Cole Jarman

UCS Senior School, Hampstead – Sixth Form College

Plant Noise Assessment

Report 19/0278/R1

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UCS Hampstead

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Hampstead
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Plant Noise Assessment

1 Introduction

1.1 It is proposed to install a marquee at University College School (UCS) Senior School in Hampstead to temporarily replace existing classrooms during refurbishment works to the school. The marquee is to be installed between August 2020 to February 2021 and therefore requires planning permission.

1.2 As part of this, temporary plant is to be installed in order to heat the marquee when required throughout the duration of its installation.

1.3 This report contains full details of the noise survey, assessment methodology and required mitigation measures in order to meet the derived plant noise limits set for the site, in accordance with relevant local authority and national guidance.

2 Site Description

2.1 The proposed marquee location is shown within the site and its wider surroundings on the attached site plan 19/0278/SP1.

2.2 The marquee is to be on the northernmost existing tennis court, separate from the main school buildings, which are to the west.

2.3 To the east lies Ellerdale Road, a primarily residential road with dwellings and associated gardens that back onto the eastern boundary of the site. These dwellings are nearest to the site and are adjudged to be affected by noise from the installation.

2.4 It is proposed to install a single indirect fired oil heater at ground level to the west of the marquee and is to be fully screened using an acoustic barrier. The proposed location of the plant is also shown in attached site plan 19/0278/SP1.

3 Background Noise Survey

3.1 **Methodology & Instrumentation**

3.1.1 An unattended noise survey was undertaken at the site, commencing at 1200 hours on Wednesday 5th February, concluding at 1100 hours on Thursday 6th February 2020.

3.1.2 Measurements of background noise level were taken from a single free field position at approximately 3m above ground level at the top of the easternmost section of tennis court fencing. This position is described below and is illustrated in attached site plan 19/0278/SP1.

- MP1 – Free-field measurement position approximately 3m above local ground level at tennis court eastern boundary.

3.1.3 This position was selected to quantify background noise levels representative of the nearest noise sensitive receptors to the site, namely dwellings along Ellerdale Road.

3.1.4 Measurements of the L_{Aeq}, L_{Amax} and L_{A90} indices were recorded over consecutive 15-minute periods for the duration of the survey using the equipment listed within table T1 below (see attached Glossary of Acoustic Terms for an explanation of the noise units used).

Item	Manufacturer	Type
Sound Level Analyser	Norsonic	118
Acoustic Calibrator	Norsonic	1251
Weatherproof windshield	Norsonic	1212

T1 Equipment used during unattended noise survey.

3.1.5 The microphone was fitted with a weatherproof windshield, and the sound level meter was calibrated before and after the survey in order to confirm an acceptable level of accuracy. No significant drift was noted to have occurred.

3.1.6 The weather conditions when setting up the equipment and collecting the equipment were of clear skies with little wind and dry roads. These conditions are deemed acceptable and are not considered to have affected the measurement results.

3.2 Results

3.2.1 The results of the noise measurements are presented in attached time history graph 19/0278/TH1.

3.2.2 The noise climate perceived on site was dominated by noise from school children and intermittent, distant construction noise.

3.2.3 We have been informed that the unit is to operate between 0800-1800 on weekdays only. The measured representative background noise levels have been presented during this time and can be seen in table T2 below:

Location	Representative Background Noise Level, dB(A) Daytime (0800-1800)
MP1 – Eastern Boundary	43

T2 Measured representative background noise level, L_{A90}.

4 Mechanical Services Plant Noise Criteria

4.1 BS 4142:2014

4.1.1 British Standard 4142:2014 relates directly to installation of mechanical plant items. According to this standard, the rating level of the noise from items of plant is determined and compared to the existing background measured L_{A90} background noise level for that period. It states:

"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact."

4.1.2 It also notes that:

"A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context."

"A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context."

"Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

4.2 Planning Practice Guidance (PPG)

4.2.1 The Department for Communities and Local Government 'Planning Practice Guidance' (PPG) was published on 6 March 2014 and updated in July 2019.

4.2.2 The PPG on Noise expands upon the NPPF[1] and NPSE[2] and sets out more detailed guidance on noise assessment. Like the NPPF and NPSE, the guidance does not include any specific noise levels but sets out further principles that should underpin an assessment.

4.2.3 The PPG includes a section on noise, which states:

"*Plan-making and decision making need to take account of the acoustic environment and in doing so consider:*

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."

[1] National Planning Policy Framework
[2] Noise Policy Statement for England

4.2.4 It then refers to the NPSE and states that the aim is to identify where the overall effect of the noise exposure falls in relation to Significant Observed Adverse Effect Level [3] (SOAEL), the Lowest Observed Adverse Effect Level [4] (LOAEL) and the No Observed Effect Level [5] (NOEL).

4.2.5 The guidance then presents a table, which is reproduced as table T3 overleaf. The implication of the final line of the table is that only the 'noticeable and very disruptive' outcomes are unacceptable and should be prevented. All other outcomes (i.e. all other lines in the table) can be acceptable, depending upon the specific circumstances and factors such as the practicalities of mitigation.

[3] The level of noise exposure above which significant adverse effects on health and quality of life occur.
[4] The level of noise exposure above which adverse effects on health and quality of life can be detected.
[5] The level of noise exposure below which no effect at all on health or quality of life can be detected.

Response	Examples of Outcomes	Increasing effect level	Action
NOEL *(No Observed Effect Level)*			
Not present	No Effect	No Observed Effect	No specific measures required
NOAEL *(No Observed Adverse Effect Level)*			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
LOAEL *(Lowest Observable Adverse Effect Level)*			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL *(Significant Observed Adverse Effect Level)*			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

T3 Summary of Noise Exposure Hierarchy (from PPG)

4.3 Local Authority Criteria

4.3.1 The site falls under the jurisdiction of the London Borough of Camden.

4.3.2 Policy A4 of the London Borough of Camden's *Local Plan 2017* relates specifically to noise:

"We will only grant permissions for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity.

Planning conditions will be imposed to require that plant and equipment which may be a source of noise is kept working efficiently and within the required noise limits and time restrictions.

Conditions may also be imposed to ensure that attenuation measures are kept in place and are effective throughout the life of the development."

4.3.3 With regard to noise from new mechanical services plant, Appendix 3 of the *Local Plan also* sets out the following:

"A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014. 'Methods for rating and assessing industrial and commercial sound' (BS4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15 dB if tonal components are present) should be considered as the design criterion."

4.3.4 The Camden Local Plan Appendix 3 sets out a 'traffic light' system which provides noise limits and their associated impact:

- Green – where noise is considered to be at an acceptable level;
- Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development;
- Red – where noise is observed to have a significant adverse effect.

4.3.5 Under the section *'Industrial and Commercial Noise Sources'*, Table C provides the definitive limits and 'traffic light' categories and is replicated below:

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (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' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background

T4 Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery) of Camden Local Plan 2017
*10dB should be increased to 15dB if the noise contains audible tonal elements (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.
**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

4.4 Plant Noise Rating Levels

4.4.1 Based on the results of our background noise survey set out within table T2 in addition to the guidance above, the following derived values are set at the nearest noise sensitive premises, which are illustrated attached site plan 19/0278/SP1.

4.4.2 As the plant is temporary in nature, Camden's traffic light system has been followed, with the LOAEL targeted and the above the SOAEL being unacceptable – but taking into account merits of the project and context. This range is set out below:

Location	Noise Emission (Rating) Levels, dB	
	Daytime (0800-1800)	
	LOAEL	SOAEL
MP1 – Eastern Boundary	33	48

T5 Plant noise emission limits at the nearest residential properties, $L_{Ar,Tr}$.

4.4.3 Any limit is to apply to all plant items running simultaneously in the representative time periods, when running at design duty and are to apply free-field 1.5m above nearby gardens and façade-incident 1m from nearby residential windows. A 5dB penalty correction is to be added where plant is found to have a tonal component, in line with Camden's guidance.

5 Plant Noise Assessment

5.1 Proposed Installation

5.1.1 A single item of plant is proposed to be installed during refurbishment works in order to heat the proposed marquee, which is as follows:

- Indirect Fired Oil Heater H01: High Capacity Heater – Aurora FH185

5.1.2 The unit is to be installed to the west of the proposed marquee.

5.2 Methodology

5.2.1 Our assessment has used manufacturer's noise data for the oil heater unit. The noise data is only available in single figure and therefore it is not possible to identify tonal qualities the equipment may possess.

5.2.2 Research on typical noise from indirect oil-fired heaters such as that proposed indicates that the noise can be expected to be broadband and therefore requires no correction applied. Other units of the nature proposed were also found to emit similar noise levels to the proposed unit.

5.2.3 The nearest and most exposed noise sensitive receivers to the proposed plant installation are described below and illustrated on the attached site 19/0278/SP1 as assessment positions AP1 and AP2:

- AP1 – 1m inside garden boundary of 16 Ellerdale Road.
- AP2 – 1m from first floor rear window of 16 Ellerdale Road.

5.2.4 The noise levels generated by the proposed plant have been calculated by correcting the plant noise levels for distance and radiation losses, façade reflections and screening where appropriate.

5.3 Results

Without Mitigation

5.3.1 The calculated noise levels from the unit ***without mitigation*** are set out in the table below:

Location	Rating Level, dB(A) Daytime (0800-1800)
AP1 – Garden of 16 Ellerdale Road	57
AP2 – First floor window of 16 Ellerdale Road	56

T6 Calculated plant noise emission levels without mitigation at the assessment positions.

5.3.2 It is seen that without mitigation, the calculated noise levels exceed the SOAEL at both positions and therefore would be unacceptable.

Mitigation Options

5.3.3 This position is as far as practicable from the nearest residences and allows the unit to benefit the most from screening afforded by changes in the local ground level between the unit and the nearest residences.

5.3.4 Temporary screening has been selected as a mitigation option. It is therefore proposed for the unit to be surrounded with Heras fencing of 2m in height. The Heras fencing is to be fitted with a quilt acoustic barrier system to provide screening.

5.3.5 We have been informed that it is intended to install Sound Quilt Acoustic Barrier to the Heras fencing. It will be necessary to install two layers of the material with staggered seams in order to avoid holes and a reduced screening benefit. If two layers of the quilt is not practicable, then it is paramount to ensure that there are no holes or gaps between the sheeting.

5.3.6 Quieter equipment has been researched but no suitable alternatives have been found.

With Mitigation

5.3.7 The noise levels calculated ***with the proposed mitigation measures*** set out above are shown in table T7 below.

Location	Rating Level, dB(A) Daytime (0800-1800)
AP1 – Garden of 16 Ellerdale Road	41
AP2 – First floor window of 16 Ellerdale Road	40

T7 Calculated plant noise emission levels at the assessment positions.

5.3.8 The full calculation of results can be found in attached calculation sheets 19/0278/CS1-CS4.

Context

5.3.9 The noise levels are seen to be comfortably below the derived SOAEL level and are 2-3dB below the representative measured background noise level, which can be seen to sit within the "amber" category of Camden's traffic light system (where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development). These merits are discussed here:

5.3.10 The unit is to be temporary, operating between 0800-1800. This is important as any noise impact will be temporary, and could be included as part of the construction noise associated with the development.

5.3.11 As the unit is only providing heating to the marquee, it is expected to operate in colder weather, when local residences are more likely to have windows closed or spend prolonged periods in garden areas.

5.3.12 The noise levels calculated are below the representative background noise levels measured on site and so the unit is not expected to be the dominant noise source of the nearby noise climate when in operation.

Summary

5.3.13 Noise levels have been assessed to be in the amber range of Camden's traffic light system, where noise levels may be acceptable, when context is taken into account.

5.3.14 The above noise levels are considered acceptable when considering the temporary nature of the scheme, when the unit will be in use and the absolute noise levels expected from the installation.

6 Conclusions

6.1 It is proposed to install a marquee at University College School Senior School in Hampstead to temporarily replace existing classrooms during refurbishment works to the school. The marquee is to be installed for over one month and therefore requires planning permission.

6.2 Details of the unattended survey have been set out within this report, quantifying the existing background noise levels. A plant noise assessment has been undertaken assessing the impact of the proposed temporary plant to be installed on site.

6.3 With the proposed screening installed, noise from the proposed temporary plant will be lower than the existing background noise level and consistently and comfortably below SOAEL at the nearest, most exposed noise sensitive receptors.

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly, L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_n.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

End of Section

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Figure 19/0278/SP1

Title:

Site plan showing marquee site, surrounding area, measurement and assessment positions

North

Project:

UCS Senior School, Hampstead

Date:

February 2020

Revision:

-

Scale:

Not to scale

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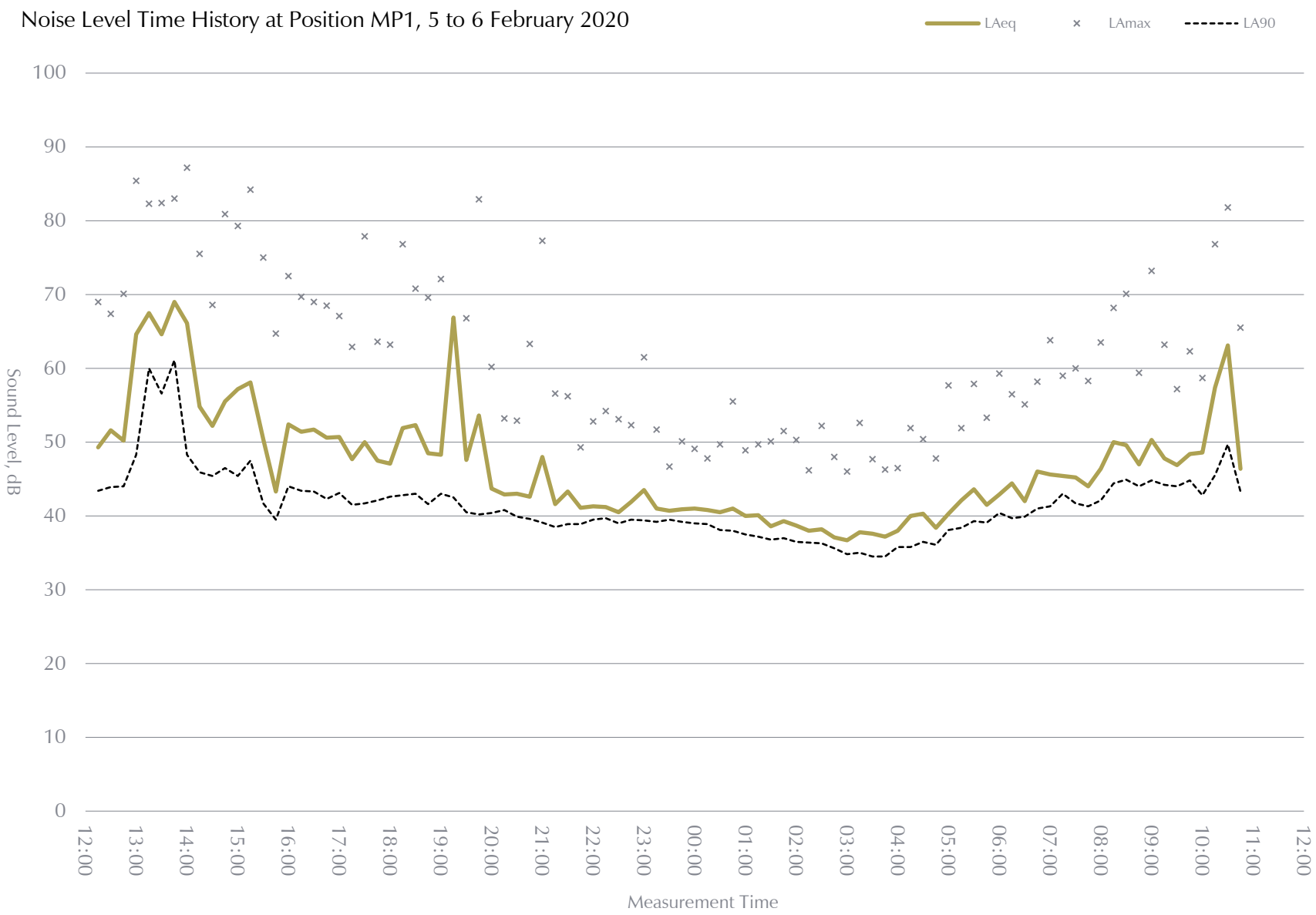


Figure 19/0278/TH01

Calculation Sheet 19/0278/CS1

Oil Heater to AP2

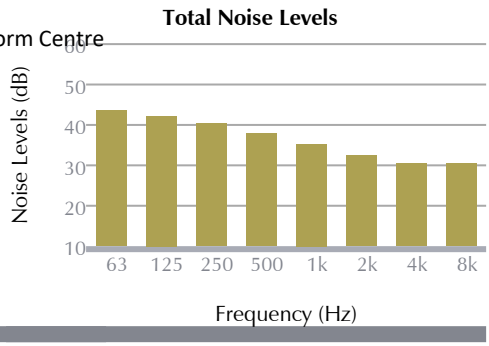
		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Noise Source									
Noise Source - Oil Heater									
Sound Pressure Levels @ 1m		**75.0**	**75.0**	**75.0**	**75.0**	**75.0**	**75.0**	**75.0**	**75.0**
Full Conformal Area									
Distance (m)	1.0								
Type - Semi-anechoic									
		16.6	*16.6*	*16.6*	*16.6*	*16.6*	*16.6*	*16.6*	*16.6*
Point Source Radiation Loss									
Radiation - Hemispherical									
Single Figure Read	8.0								
		-8.0	*-8.0*	*-8.0*	*-8.0*	*-8.0*	*-8.0*	*-8.0*	*-8.0*
Point Source Distance Loss									
Start Distance (m)	1.0								
End Distance (m)	72.5								
		-37.2	*-37.2*	*-37.2*	*-37.2*	*-37.2*	*-37.2*	*-37.2*	*-37.2*
Maekawa Screening Loss									
Path Difference (m)	0.2								
		-6.4	*-7.6*	*-9.3*	*-11.5*	*-14.0*	*-16.8*	*-19.7*	*-20.0*
Facade Reflection									
Reflection (dB)	2.5								
		2.5	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
External Receiver									
External Receiver - AP2									
Sound Pressure, Lp		**42.4**	**41.3**	**39.5**	**37.4**	**34.8**	**32.1**	**29.2**	**28.9**

Calculation Sheet 19/0278/CS2

Oil Heater to AP1

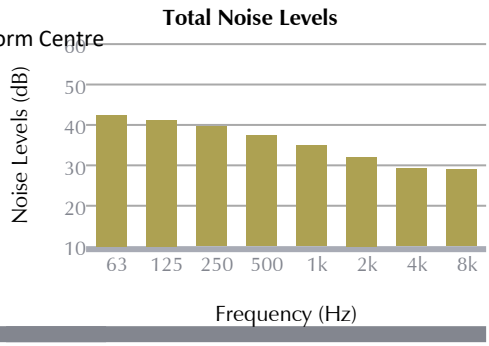
		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Noise Source									
Noise Source - Oil Heater									
Sound Pressure Levels @ 1m		**75.0**	**75.0**	**75.0**	**75.0**	**75.0**	**75.0**	**75.0**	**75.0**
Full Conformal Area									
Distance (m)	1.0								
Type - Semi-anechoic									
		16.6	*16.6*	*16.6*	*16.6*	*16.6*	*16.6*	*16.6*	*16.6*
Point Source Radiation Loss									
Radiation - Hemispherical									
Single Figure Read	8.0								
		-8.0	*-8.0*	*-8.0*	*-8.0*	*-8.0*	*-8.0*	*-8.0*	*-8.0*
Point Source Distance Loss									
Start Distance (m)	1.0								
End Distance (m)	45.5								
		-33.2	*-33.2*	*-33.2*	*-33.2*	*-33.2*	*-33.2*	*-33.2*	*-33.2*
Maekawa Screening Loss									
Path Difference (m)	0.3								
		-6.9	*-8.3*	*-10.2*	*-12.5*	*-15.1*	*-17.9*	*-20.0*	*-20.0*
External Receiver									
External Receiver - AP1									
Sound Pressure, Lp		**43.6**	**42.2**	**40.3**	**37.9**	**35.3**	**32.5**	**30.4**	**30.4**

Project Name	UCS Senior School, Hampstead - Sixth Form Centre
Project Reference	19/0278
Receiver Reference	AP1
Description	Resi Window
Noise Limit	48
dBA	41.1



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Oil Heater	43.6	42.2	40.3	37.9	35.3	32.5	30.4	30.4

Project Name	UCS Senior School, Hampstead - Sixth Form Centre
Project Reference	19/0278
Receiver Reference	AP2
Description	Resi Garden
Noise Limit	48
dBA	40.4



Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
Oil Heater	42.4	41.3	39.5	37.4	34.8	32.1	29.2	28.9

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