa for sound pressure, 10-12 W for sound power).
Façade	A sound monitoring position is a "façade" position when it includes a strong reflection from an adjacent building or structure. This corresponds with a position that is between 1 and 2 metres away from a reflecting building or structure.
Free-field	A sound monitoring position is a "free-field" position when it is not affected by sound reflections from surrounding buildings and structures. This corresponds with a position at least 3.5 metres away from reflecting buildings or structures.
Frequency	The number of oscillations per second of a vibrating particle in a medium, measured in Hertz (Hz) or cycles per second.
$L_{A90,T}$	The A-weighted sound pressure level exceeded during 90% of the time interval, T. Typically used to quantify the background sound level at a specified position.
$L_{Aeq,T}$	The equivalent continuous A-weighted sound pressure level over a time interval, T. This is an energy-average sound pressure level over the specified time period.
Noise	Unwanted or undesirable sounds observed by a listener.
Octave band	A frequency band used in acoustical measurements. An octave is a frequency interval between two sounds where the frequency of the lower sound is half the frequency of the upper sound. The human hearing range is divided into ten logarithmically equal frequency divisions called octave bands, with centre-band frequencies as follows: (16 Hz, 32 Hz,) 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 16000 Hz.

Rating level, $L_{Ar,Tr}$	The specific sound level plus a correction accounting for acoustic features such as impulses, tones, intermittent features, or any other characteristics that draw more attention to the sound source.
Residual sound level	The equivalent continuous A-weighted sound pressure level of the ambient sound remaining at a specified position when the specific sound source (the sound source being assessed) does not contribute to the ambient sound.
R_w	The weighted sound reduction index of an architectural element. A single-figure rating of the sound insulation provided by the architectural element in idealised conditions over a range of frequencies. Measured in a laboratory in accordance with BS EN ISO 140-3 (or BS EN ISO 10140-2), with single figure rating determined in accordance with BS EN ISO 717-1.
Sound	The vibration, or oscillation, of particles in a medium, such as air, which may be detected by the human ear.
Sound insulation	The ability of architectural elements or structures to reduce the transmission of sound, predominantly due to the reflection of sound incident on the element or structure. Typically measured as the difference in sound pressure levels between a "source" room containing a loudspeaker and an adjacent "receiving" room.
Sound power level	A logarithmic measurement that quantifies the total sound power of a source emitted in all directions relative to a reference sound power (W_{ref} = 1 pW or 10-12 W). Equal to 10 log10 (W / W_{ref}) and expressed in decibels.
Sound pressure level (SPL)	A logarithmic measurement that quantifies the sound pressure at a specified position relative to a reference sound pressure (pref = 20 µPa). Equal to 20 log10 (p / p_{ref}) and expressed in decibels.
Specific sound level	The equivalent continuous A-weighted sound pressure level at a specified position due to the specific sound source (the sound source being assessed).
Third-octave band	A higher-resolution frequency band used in acoustical measurements. A third-octave band is equal to one of three logarithmically equal parts of the corresponding octave frequency band. The upper band edge frequency is equal to the lower band-edge frequency multiplied by 1/3.

Appendix B - Policy, Standards and Guidelines

Legislation

Control of Pollution Act, 1974

Section 60 of the Control of Pollution Act, 1974 (the 'Act'), Part III - Noise enables a local authority to serve a notice on anyone (including a company) who is carrying out, or intending to carry out, works in relation to construction, demolition, road-works, railway maintenance etc. in order to control the noise from those operations. Section 61 of the Act also enables such a person to apply to the local authority for consent in respect of such works.

The Act introduces the concept of using 'Best Practicable Means' (BPM) to control the impact of noise where significant impacts are likely to occur. BPM essentially means selection of the quietest techniques and equipment, in addition to considering factors such as timing, duration, location and opportunities for acoustic screening or separation, to ensure that impacts are controlled in so far as is reasonably practicable. The demonstrable use of BPM can also be used as a defence to enforcement action under nuisance legislation.

National Policy

National Planning Policy Framework, 2023

The latest revision to the National Planning Policy Framework (NPPF) was published in 2023. The NPPF sets out the Government's planning policies for England and how these should be applied. It provides a framework within which local plans for housing and other development can be produced.

This document makes reference to voiding significant adverse impacts, and mitigating and reducing potential adverse impacts resulting from noise to a minimum but it does not set absolute criteria.

Noise Policy Statement for England, 2010

The underlying principles and aims of existing noise policy documents, legislation and guidance are clarified in the Noise Policy Statement for England (NPSE). The NPSE sets out the 'Long Term Vision' of Government noise policy as follows: "Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development".

The NPSE outlines the following three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- "Avoid significant adverse impacts on health and quality of life
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvement of health and quality of life".

The guidance defines three established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation (WHO):

- "NOEL (No observed Effect Level) – This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise"
- "LOAEL (Lowest Observed Adverse Effect Level) – This is the level above which adverse effects on health and quality of life can be detected"; and
- "SOAEL (Significant Observed Adverse Effect Level) – This is the level above which significant adverse effects on health and quality of life occur".

The guidance also states that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations and that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

National Planning Practice Guidance, England, 2023

Further guidance in relation to the National Planning Policy Framework and the Noise Policy Statement for England has been published in the National Planning Practice Guidance in England: Noise (NPPG-Noise), which summarises the noise exposure hierarchy, based on the likely average response.

The National Planning Practice Guidance (NPPG) has been revised and updated to be easily accessible and available online.

The Noise Guidance advises on how planning can manage potential noise impacts in new development. It sets out when noise is relevant to planning and outlines the following Observed Effect Levels to determine the noise impact:

- Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur
- Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected
- No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

The document recognises the subjective relationship between noise levels and the impact on those affected and advises on factors which may influence on whether noise could be a concern.

The significance criteria from NPPG-Noise are reproduced in Table B1 below.

Table B1: Significance Criteria from NPPG In England: Noise

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Local Policy

Camden Council

Camden's Local Plan Policy A4 addresses noise and vibration control to safeguard health and quality of life within the borough. The policy outlines the following key measures:

- **Noise and Vibration Impact Assessments:** Developments introducing noise-sensitive uses near existing noise sources, or those likely to generate noise, must submit detailed assessments. These evaluations consider thresholds detailed in Appendix 3, alongside relevant national and regional guidelines and British Standards.
- **Design-Stage Noise Mitigation:** Required noise mitigation strategies should be integrated during the design phase to ensure effectiveness and compliance.
- **'Agent of Change' Principle:** Developments introducing noise-sensitive uses must implement measures to protect occupants from existing noise and vibration sources, ensuring that established operations are not adversely affected by new sensitive developments.
- **Resistance to Noise-Generating Developments:** The council may oppose developments likely to produce unacceptable noise and vibration impacts, prioritizing community well-being.
- **Operational Noise Control:** Applicants must demonstrate that any noise-generating operations, including machinery, can function without harming local amenity.
- **Retrofitting for Noise Reduction:** The policy supports updating existing noise sources and sensitive uses with measures to minimize noise and vibration impacts on occupants.
- **Minimizing Construction and Delivery Impacts:** Efforts should be made to reduce disturbances from deliveries and during demolition and construction phases.

Appendix 3 of the policy goes on to outline noise levels for industrial and commercial developments, including plant and machinery, based on the British Standard 4142:2014 (BS 4142):

Table B2: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAL (Green)	LOAEL to SOAEL (Amber)	SOAEL (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 10dB 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 10 dB between 9 dB below and 5 dB above background and no events exceeding between 57 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
**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

Where achieving the above rating levels doesn't provide sufficient protection, the council may require the use of a Noise Rating (NR) curve, with a maximum of NR35 in quiet areas, based on measured or predicted noise levels 1 meter from the affected premises' façade.

Standards and Guidelines

BS 4142:2014+A1 'Methods for Rating and Assessing Industrial and Commercial Sound'

BS 4142:2014+A1 describes the method for assessing the likely impact of noise sources of an industrial, commercial or fixed nature on people residing in the area.

New commercial development can often incorporate plant and processes that have the potential to generate noise, especially if operated at night-time when background noise levels are at their lowest.

Good practice dictates that new developments should be designed to give a cumulative noise rating level ($L_{Ar,Tr}$) of no more than the current prevailing background noise level (L_{A90}) at a distance of 1m from the nearest residential facades, when assessed in accordance with BS 4142:2014+A1 as this is defined as a low impact.

BS 4142:2014+A1 sets out a method to assess the likely impact of noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises on noise-sensitive receptors in the vicinity.

The procedure contained in BS 4142:2014+A1 for assessing the likely impact is to compare the measured or predicted noise level from the source in question, the $L_{Aeq,T}$ 'specific noise level', immediately outside the dwelling with the $L_{A90,T}$ background noise level.

Where the noise contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific noise level to obtain the $L_{Ar,Tr}$ 'rating noise level'. A correction to include the consideration of a level of uncertainty in noise measurements, data and calculations can also be applied, when considered necessary.

BS 4142:2014+A1 states: "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". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:

Typically, the greater this difference, the greater the magnitude of the impact.

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5dB 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 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 level, this is an indication of the specific sound source having a low impact, depending on the context."

The periods associated with day or night, for the purposes of the standard, are considered to be 07.00 to 23.00 and 23.00 to 07.00, respectively.

Appendix C - Photographs of Measurement Positions

Figure C1: Photograph of measurement position MP1

Appendix D - Sound Survey Time History