




CLEAR

ACOUSTIC DESIGN

Report

DMS Watson Building
University College London

Environmental Noise Assessment

Document History

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Initial	Nathan Matthews	Stefan Hannan BSc (Hons) PGDip MIOA	28/03/2025
Revision 1			
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Revision 1	
Revision 2	
Revision 3	

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1.0 Introduction

1.1 Brief

Clear Acoustic Design has been appointed to carry out a noise impact assessment in relation to the proposed mechanical plant installation at DMS Watson Building, University College London, Gower Street, London, WC1E 6BT. Proposals are for the installation of an external roof-mounted chiller to replace existing chiller in the same location.

A noise impact assessment has been requested in order to safeguard the amenity of the surrounding noise sensitive receptors. The noise impact assessment is in line with BS 4142: 2014 + A1: 2019 *Methods for Rating and Assessing Industrial and Commercial Sound*. These criteria are seen to be appropriate in assessing and mitigating noise impact from this source.

1.2 Report Summary

The report will show that the noise level from the proposal is at least 10 dB below the existing background noise level. This is considered an acceptable outcome, in line with the local authority requirements and BS 4142: 2014 + A1: 2019. It is deemed that noise should not impact the decision outcome of the proposal.

1.3 Credentials

This report has been approved and issued by Stefan Hannan of Clear Acoustic Design. Stefan is a Company Director with 18 years of acoustic consulting experience. Stefan is also a full corporate member of the Institute of Acoustics (MIOA).

1.4 Glossary

A supporting glossary of acoustic terms can be found in Appendix C.

2.0 Legislative and Policy Framework

2.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local people and their council can produce their own distinctive local and neighbourhood plans. With explicit reference to noise, the NPPF states that "Planning policies and decisions should contribute to and enhance the natural and local environment by … preventing new and existing development from contributing to, being put at unacceptable risk from … noise pollution".

2.2 Noise Policy Statement for England (NPSE)

The NPPF refers to the Noise Policy Statement for England (NPSE), which applies to most forms of noise including environmental noise. The NPSE sets out the long-term vision of Government policy which is to "Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.". It aims that "Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- 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 use of the terms "significant adverse" and "adverse" are key phrases within the NPSE. The guidance establishes the concept of how the level of adverse effect on health and quality of life can be referenced including:

- 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.

- SOAEL – Significant Observed Adverse Effect Level - This is the level above which *significant adverse* effects on health and quality of life occur.

Under the first aim of the NPSE ("avoid significant adverse impacts on health and quality of life"), an impact in line with SOAEL should be avoided. Under the second aim ("mitigate and minimise adverse impacts on health and quality of life"), where the impact lies somewhere between LOAEL and SOAEL, requiring that all reasonable steps are taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, but does not mean that such adverse effects cannot occur.

2.3 Planning Practice Guidance on Noise (PPG-N)

The Planning Practice Guidance on Noise (PPG-N) is part of a suite of web-based guidance which is intended to support the implementation of the policies in the NPPF and the NPSE. It aids in expanding on the definitions form the NPSE of NOEL, LOAEL and SOAEL, by linking these terms to 'examples of outcomes', i.e. changes in behaviour and/or attitude to noise. The table below summarises the guidance from PPG-N in this regard.

Perception	Examples of outcomes	Increasing effect level	Action
NOEL - No Observed Effect Level [1]			
Not noticeable	No Effect	No Observed Adverse 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.		
LOAEL - 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 the 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
SOAEL - Significant Observed Adverse Effect Level			
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 a change in the 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 the 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
[1] This line is an assumption of the adverse effect level and is not explicitly referenced by PPG-N, though this appears to be a safe assumption.			

Table 2.1: Noise exposure hierarchy based on the likely average response – adapted from PPG-N

2.4 BS 4142: 2014 + A1: 2019

BS 4142: 2014 + A1: 2019 *Methods for Rating and Assessing Industrial and Commercial Sound,* also referred to as "BS 4142", is a method of assessing the noise impact of sources of industrial and/or commercial noise on sensitive receptors such as residential buildings. This is done by comparing the rating level of the industrial noise ($L_{A,rT}$) against the existing level of background noise (L_{A90}), depending on the context.

The background sound level is an underlying level of sound over a period, *T*, and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

BS 4142 uses the term 'low' to describe an acceptable impact of commercial/industrial noise at a receptor. This is typically applicable when the rating level does not exceed the existing background noise level.

The BS 4142: 2014 + A1: 2019 Technical Note, dated March 2020, produced by the Acoustic & Noise Consultants Working Group (ANC), looks to address any content regarded as ambiguous in the original standard by contextualising the information within it. It also states that, there are many instances in the application of BS 4142 where professional judgement is required and where a range of interpretations is possible.

2.5 Local Authority Requirements

Camden Council state that "Developments proposing plant, ventilation, air extraction or conditioning equipment and flues will need to provide the system's technical specifications to the Council accompanying any acoustic report. 'BS4142 Method for rating Industrial and Commercial Sound' contains guidance and standards which should also be considered within the acoustic report."

It is deemed that an assessment to BS 4142: 2014 + A1: 2019 *Methods for Rating and Assessing Industrial and Commercial Sound* is therefore appropriate for this proposal.

The Camden Local Plan details that the rating level from the proposed mechanical plant should not exceed a level that is 10 dB below the existing background noise level at the façade of the nearest noise sensitive receptor.

3.0 Environmental Noise Survey

3.1 Proposal

The proposal involves the installation of an external chiller which is to be located of the roof of the DMS Watson Building on the grounds of University College London (UCL).

Proposed plans of the location of the unit can be seen in Appendix B.

In order to meet the local authority's requirements, the noise level from the proposed chiller at the nearest receptors should not exceed the 10 dB below the existing background noise level.

3.2 Identification of Receptors

In order to assess the impact of the proposed noise source on the existing noise levels, an environmental noise survey has been undertaken by Clear Acoustic Design at a location representative of the nearest noise sensitive receptors.

The closest noise sensitive receptor to the proposed mechanical plant location is deemed to be the office/study rooms on the east side of the Darwin Building on the University College London grounds. Note that this building is part of UCL, but given the activities conducted here is considered a noise sensitive receptor. This receptor is approximately 10 metres from the proposed noise source. The nearest residential receptor is more than 45 metres from the proposal site, on Gower Street. These are student halls which belong to the university.

Due to distances and screening, compliance at the nearest receptor (Darwin Building), guarantee compliance at all other receptor locations.

The survey location which representative of this receptor is marked as R1 in figure 3.1 below. The residential halls are marked as R2.

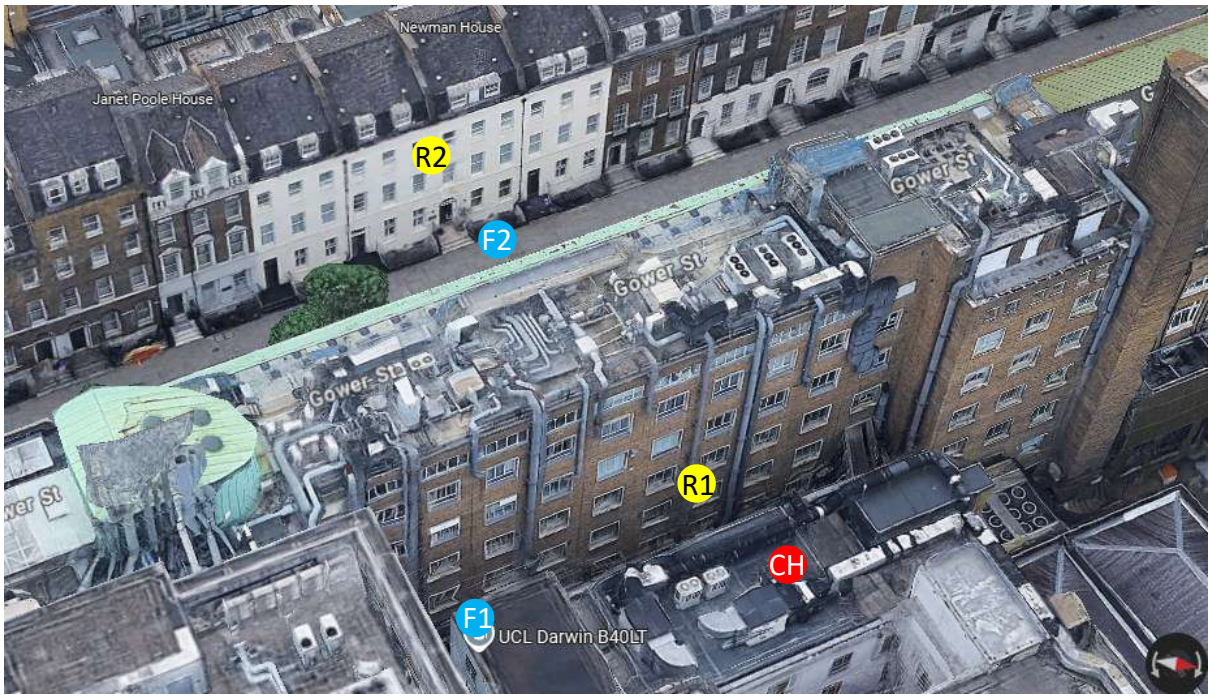


Figure 3.1 Aerial view of site with survey location (F1, F2), nearest receptor façades (R1, R2), and proposed chiller location (CH, red)

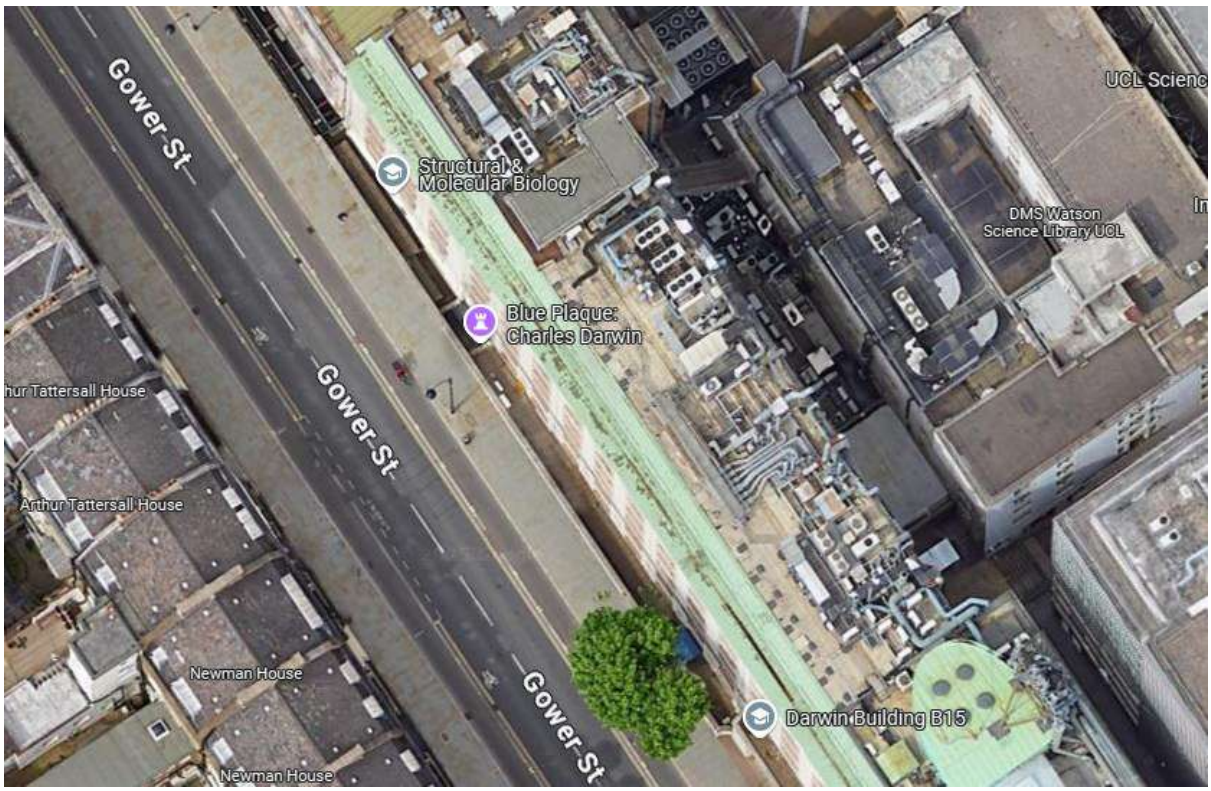


Figure 3.2 Aerial view of site facing north for context

3.3 Noise Monitoring Position and Methodology

Noise levels were measured between 18/03/25 and 19/03/25 using a single noise monitor, known as F1.

A sound level meter was attached to a tripod and positioned 2.5 metres above floor level on the roof of DMS Watson Building, at equidistant from existing roof-mounted plant. The sound level meter was at least 3.5 metres from any vertical reflective surfaces.

The unit that is to be replaced was understood to not be operational during the survey period.

This location is seen to be representative of the ambient and background noise levels at the identified noise sensitive receptor façade of R1.

Due to distances and screening, compliance at these receptors guarantees compliance at all other receptor locations.

For context, a further attended measurement was taken at F2, representative of the nearest residential receptor. This was taken at street level at the façade of the nearest residential receptor.

The acoustic environment at receptor R1 is predominantly existing mechanical plant noise from other roof mounted plant on DMS Watson Building and surrounding buildings. The dominant noise source at receptor R2 is road noise on Gower Street.

3.4 Measurement Equipment and Environmental Conditions

The weather was dry and overcast for the duration of the survey with a high temperature of 19°C during the day and a low of -2°C during the night.

Wind speeds were below 5m/s^{-1} for the duration of the noise surveying periods.

The conditions were seen to be good for conducting noise measurements.

The following noise measurement equipment as seen in table 3.3 was used for the survey.

Equipment	Serial Number	Calibration Date
B&K 2250 G4A Sound Level Meter	2449831	26/11/23
B&K 4189 Microphone	1837044	26/11/23
B&K VZ 0032 Preamplifier	17002	26/11/23

Table 3.3 Measuring Equipment Used for Survey

3.5 Fixed Noise Monitoring Graph – F1

Figure 3.4 below provides a graph of the measured noise levels at survey position F1. The ambient (L_{Aeq}) and background (L_{A90}) noise levels are shown.

Measurements were taken over 15-minute periods.

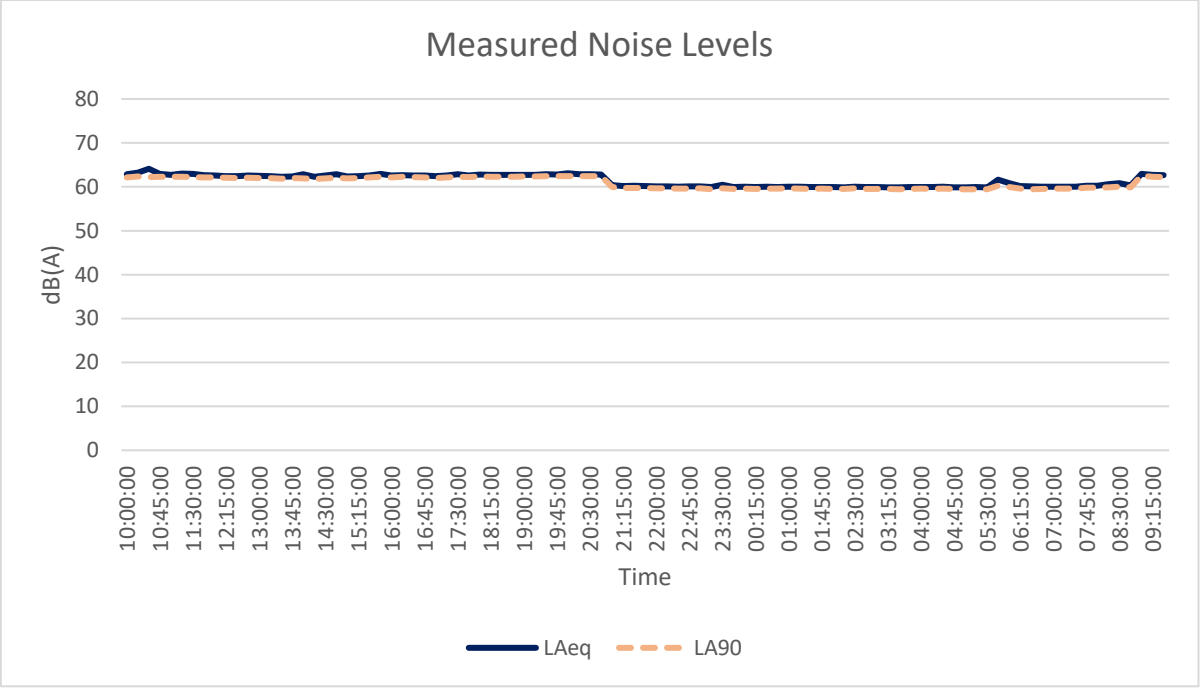


Figure 3.4 Long Term Measurement Graph – F1

3.6 Measured Noise Levels from Survey

To conduct an assessment in line with BS 4142, it is necessary to extrapolate the lowest typical representative background noise levels from the long-term survey data.

These background daytime and night-time noise levels are presented in table 3.4 below.

Receptor	Measurement Time Period	Assessment Background Noise Level, L_{A90}, dB
F1	Day (07:00-23:00)	62
	Night (23:00-07:00)	60
F2	Day (12:00-13:00)	55

Table 3.4 Survey Noise Levels – Receptor R1

The local authority requires a noise level that does not exceed 10 dB below the existing background noise level.

The noise level from the chiller unit should therefore not exceed 50 dB(A) at the nearest receptor.

4.0 BS 4142: 2014 + A1: 2019 Noise Impact Assessment

4.1 Noise Source - Daikin EWYT/EWAT/040CZN-A2

The proposed installation is of one Daikin EWYT/EWAT/040CZN-A2 chiller unit.

The sound pressure level of one Daikin EWYT/EWAT/040CZN-A2 unit at is presented in table 4.1 below.

The spectrum is based on the manufacturer's datasheet. The noise measurement is understood to be taken at 1.5 metres from the unit.

The unit will operate during the following times:

- Monday to Friday, 8:30 - 00:00
- Saturday to Sunday, 11:00 – 21:00

As the unit operates during a portion of the nighttime period, the proposed noise will be assessed against the existing background noise level during the night at the nearest receptor.

	Octave Band Frequency							
Noise Source	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	L_p, dB(A) at 1.5m
Daikin EWYT/EWAT/040CZN-A2	68.6	62.7	59.7	58.8	59.5	55.9	49.2	63

Table 4.1: Noise Source, Sound Pressure Level, dB

4.2 Rating Penalties

BS 4142: 2014 + A1: 2019 states that penalties can be applied to the rating level if acoustic features that increase the significance of the noise impact are present.

Rating penalties are determined based on tonality, impulsivity, and intermittency, depending on their distinguishability against the existing background noise level.

The unit's frequency spectrum is generally broadband in nature and is not deemed to be tonal.

The noise from the unit is not deemed to be readily distinguishable against the existing acoustic environment, as determined by the assessment outcome below.

Furthermore, the unit will generally operate without impulse or intermittency that would be perceivable at the receptor, given the existing acoustic environment.

Therefore, it does not incur any rating penalties in this assessment.

4.3 Source Directivity

Where the source is located at the junction of one surface, a source directivity correction of 3 dB has been added to the final calculation of the source, to account for a hemispherical propagation of the noise off the floor surface.

4.4 Screening Corrections

Where a receptor does not have a direct line of sight to a noise source behind at least a single noise barrier that has a surface density of at least 15kg/m^2, such as a close-board timber fence or masonry wall, a screening correction can be applied to the calculation.

The effectiveness of a barrier in reducing sound transmission between source and receiver is limited by diffraction of sound over the top and around the sides of the barrier or screening, which is determined by the size of the barrier compared with wavelength of the sound. The attenuation provided by the barrier (also known as the insertion loss) is the reduction in noise level at the receiver (receptor) arising from the noise source as a result of the presence of the barrier.

As a general rule, a barrier which removes the line of sight from the receptor to the noise source provides at least 10 dB of attenuation to the noise. This is in line with guidance from the Association of Noise Consultants (ANC). A building which removes the line of sight to the source generally provides at least 15 dB of attenuation.

Receptor R2 is screened from the unit by a building and so a correction of 15 dB has been applied to the final calculation.

4.5 Assessment Outcome at Nearest Receptor

Calculations have been undertaken to determine the noise level of the proposed Daikin unit at the nearest receptor in its proposed position.

Calculations show that when the mechanical plant is operational in its proposed location the rating level at the receptor R1 will be 50 dB(A).

The noise from the proposed unit is 10 dB below the existing background noise level during the nighttime period. In line with the guidance from BS 4142: 2014 + A1: 2019 and the local authority requirements, the noise from the proposal is therefore deemed to be acceptable.

The results are summarised in table 4.3 below. Supporting calculations can be seen in Appendix A.

Receptor	Assessment Background Noise Level, L_{A90}, dB	Target Rating Level (-10 dB), L_{A90}, dB	Rating Level at Receptor, $L_{Ar,Tr}$, dB	Difference between Rating Level and Background Noise Level, dB
R1	60	50	50	-10

Table 4.3: Results of Assessment to BS 4142 at nearest receptor

4.6 Assessment Outcome at Nearest Residential Receptor

Calculations have been undertaken to determine the noise level of the proposed Daikin unit at the nearest receptor in its proposed position. As determined above, the proposed unit's noise is already 10 dB below the background noise level at the nearest receptor. The calculation of the noise at the nearest residential receptor, however, is included for context.

Calculations show that when the mechanical plant is operational in its proposed location the rating level at receptor R2 will be 22 dB(A). This is 23 dB below the existing background noise level during the daytime at receptor R2.

BS 4142: 2014 + A1: 2019 states that rating levels of 35 dB(A) and below constitute a very low level of absolute noise. The calculated rating level at the nearest residential receptor is 13 dB below this threshold, and is therefore likely to be inaudible at the receptor.

In line with the guidance from BS 4142: 2014 + A1: 2019 and the local authority requirements, the noise from the proposal is therefore deemed to be acceptable at the nearest residential receptor.

The results are summarised in table 4.4 below. Supporting calculations can be seen in Appendix A.

Receptor	Rating Level at Receptor, $L_{Ar,Tr}$, dB	Difference between Rating Level and Background Noise Level (Daytime), dB	Difference between Rating Level and BS4142 'Low' Rating Level, dB
R2	22	-23	-13

Table 4.4 Results of Assessment to BS 4142 at nearest residential receptor

5.0 Conclusion

5.1 Summary

Clear Acoustic Design has been appointed to carry out a noise impact assessment in relation to the proposed mechanical plant installation at DMS Watson Building, University College London, Gower Street, London, WC1E 6BT. Proposals are for the installation of an external roof mounted chiller to replace existing chiller in the same location.

The noise survey has been conducted to obtain the existing background noise level at the nearest noise sensitive receptor.

BS 4142: 2014 + A1: 2019 states that a rating level that does not exceed the existing background noise level, or is 35 dB(A) or below, is considered to have a low noise impact to the receptor. This is typically deemed an acceptable outcome. The local authority requires a rating level that is 10 dB below the existing background noise level.

5.2 Outcome

Following the noise monitoring survey, calculations have been undertaken to determine the noise level of the proposed mechanical plant at the façade of the nearest receptor.

The noise level from the mechanical plant will not exceed a noise level of 10 dB(A) below the background noise level at the nearest noise sensitive receptors, as demonstrated in sections 4.5 and 4.6 of this report. The results are summarised within these sections and full calculations can be found in Appendix A.

In line with the guidance from BS 4142: 2014 + A1: 2019 and the local authority requirements, the noise from the proposal is therefore deemed to be acceptable at the nearest residential receptor. It is deemed that noise should not hinder the proposal outcome.

Appendix A – Calculations

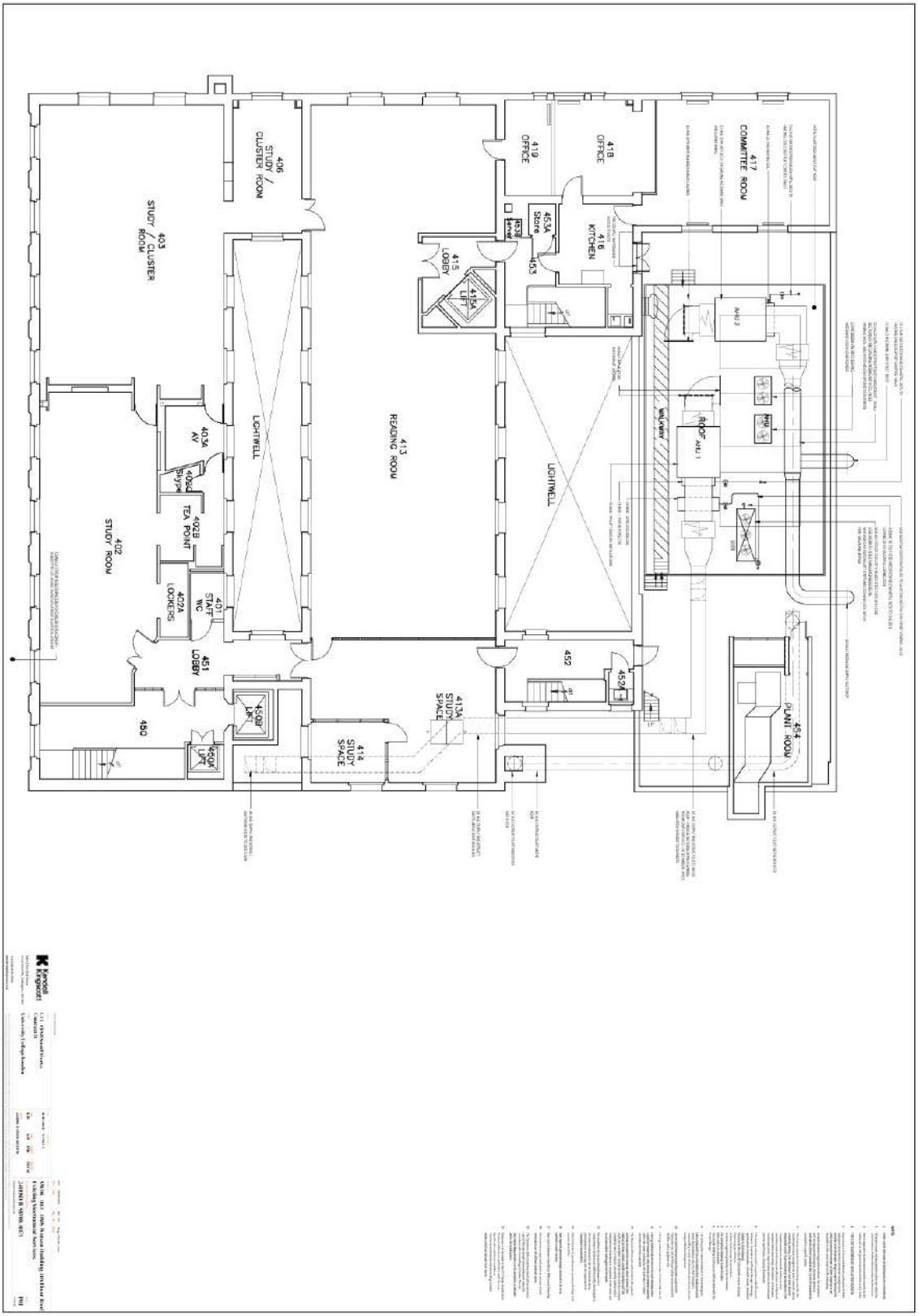
	Octave Band Centre Frequencies, Hz							
	63	125	250	500	1000	2000	4000	dB(A)
Lp from chiller at 1.5m	68.6	62.7	59.7	58.8	59.5	55.9	49.2	63
Distance measured at source (metres)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Source Directivity Correction, dB	3	3	3	3	3	3	3	
Louver / breakout losses	0	0	0	0	0	0	0	
Other losses (screening, etc)	0	0	0	0	0	0	0	
Distance to receptor (metres)	10	10	10	10	10	10	10	
Lp at Receptor	55	49	46	45	46	42	36	50

Figure 1: Calculated rating level at receptor R1

	Octave Band Centre Frequencies, Hz							
	63	125	250	500	1000	2000	4000	dB(A)
Lp from chiller at 1.5m	68.6	62.7	59.7	58.8	59.5	55.9	49.2	63
Distance measured at source (metres)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Source Directivity Correction, dB	3	3	3	3	3	3	3	
Louver / breakout losses	0	0	0	0	0	0	0	
Other losses (screening, etc)	15	15	15	15	15	15	15	
Distance to receptor (metres)	45	45	45	45	45	45	45	
Lp at Receptor	27	21	18	17	18	14	8	22

Figure 2: Calculated rating level at receptor R2

Appendix B – Site Plans



Appendix C – Glossary

Acoustic environment

Sound from all sound sources as modified by the environment.

Ambient sound

Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far. Note: the ambient sound comprises the residual sound and the specific sound when present.

Decibel (dB)

A relative unit for the measurement of sound. The dB is a logarithmic ratio between the measured level and a reference (threshold) level of 0dB.

dB(A)

The 'A' weighted sound pressure level, denoted as dB(A), is frequency filtering system which approximates under defined conditions the frequency response of the human ear. This weighting has been shown to correlate with a human's subjective response to noise.

Free field

The sound pressure level away from any reflecting surfaces. Measurements made 1.5m above the ground and at least 3m away from other reflecting surfaces are usually regarded as free field.

Hertz (Hz)

The frequency (or pitch) of a sound. 1 Hz = 1 cycle per second, 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.

$L_{Aeq,T}$ or 'ambient sound level'

The equivalent continuous sound level is a notional steady state level which over a quoted time period would have the same acoustic energy content as the actual fluctuating noise measured over that period. $L_{Aeq,16hour}$ (07:00 to 23:00 hours) and $L_{Aeq,8hour}$ (23:00 to 07:00 hours) are used to qualify daytime and night-time noise levels. Also known as the ambient noise level.

$L_{Ar,Tr}$ or 'rating level'

The 'rating level', as described in BS 4142: 2014 + A1: 2019 is the specific noise source plus any adjustment for the characteristic features of the sound.

L_{A90} or 'background noise level'

The A-weighted sound level which is exceed for 90% of the measurement period. i.e. The level exceeded for 54 minutes of a 1 hour measurement – used as a measure of the 'background noise level'.

Maekawa formula

A method for predicting the barrier attenuation arising from diffraction, developed by Maekawa, based on path difference.

Noise sensitive receptor or 'receptor'

In the context of noise, noise sensitive receptors are typically residential premises, but can also include schools, places of worship, offices, recreational areas and noise sensitive commercial premises, depending on the context of the proposal and noise source. The noise level at the receptor is typically calculated to 1 metre from the façade of the building, where a building is considered the most sensitive receptor.

Residual sound level

The ambient sound level when the specific sound is not operational.

Specific sound level

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval.

Specific sound source

The sound or noise source that is being assessed.

Sound pressure level (L_p)

A logarithmic measure of the effective pressure of a sound relative to a reference value, defined in dB (decibel). Sound pressure is the local deviation from the ambient air pressure caused by a sound wave. As the pressures to which the human ear responds can range from 20 μ Pa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where L_p = sound pressure level in dB; p = RMS sound pressure in Pa; and p_0 = reference sound pressure (20 μ Pa).

Sound power level (L_w)

The total sound energy radiated by a sound source. This is a property of the noise-emitting object itself and does not change depending on where you are in relation to said object.

Source directivity

A measure of the directional characteristic of a sound source. It is often expressed as a Directivity Index in decibels, or as a dimensionless value of Q. The directional characteristics of a sound source are highly influenced by nearby reflecting surfaces.