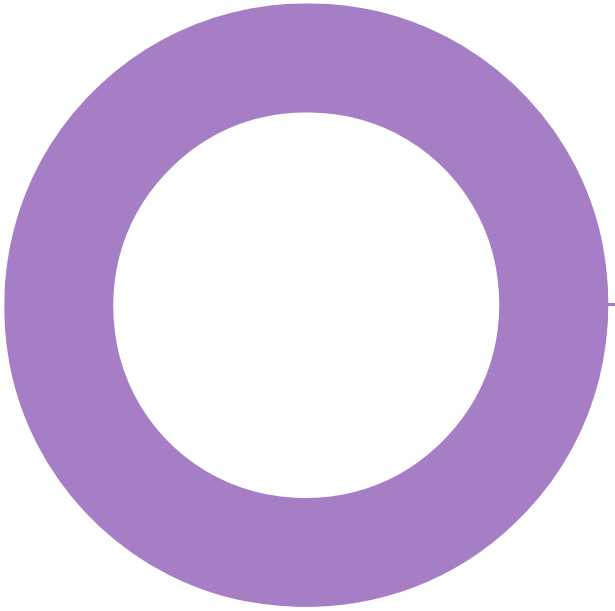
HOARE LEA

Avalon House.
Richmond, London.
Barings.

ACOUSTICS
NOISE IMPACT ASSESSMENT
PLANNING STAGE
REVISION 00 – 30 MAY 2024



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	30/05/2024	Initial issue.	KS / AD	MB	BJ

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Contents.

Executive summary

This report has been prepared as supporting information for a planning application to the London Borough of Richmond upon Thames to demonstrate feasibility compliance with their noise and vibration guidance and requirements for noise generating development near noise sensitive properties.

A noise impact assessment for the proposed redevelopment of Avalon House, Richmond, London has been carried out covering the operation of new building services plant, external terraces used for breakout purposes and the demolition and construction activities,

Operational noise limits for buildings services plant, background noise levels and initial building services plant selections have been identified and assessed with reference to nearest noise sensitive properties in Tersha Street, Cedar Terrace and West Sheen Vale.

Additional noise control mitigation for building services has been proposed. The results from incorporation of the mitigation indicate the proposed design criteria and hence London Borough of Richmond upon Thames requirements can feasibly be satisfied as the design progresses.

It is expected that the London Borough of Richmond upon Thames will apply standard conditions to secure the building services design criteria proposed, use of the external terraces and submission of a Noise and Vibration Demolition Method Statement (DMS) and a Construction Method Statement (CMS). On this basis, noise should not pose an obstacle to granting planning permission.

1. Introduction.

Hoare Lea LLP have been appointed to provide a noise impact assessment to support the planning stage of the proposed redevelopment of Avalon House, 72 Lower Mortlake Road, Richmond, TW9 2JY, London. This report sets out the existing noise climate, proposes plant noise emission limits and summarises the acoustic assessment undertaken.

The Local Planning Authority for the redevelopment site is London Borough of Richmond upon Thames (LBRuT). Relevant local and national planning policy as well as recognised guidance has been reviewed in relation to the proposed redevelopment. Guidance methodology has been adopted in order to set external building services plant noise emission limits at the closest noise-sensitive receptors.

2. Site context.

The Site is a three-storey commercial office building located on the southern side of Lower Mortlake Road (A316) and is bounded to the east by residential development (Eminence House Apartments, five floor levels in height) and dwellings (two floor levels in height) along West Sheen Vale. To the south are residential apartments and dwellings off Tersha Street (up to three floor levels in height). To the west are residential dwellings (up to three floor levels in height) with the rear gardens and close boarded timber fence facing the proposed development. Figure 1 below provides a plan view of the immediate surroundings.

Figure 1: Site location and context.

The predominant noise source is road traffic on the A316, road traffic on other local residential roads and frequent aircraft fly-overs.

The proposed redevelopment includes:

- Partial demolition of the existing Avalon House (roof, upper floor level and some portions on facades;
- Construction of two new floor levels, increasing the overall to one floor level greater than the existing building;
- Introduction of new ground level external (or venting to/from external) building services plant on the southern façade with the nearest residential properties being the apartments off Tersha Street; and
- Relocation of the roof building services plant compound to the western end of Avalon House (open to the southern side of the building) with the nearest residential properties being the rears of numbers 10 and 11 Cedar Terrace.

3. Planning policy and guidance.

3.1 Noise Policy Statement for England.

The *Noise Policy Statement for England* (NPSE) advises that noise impacts should be assessed on the basis of adverse and significant adverse effect but does not provide any specific guidance on assessment methods or noise limits.

The NPSE introduces the concepts summarised in Table 1 that can be applied when considering the significance of noise impacts, which are applied by the World Health Organization.

The document advises that it is not possible to have "*a single objective noise based measure…. that is applicable to all sources of noise in all situations*"[1]. It further advises that the sound level at which an adverse effect occurs is likely to be different for different noise sources, for different receptors at different times.

Table 1: NPSE observed effect levels.

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

3.2 National Planning Policy Framework.

National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing and Communities, 2023) sets out the Government's planning policies and how these are expected to be applied. In relation to noise and vibration, NPPF section 15 paragraphs 174, 185 and 187 are presented below:

'174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

a. *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution…'.*

'185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

b. *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*

c. *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*

d. *limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

'187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'

3.3 Planning Practice Guidance.

Online *Planning Practice Guidance* (PPG) (Ministry of Housing, Communities & Local Government, 2019) has been published to provide greater details in relation to the relevance of noise to the planning process following the introduction of NPPF and NPSE.

This guidance states, under the heading *'How to Determine the Noise Impact'*, that the following should be considered by local authorities:

- 'whether or not a significant adverse effect is occurring or likely to occur;
- whether or not an adverse effect is occurring or likely to occur; and
- whether or not a good standard of amenity can be achieved.'

In line with NPSE, this includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation during the operation of the Proposed Development.

Further guidance on each of the various observed effect levels set out in NPSE is provided in the table detailed in the section headed *'How to Recognise when Noise could be a concern*?' which is reproduced below in Table 2.

It is important to note that no specific noise parameters or target noise levels are defined in the text. Under the heading 'What factors influence whether noise could be a Concern?', the subjective nature of noise is discussed. It is stated that there is no simple relationship between noise levels and the impact on those affected. This depends on how various factors combine in particular situations.

Table 2: PPG observed effects.

Perception	Example 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 specific measures required
Lowest Observed Adverse Effect Level			
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; closing windows for some of the time because of the noise. Potential for non-awakening 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			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. 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 Level	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or 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

3.4 Relevant local policy.

Relevant planning policies are contained in the documents referenced below. Policies and supporting text that address noise and are relevant for this development have been reproduced below.

The London Plan (March 2021).

The latest London Plan refers to noise in several of the adopted polices, the most relevant for noise impact assessments are summarised below.

Policy D.13 Agent of Change places the responsibility for mitigating impacts from existing noise-generating activities or uses on the proposed new noise-sensitive development. It states that noise impact assessments accompanying planning applications should be carefully tailored to local circumstances and be fit for purpose.

Policy D.14 of The London Plan refers specifically to noise and encourages management of noise and good acoustic design. Section 3.14.3 specifically refers to recognised acoustic guidance as follows:

> "*The management of noise also includes promoting good acoustic design of the inside of buildings. Section 5 of BS 8223:2014 provides guidance on how best to achieve this. The Institute of Acoustics has produced advice, Pro:PG Planning and Noise (May 2017), that may assist with the implementation of residential developments. BS4214 provides guidance on monitoring noise issues in mixed residential/industrial areas*."

London Borough of Richmond Upon Thames (LBRuT).

Local Plan

The *London Borough of Richmond Upon Thames Local Plan (July 2018)* (Local Plan) sets out the planning strategy between 2018 and 2033. The strategic vision includes the following:

1. Protecting Local Character

Residential quality of life

Richmond borough will be the best place in London to live as a result of the quality of the built environment which considers the health and wellbeing of local residents and the high quality design of new development that respects and enhances its distinctive character. The amenity of residents and local neighbourhoods will have been protected and action taken on environmental issues and pollution. The quiet and peaceful nature of the borough, alongside its breathtakingly beautiful parks and open spaces, will continue to ensure that all Richmond borough residents cherish their local area as a place to live.

The strategic objectives of the Local Plan include the following:

A Sustainable Future

4. Reduce or mitigate environmental impacts and pollution levels (such as air, noise, light, odour, fumes, water and soil) and encourage improvements in air quality, particularly along major roads and areas that already exceed acceptable air quality standards.

5. Ensure local environmental impacts of development are not detrimental to health, safety and the amenity of existing and new users or occupiers of a development or the surrounding area.

Policy LP 8:

Amenity and Living Conditions

All development will be required to protect the amenity and living conditions for occupants of new, existing, adjoining and neighbouring properties. The Council will:

4. ensure there is no harm to the reasonable enjoyment of the use of buildings, gardens and other spaces due to increases in traffic, servicing, parking, noise, light, disturbance, air pollution, odours or vibration or local micro-climatic effects.

Policy LP 10

Local Environmental Impacts, Pollution and Land Contamination

A. The Council will seek to ensure that local environmental impacts of all development proposals do not lead to detrimental effects on the health, safety and the amenity of existing and new users or occupiers of the development site, or the surrounding land. These potential impacts can include, but are not limited to, air pollution, noise and vibration, light pollution, odours and fumes, solar glare and solar dazzle as well as land contamination.

Developers should follow any guidance provided by the Council on local environmental impacts and pollution as well as on noise generating and noise sensitive development. Where necessary, the Council will set planning conditions to reduce local environmental impacts on adjacent land uses to acceptable levels.

Noise and Vibration

C. The Council encourages good acoustic design to ensure occupiers of new and existing noise sensitive buildings are protected. The following will be required, where necessary:

1. a noise assessment of any new plant and equipment and its impact upon both receptors and the general background noise levels;

2. mitigation measures where noise needs to be controlled and managed;

3. time limits and restrictions for activities where noise cannot be sufficiently mitigated;

4. promotion of good acoustic design and use of new technologies;

5. measures to protect the occupiers of new developments from existing sources.

Draft Local Plan

It is intended that by the end of 2024, there will be a new replacement Local Plan. The consultation process has been completed and the consultation draft version the *Richmond Local Plan 'the best for our borough' draft for consultation Planning (2021 – 2022)* (Draft Local Plan) included the following:

Strategic objectives

Reduce or mitigate environmental impacts and pollution levels (such as air, noise, light, odour, fumes, water and soil) and secure improvements in air quality, particularly along major roads and areas that already exceed acceptable air quality standards.

Policy 46. Amenity and living conditions

A. All development will be required to protect the amenity and living conditions for occupants of new, existing, adjoining and neighbouring properties. The Council will:

2. Ensure balconies do not raise unacceptable overlooking or noise or disturbance to nearby occupiers, height massing or siting, including creating a sense of enclosure;

4. Ensure there is no harm to the reasonable enjoyment of the use of buildings, gardens and other spaces due to increases in traffic, serving, parking, noise, light, disturbance, air pollution, odours or vibration or local micro-climate effects.

Paragraph 22.39 – Balconies or terraces on roofs or main buildings can be visually intrusive and result in serious intrusion into the privacy and quiet enjoyment of neighbouring residential properties.

Policy 53. Local Environmental Impacts

For noise and vibration the wording is the same as Policy LP 10 of the Local Plan, except the list references are different, with section C. replaced by section I. in the Draft Local Plan.

Supplementary Planning Document

The LBRuT has produced a Supplementary Planning Document (SPD) title *Development Control for Noise Generating and Noise Sensitive Development (2018)* relating specifically to noise and planning. The key features included relevant to the proposed redevelopment are:

- The SPD forms part of the Local Plan and will also be part of the 2024 Draft Local Plan;
- Noise can interfere with residential and community amenity and the utility of noise sensitive land uses;
- …noise exposure can lead to adverse effects including sleep disturbance and annoyance, which impact on health and quality of life;
- Avoid significant adverse effects of noise on people living and working in the Borough…;
- The applicant will be expected to demonstrate…that noise has been mitigated and reduced to a minimum and that the principles of good acoustic design have been followed;
- The most relevant standard for assessing new industrial and commercial development is BS4142:2014;
- The LBRuT will seek for a 'Minimal' ($L_{A,Tr} - L_{A90,T} \leq -5$) or 'Low' ($L_{A,Tr} - L_{A90,T}$ is > -5 & ≤ 0) noise risk assessment for the external noise level;
- Desktop assessment, maximum noise emission criteria of 45dB(A) $L_{Aeq,1hour}$ daytime (07:00-23:00) and 35dB(A) $L_{Aeq,15minute}$ night time; and
- …Noise and Vibration Demolition Method Statement (DMS) and Construction Method Statement (CMS) will typically include an acoustic report undertaken by a suitably qualified and experienced consultant.

3.5 Recognised guidance documentation.

British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.
This British Standard provides an objective method for rating the significance of impact from industrial and commercial operations. It describes a means of determining sound levels from fixed plant installations and determining the background sound levels that prevail on a site.

The assessment of the impacts is based on the subtraction of the pre-existing background sound level ($L_{A90,T}$) from the rating level ($L_{Ar,Tr}$).

The standard does not give a definitive method for determining the background sound level but instead, as a commentary, states that *"the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods"*.

Clause 8.1.4, which discusses the monitoring duration, states *"there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."* As a note to this clause the following commentary is given on obtaining a representative backgrounds sound level:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

The rating level is defined objectively as the specific source noise level in question (either measured or predicted) with graduated corrections for tonality (up to +6 dB), impulsivity (up to +9 dB), intermittency (+3 dB) and other sound characteristics (+3 dB) which may be determined either subjectively or objectively, if necessary.

The background sound level is subtracted from the rating level and the difference used to assess the impact of the specific noise source:

- A difference of around +10 dB is likely to be an indication of a significant adverse impact, depending on context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context; and
- A difference of +0 dB or less is an indication of the specific sound source having a low impact, depending on the context.

4. Environmental noise survey.

An environmental noise survey has been undertaken to acquire representative noise measurements to support the analysis of the proposed redevelopment of Avalon House.

The survey comprised sample daytime attended measurements on Tersha Street to obtain an indication of daytime (07:00 to 23:00 hours) background noise levels. It was not possible to obtain longer-term data as there was not a secure location for unattended noise monitoring equipment to be left near the surrounding residential properties to Avalon House.

4.1 Summary of measurements

An attended sample environmental noise measurement survey has been carried out on Thursday 9th May 2024 at a position along Tersha Street. The measurements acquired are considered to be representative of the general daytime noise environment on the southern and western sides of Avalon House. The noise measurement details are provided in Appendix B attached. Figure 2 below shows the measurement position which was under free-field conditions and at a height of approximately 1.5m above local ground level.

Figure 2: Daytime attended measurement position (image source Google Maps).

The general background noise level during the daytime (07:00 to 23:00 hours) has been estimated from the measured levels of Appendix B to be in the order of 49 dB $L_{A90,15minutes}$.

To determine the background noise level at night, an observational comparison has been made to the Extrium Ltd publicly available noise maps for the local area. The difference between the daytime and night road traffic sound levels demonstrates a 5 dB(A) drop at night at the measurement position. Therefore, the night (23:00 to 07:00 hours) background noise level has been determined in the order of 44 dB $L_{A90,15minutes)}$.

5. Proposed plant noise limits.

5.1 Under normal operational duty.

Results from the environmental noise survey have been used to define appropriate plant noise limits. The guidance of the LBRuT SPD with respect to a 'Low noise risk assessment' during the daytime and a 'Minimal noise risk assessment' at night has been adopted to determine proposed redevelopment overall combined MEP plant noise limits in terms of a BS 4142 rating level $L_{Ar,15minutes}$ dB as defined in Table 3 below. This approach has been applied in order to protect the residential amenity of the surrounding area to Avalon House. The limits apply at 1 m from the façade of the nearby noise sensitive receptors.

Table 3: Proposed MEP external plant noise limits.

Operating Period	Background Noise Level $L_{A90,15minutes}$ dB	LBRuT SPD Guidance Applied	BS4142 Design Rating Level $L_{Ar,15minutes}$ dB
Daytime (07:00 to 23:00 hours)	49	$L_{A,Tr} - L_{A90,T}$ is ≤ 0	49
Night (23:00 to 07:00 hours)	44	$L_{A,Tr} - L_{A90,T}$ is = -5	39

5.2 Emergency operation.

Life safety MEP plant (generator) is only operational in an emergency and for periodic testing. It is proposed to limit the operational noise to a maximum $L_{Ar,15minutes}$ 59 dB, which is +10 dB(A) above the representative daytime background noise level. This approach is commonly accepted.

6. Assessment of plant and outline mitigation.

6.1 Identified sound sources.

It is intended that new MEP building services plant will be distributed as shown in Figure 4 below.

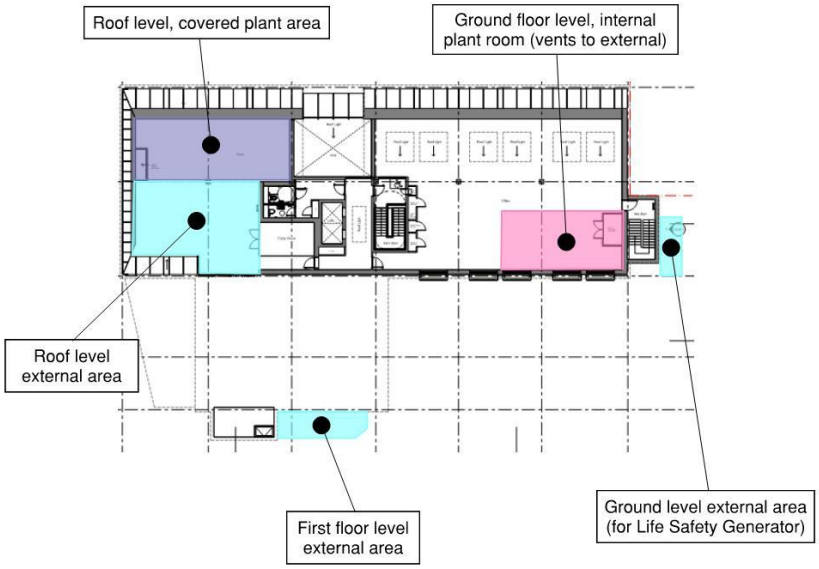

Figure 4: Intended location of MEP plant.

Manufacturer's sound level data has been obtained for initial building services plant selections to permit an assessment of feasibility to be undertaken for noise emissions and to propose mitigation for incorporation. Source noise level data used within the assessment is included within Appendix C attached.

6.2 Sensitive receptors.

Two locations have been used to represent all the nearest surrounding residential properties which are sensitive receptors:

1. Tersha Street (Apartments) – represents the apartments and terraced dwellings of Tersha Street, Eminence House apartments and dwellings on West Sheen Vale.
2. Cedar Terrace – represents the rear facades of dwellings along Cedar Terrace.

The worst-case used is a receiver height of 7.5m above local ground to represent a Second Floor level habitable room, which could overlook the building services plant with minimal screening effect at some locations.

The proposed noise sources from building services plant will produce different noise contributions to the sensitive receptors due to direction of propagation and screening effects. The above two locations cover all the worst-case distances.

6.3 Assessment.

An assessment following the principles of BS 4142 has been carried out and the resultant rating noise levels compared to the proposed design noise limits derived from the guidance of the LBRuT SPD.

6.3.1 Methodology and assumptions

In-house Hoare Lea LLP developed software 'MandE' has been used to facilitate the propagation calculations. The software implements the following reference procedures:

- CIBSE Guide B4: 2016 'Noise and vibration control for building services systems';
- International Standards Organization (ISO) 9613 'Acoustics — Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors' 2024;
- Sound Research Laboratories Ltd (SRL) 'Noise Control in Building Services' 2013; and
- British Standard BS EN ISO 3746 : 'Sound Power Level Measurements' 2010.

All building services plant is expected to be running at normal design duty during the daytime (07:00 to 23:00 hours) and has been included as such in the calculations, assuming all equipment running simultaneously.

At night (23:00-07:00), only the DX Condensers are expected to be running and therefore the AHUs and ASHPs have been excluded from the calculations. Overnight the DX Condensers are likely to reduce in load and hence should reduce in output noise level. However, for the purposes of the assessment, a worst-case approach has been used assuming no reduction in duty.

6.3.2 Proposed noise control mitigation.

An initial assessment concluded that without any mitigation in place, the noise limits would not be achieved.

The following is a list of the advised noise mitigation scheme which could be applied to reduce the noise contributions from initial selections of proposed building service plant to satisfy the proposed design criteria. These mitigation measures have been incorporated into the preliminary design for the scheme.

- Incorporate a proprietary in-line sound attenuator to the exhaust discharge of the AHU to be located within Ground Floor Internal plant room. A provisional selection would be an 1800mm long, 32.5% free-area rectangular sound attenuator;
- Incorporate a proprietary in-line sound attenuator to the intake of the AHU to be located within Ground Floor Internal plant room. A provisional selection would be an 1800mm long, 50% free-area rectangular sound attenuator;

- Incorporate a 300mm thick minimum acoustically attenuated louvre to all exposed (currently open) vents to external in the façade of the Ground Floor Internal plant room, where the AHU is situated to control breakout noise. An alternative approach could be to increase the sound insulation of the AHU casing;
- Incorporate a proprietary in-line sound attenuator to the exhaust discharge of the AHU to be located within the Roof Level, Covered plant room. A provisional selection would be a 600mm long, 50% free-area rectangular sound attenuator;
- Incorporate a proprietary in-line sound attenuator to the intake of the AHU to be located within the Roof Level, Covered plant room. A provisional selection would be a 600mm long, 50% free-area rectangular sound attenuator; and
- The screen around the First Floor External plant compound is required to be of a solid continuous material and to a height of at least 0,5m above the top of the DX Condensers.

The above is provisional based on the initial building services plant selections and could be subject to change dependent on final plant selections / installations. LBRuT can secure by condition information to be provided prior to occupation to demonstrate the proposed design criteria are satisfied.

Table 4 and Table 5 below provide an assessment for daytime and night respectively based on the above noise control mitigation being incorporated to demonstrate that compliance with the proposed design criteria is feasible. The resultant noise levels for individual items of equipment are presented in Appendix C.

Table 4: Daytime mitigated assessment summary.

Calculation Step	Assessment to Tersha Street	Assessment to Cedar Terrace
Cumulative specific noise level at receptor, dB $L_{Aeq,15minutes}$	44	44
BS 4142 corrections applied, dB	+5	+5
Cumulative rating noise level at receptor, dB $L_{Ar,Tr}$	49	49
Background sound level, dB $L_{A90,T}$	49	49
Difference	+0	+0
Assessment	Low impact	Low impact

Table 5: Night mitigated assessment summary.

Calculation Step	Assessment to Tersha Street	Assessment to Cedar Terrace
Cumulative specific noise level at receptor, dB $L_{Aeq,15minutes}$	34	28
BS 4142 corrections applied, dB	+5	+5
Cumulative rating noise level at receptor, dB $L_{Ar,Tr}$	39	33
Background sound level, dB $L_{A90,T}$	44	44
Difference	-5	-11
Assessment	Minimal impact	Minimal impact

6.3.3 Emergency operation

As the design develops, the initial proposal for an external life safety generator may become redundant. If not, it is advised that an operational management plan is developed to only undertake routine testing or maintenance during the normal working daytime hours. This can be conditioned by LBRuT.

7. Assessment of terraces.

Two external terraces are proposed, one at floor Level 02 at the southwestern corner and the other at floor Level 03 on the southernmost façade. It is understood that the terraces will be primarily used as breakout spaces for the offices, where users can eat their lunch and socialise with colleagues, with conversations being the primary source of noise. It is understood that the terrace would not be used to host events or be in operation during the night (23:00 to 07:00 hours).

Due to the size of the terraces the number of workers expected to be using the terraces at any one time will be small. There will be no amplified music and it is expected that the hours of use will be limited.

The approach will be developed as the design progresses with the intent of protecting the amenity of the neighbouring residential properties. An operational management plan will be developed to reduce the impact of sound from the terraces on the nearest noise sensitive residences to a practicable minimum and will follow the principles of planning practice guidance. This may include limiting the hours of use of the terrace as part of a noise management plan within the operational management plan.

The need to control operational sound from the terraces can be addressed through a suitably worded planning condition imposed on the redevelopment.

8. Demolition and construction

At this stage of the proposed redevelopment of Avalon House there is insufficient information available to review and assess the demolitions and construction activities or identify potentially necessary mitigation provisions.

It is expected that submissions of a Noise and Vibration Demolition Method Statement (DMS) and a Construction Method Statement (CMS) incorporating provisions for minimisation of both noise and vibration will be required by LBRuT at a later stage by the use of planning conditions.

It is also expected that demolition and construction activities will not require out of normal hours working, although provision for emergency situations should not be constricted. The Considerate Constructors Scheme is expected to be followed by the successfully appointed demolition and construction organisations.

9. Summary and conclusion.

Hoare Lea LLP have carried out a noise impact assessment for the proposed redevelopment of Avalon House, Richmond, London. The assessment has covered the operation of new building services plant, external terraces used for breakout purposes and the demolition and construction activities,

Operational noise limits for buildings services plant have been proposed based on the guidance planning criteria of London Borough of Richmond upon Thames.

Background noise levels have been measured and established for the nearest noise sensitive residential receptors.

Initial selections and provisions for building services plant have been identified and assessed by calculation adopting the principles of BS 4142 at two representative nearest sensitive receptors in Tersha Street and Cedar Terrace. The results for the un-mitigated plant noise assessment indicated additional noise control would be necessary.

Additional noise control mitigation for building services has been proposed. The results from incorporation of the mitigation indicate the proposed design criteria and hence London Borough of Richmond upon Thames requirements can feasibly be satisfied as the design progresses.

External terraces are expected to be used for daytime breakout purposes only with no amplified music. Control of noise and operational hours can be conditioned by the London Borough of Richmond upon Thames.

Demolition and construction noise and vibration will be a managed process. It is the intention to submit a Noise and Vibration Demolition Method Statement (DMS) and Construction Method Statement (CMS) incorporating provisions for minimisation of both noise and vibration. This can be conditioned be the London Borough of Richmond upon Thames.

Appendix A: Acoustics terminology

Sound.
Sound is physically a regular and order oscillation of air molecules that travels away from a source of vibration and creates fluctuating positive and negative acoustic pressure. When acoustic pressure acts on any solid object it causes microscopic deflections in the surface so that it can manifest in both air and structure.

Noise.
Noise is subjectively sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcome to the receiver.

Sound pressure level.
Sound pressure level is stated on many of the charts herein. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Decibel (dB).
The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Octave and Third Octave Bands.
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

A-Weighting
The 'A' weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies. An 'A' weighted value would be written as dB(A).

Equivalent continuous sound pressure level.
The equivalent continuous sound pressure level (L_{eq}) is a parameter defined as the equivalent continuous sound pressure level. Over a defined time period 'T', it is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal. The $L_{eq,T}$ can be seen to be an "average" sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an 'A' weighted noise level in dB(A). It is commonly used to describe all types of environmental noise sources.

Frequency.
Frequency is a term that is regularly used. It is the number of acoustic pressure fluctuations per second (also know is the 'pitch' of a sound). Hertz (Hz) is the unit normally employed to measure the frequency of sound, equal to cycles per second of acoustic pressure fluctuations. The frequency limits of audibility of a healthy human ear are generally accepted as being from 20 Hz to 20,000 Hz.

Background Noise Level L_{90}.

The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined to other acoustic parameters. It is generally used to describe the prevailing background noise level or underlying noise level.

BS 4142 Rating Level $L_{Ar,T}$.

The Rating Level is a combined value incorporating the specific noise level generated by a process, activity or combination of events and feature corrections for the character or the sound. It is normally written as $L_{Ar,T}$ dB and is defined for a 1 hour period in the daytime and 15 minutes at night.

Appendix B: Noise measurements survey

Location and duration.

A tripod mounted sound level meter was positioned as shown in Figure AppB-1 and Figure AppB-2 below. Sound levels were measured in attendance on Thursday 9th May 2024 between approximately 11:45 and 13:45 hours. The position along Lower Mortlake Road (A316) was a façade measurement location for information purposes only and the position on Tersha Street was a free-field measurement location which has been used for planning assessment purposes. At both positions the microphone was approximately 1.5m above local ground level.

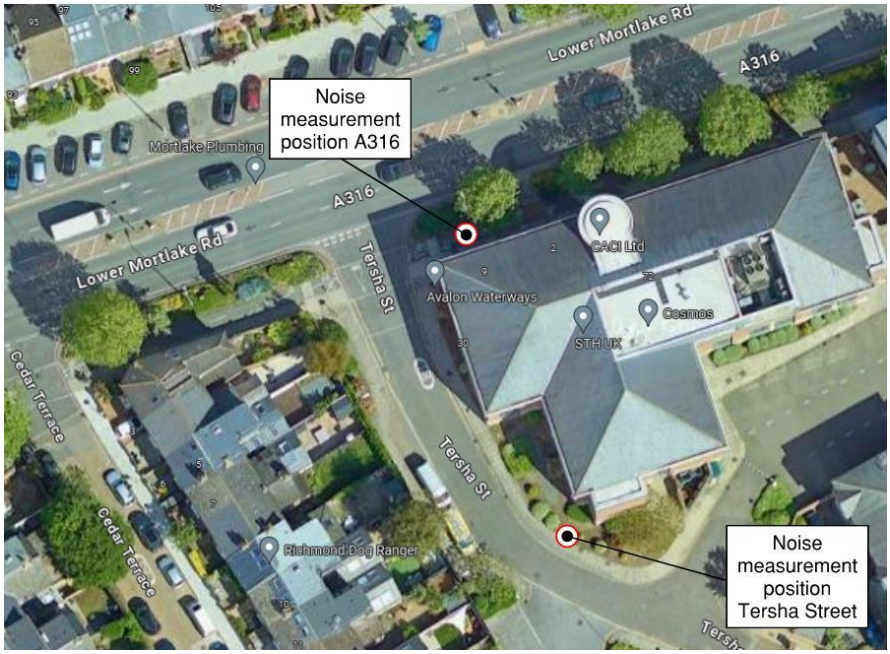

Figure AppB-1: Plan view of noise measurement positions (image source Google Maps).

Figure AppB-2: Photographic records.

Equipment used.

The sound level meter used was owned and operated by Hoare Lea LLP and is regularly calibrated by an accredited organisation externally and field calibrated upon set-up and collection. No significant drift in calibration was observed during the measurement period. The sound level meter system used is outlined in Table AppB-1 below

Table AppB-1: Measured equipment details.

Description	Manufacturer	Model	Serial number	Date of calibration
Sound Level Meter	Rion	NA-28	01260201	16/02/2024
Microphone	Rion	UC-59	00281	16/02/2024
Pre-amplifier	Rion	NH-23	60104	16/02/2024
Acoustic Calibrator	Rion	NC-74	34172704	04/08/2023

Weather.

The weather conditions during the measurements were dry, sunny and a light variable direction breeze.

Measured sound levels.

Table AppB-2 below provides a summary of the measured sound levels at both measurement positions.

Table AppB-2: Measured sound levels – daytime.

Measurement Start Time	Duration Minutes T	Ambient Sound Level dB $L_{Aeq,T}$	Background Sound Level dB $L_{A90,T}$
Tersha Street Position (free-field)			
11:45	15	57.7	49.4
12:00	15	57.4	49.7
12:16	15	57.8	48.8
12:31	15	57.2	48.9
12:47	15	57.0	49.0
Lower Martlake Road (A316) Position (façade)			
13:27	5	71.0	61.8
13:32	5	69.8	55.5
13:38	5	70.1	61.2

Appendix C: Plant noise assessment details

Table AppC-1 below provides the initial building services plant selection information and manufacturer's stated source sound power levels.

Table AppC-1: Source sound power levels.

Proposed Location	Type of MEP Plant	Notes	Sound Power Level L_{Aw} dB
First Floor, External	Tenant 1 - DX Condenser	2 Units (1 x duty, 1 x standby)	63 (per unit)
	Tenant 2 - DX Condenser	2 Units (1 x duty, 1 x standby)	63 (per unit)
	Tenant 3 - DX Condenser	2 Units (1 x duty, 1 x standby)	63 (per unit)
Ground Level, External	Life Safety Generator	Emergency use only	N/A*
Ground Floor, Internal	Air Handling Unit (AHU) Exhaust	Through louvre to external	85 (in duct)
	Air Handling Unit (AHU) Intake	Through louvre from external	74 (in duct)
	Air Handling Unit (AHU) breakout	Through louvres to external	80
Roof Level, External	Tenant 1 – DX Condenser	2 Units (2 x duty)	63 (per unit)
	Tenant 2 – DX Condenser	2 Units (2 x duty)	63 (per unit)
	Tenant 3 – DX Condenser	2 Units (2 x duty)	63 (per unit)
	Landlord – DX Condenser	1 Unit (1 x duty)	63 (per unit)
	Air Source Heat Pump (ASHP)	2 Units (2 x duty)	86 (per unit)
Roof Level, Covered	Air Handling Unit (AHU) Exhaust	Through grille/louvre to external	87 (in duct)
	Air Handling Unit (AHU) Intake	Through grille/louvre from external	73 (in duct)
	Air Handling Unit (AHU) breakout	Direct to external	78
* note that a noise emission limit is proposed as the plant item has not been selected.			

Table AppC-2 below provides the full assessment predicted building services plant contribution noise levels during the daytime for the proposed mitigated redevelopment.

Table AppC-2: Daytime mitigated assessment contributions and analysis.

Plant Location	Description	Tersha Street Contribution dB(A)	Cedar Terrace Contribution dB(A)
First Floor, External	Tenant 1 - DX Condenser	29	20
	Tenant 2 - DX Condenser	29	20
	Tenant 3 - DX Condenser	29	20
Ground Floor, Internal	AHU Exhaust	33	6
	AHU Intake	32	5
	AHU Breakout	36	9
Roof Level, External	Tenant 1 (1) - DX Condenser	18	19
	Tenant 1 (2) - DX Condenser	18	19
	Tenant 2 (1) - DX Condenser	18	19
	Tenant 2 (2) - DX Condenser	18	19
	Tenant 3 (1) - DX Condenser	18	19
	Tenant 3 (2) - DX Condenser	18	19
	Landlord (1) - DX Condenser	18	19
Roof Level, Covered	AHU Exhaust	22	26
	AHU Intake	20	21
	AHU Breakout	31	30
Roof Level, External	ASHP (1)	39	40
	ASHP (2)	39	40
BS 4142	Specific Noise Level ($L_{Aeq,T}$)	44	44
	Tonal correction	2	2
	Impulsive correction	0	0
	Intermittency correction	0	0
	Other sound characteristics	3	3
	Rating Level ($L_{Ar,T}$)	49	49
	Background sound level ($L_{A90,T}$)	49	49
	Impact Rating	0	0
	LBRuT SPD outcome	Low Impact	Low Impact

Table AppC-3 below provides the full assessment predicted building services plant contribution noise levels at night for the proposed mitigated redevelopment.

Table AppC-3: Night mitigated assessment contributions and analysis.

Plant Location	Description	Tersha Street Contribution dB(A)	Cedar Terrace Contribution dB(A)
First Floor, External	Tenant 1 - DX Condenser	28	19
	Tenant 2 - DX Condenser	28	19
	Tenant 3 - DX Condenser	28	19
Roof Level, External	Tenant 1 (1) - DX Condenser	17	18
	Tenant 1 (2) - DX Condenser	17	18
	Tenant 2 (1) - DX Condenser	17	18
	Tenant 2 (2) - DX Condenser	17	18
	Tenant 3 (1) - DX Condenser	17	18
	Tenant 3 (2) - DX Condenser	17	18
	Landlord (1) - DX Condenser	17	18
BS 4142	Specific Noise Level ($L_{Aeq,T}$)	34	28
	Tonal correction	2	2
	Impulsive correction	0	0
	Intermittency correction	0	0
	Other sound characteristics	3	3
	Rating Level ($L_{Ar,T}$)	39	33
	Background sound level ($L_{A90,T}$)	44	44
	Impact Rating	-5	-11
	LBRuT SPD outcome	Minimal Impact	Minimal Impact

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