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TEACHING BLOCK,

PARLIAMENT HILL SCHOOL, HIGHGATE ROAD, CAMDEN

NOISE IMPACT ASSESSMENT

Report **10883-NIA-01 RevB**

Prepared on 25 January 2019

Issued For:

Farrans Construction
New Cambridge House
Bassingbourn Road
Litlington nr Royston
SG8 0SS

Contents

List of Attachments

1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Farrans Construction to measure existing background noise levels at Parliament Hill School, Highgate Road, Camden. The measured noise levels have been used to determine noise emission criteria for a proposed plant installation in agreement with the planning requirements of the London Borough of Camden.

This report presents the results of the environmental survey followed by noise impact calculations and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

Current proposals are to install various ventilation and air conditioning plant to service proposed teaching spaces over lower ground, ground and 1st floors in the Teaching Block.

External plant units will be located on the main roof of the Teaching Block, with other internally located units ducted to external facades.

The Teaching Block is located towards the south of the school site, close to residential receivers.

The closest window to the proposed plant location is at a minimum distance of 20 m from plant located terminating on the closest facade.

Locations are shown in attached site plans 10883-SP1A and 10883-SP1B.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Procedure

Measurements representative of receivers close to the Teaching Block were undertaken at one position as shown on indicative site drawing 10883-SP1A. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the site.

The microphone was mounted on the boundary of the site on a pole above the perimeter fence to the south of the site. The position was considered to be free-field according to guidance found in BS4142:2014, and a correction for reflections has therefore not been applied. Noise levels at the monitoring position were dominated by ongoing construction noise during the installation and collection of equipment. The survey duration was therefore chosen to ensure periods outside construction work hours were captured.

Continuous automated monitoring was undertaken for the duration of the survey between 15:00 on 2 October 2018 and 13:30 on 4 October 2018.

Weather conditions were generally dry with light winds, therefore suitable for the measurement of environmental noise.

The measurement procedure generally complied with BS 7445:1991: '*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*'.

3.2 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 977 Class 1 Sound Level Meter
- Norsonic Type 1251 Class 1 Calibrator

4.0 RESULTS

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured at the location shown in site drawing 10883-SP1A.

The measured noise levels are shown as a time history in Figure 10883-TH1, with ambient and background noise levels summarised in Table 4.1.

	Average ambient noise level $L_{eq: T}$	Minimum background noise level $L_{90: 5min}$
Daytime (07:00 - 23:00)	68 dB(A)	36 dB(A)
Night-time (23:00 - 07:00)	43 dB(A)	29 dB(A)
Typical School Hours[1] (08:00 - 17:00)	70 dB(A)	46 dB(A)

Table 4.1: Average ambient and minimum background noise levels

[1] Typical school hours were extended either side in order to ensure periods unaffected by ongoing construction noise were considered when setting noise emissions criteria.

5.0 NOISE CRITERIA

The London Borough of Camden general criteria for noise emissions are as follows:

> *"The 'A' weighted sound pressure level from the plant, when operating at its noisiest, shall not at any time exceed a value of 10 dB below the minimum external background noise, at a point 1 metre outside any window of any residential property."*

It is understood that the proposed plant units will be operational during typical school hours. We therefore propose to set the noise criteria at 36 dB(A), the value 10 dB below the minimum measured background noise level during the extended school hours, in the absence of construction noise.

6.0 PROPOSED PLANT INSTALLATION

Proposed plant units have been grouped according to the location of external units, or the duct termination of internal units. The locations of each group are indicated on attached site plan 10883-SP1B.

6.1 Plant Group 1

Plant Group 1 comprises two air handling units, servicing the sports hall and the toilets and changing rooms. The AHUs themselves are located externally, meaning the intake, discharge and casing breakout must be considered for each.

The manufacturer's specified noise emissions for Plant Group 1 units are as shown in Table 6.1.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Nuaire B822T/LN/CO-L AHU [Sports Hall]								
Supply Fan Intake	68	71	80	75	72	72	69	67
Extract Fan Exhaust	72	75	79	81	81	78	74	71
Casing Breakout	72	65	70	61	54	45	37	26
Nuaire B817V/LN/CO-L AHU [WCs and Changing Rooms]								
Supply Fan Intake	60	51	64	55	52	48	35	25
Extract Fan Exhaust	72	70	80	83	81	77	73	71
Casing Breakout	71	60	69	63	53	42	36	26

Table 6.1: Manufacturer's Sound Power Levels - Plant Group 1

The proposed plant location is on the main roof in a louvred housing, in the location shown on indicative site plan 10883-SP1B.

The plant location is approximately 25 m from the residential window, with direct line of sight assumed.

6.2 Plant Group 2

Plant Group 2 comprises 3 condenser units and the ducted termination of an extract fan. Noise must be considered from the externally located condenser units and the ducted exhaust of the extract fan.

The manufacturer's specified noise emissions for Plant Group 2 units are as shown in Table 6.2.

	Noise Emission Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Condenser Units – Stated Sound Pressure Levels at 1 m								
Mitsubishi Unit PURY-P600YSLM-A1	77	72	68	65	59	51	45	40
Mitsubishi Unit PUHZ-RP100-VKA	58	59	51	48	46	41	34	29
Daikin Unit EMRQ16AAY1	67	64	63	60	59	54	46	44
Extract Fan [Prep Room R218]								
Chemical Extract Fan VB14	Overall Sound Pressure Level 56 dB(A) @ 3 m							

Table 6.2: Manufacturers' Noise Emission Levels - Plant Group 2

The proposed plant location is on the main roof, in the location shown on indicative site plan 10883-SP1B.

The plant location is approximately 25 m from the residential window, with direct line of sight assumed.

6.3 Plant Group 3

Plant Group 3 comprises 4 identical MVHR units, each servicing an individual classroom. The units themselves are located internally, with exhaust and intake ducts to the external building facade at 1st floor level. Noise emissions from the exhaust and intake ducts will therefore be considered from each of the 4 MVHR units.

The manufacturer's specified noise emissions for Plant Group 3 units are as shown in Table 6.3.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Nuaire MVHR XBC 55 [4 Units in Group 3]								
Supply Fan Intake	66	59	60	48	49	46	38	26
Extract Fan Exhaust	71	66	69	56	57	56	51	48

Table 6.3: Manufacturer's Sound Power Levels - Plant Group 3

The proposed plant location is on the north facade of the Teaching Block, in the location shown on indicative site plan 10883-SP1B.

The plant location is approximately 28 m from the residential window, with a significant amount of screening provided by the Teaching Block building envelope.

6.4 Plant Group 4

Plant Group 4 comprises 3 identical MVHR units, each servicing an individual classroom. The units themselves are located internally, with exhaust and intake ducts to the external building facade at 1st floor level. Noise emissions from the exhaust and intake ducts will therefore be considered from each of the 3 MVHR units.

The manufacturer's specified noise emissions for Plant Group 4 units are as shown in Table 6.4.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Nuaire MVHR XBC 55 [3 Units in Group 4]								
Supply Fan Intake	66	59	60	48	49	46	38	26
Extract Fan Exhaust	71	66	69	56	57	56	51	48

Table 6.4: Manufacturer's Sound Power Levels - Plant Group 4

The proposed plant location is on the south facade of the Teaching Block, in the location shown on indicative site plan 10883-SP1B.

The plant location is approximately 20 m from the residential window, with direct line of sight assumed.

6.5 Plant Group 5

Plant Group 5 comprises 3 different MVHR units, each servicing an individual classroom. The units themselves are located internally, with exhaust and intake ducts to the external building facade at 1st floor level. Noise emissions from the exhaust and intake ducts will therefore be considered from each of the 3 MVHR units.

The manufacturer's specified noise emissions for Plant Group 5 units are as shown in Table 6.5.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Nuaire MVHR XBC 55 [1 Unit in Group 5]								
Supply Fan Intake	66	59	60	48	49	46	38	26
Extract Fan Exhaust	71	66	69	56	57	56	51	48
Nuaire MVHR XBC 65 [1 Unit in Group 5]								
Supply Fan Intake	64	64	57	51	49	44	33	0
Extract Fan Exhaust	70	70	64	60	57	54	46	40
Nuaire MVHR XBC 15 [1 Unit in Group 5]								
Supply Fan Intake	55	45	40	41	47	40	32	28
Extract Fan Exhaust	60	58	50	52	53	50	45	43

Table 6.5: Manufacturer's Sound Power Levels - Plant Group 5

The proposed plant location is on the south facade of the Teaching Block, in the location shown on indicative site plan 10883-SP1B.

The plant location is approximately 20 m from the residential window, with direct line of sight assumed.

7.0 PROPOSED MITIGATION

In order to demonstrate compliance with the set criterion shown in Section 3.0, certain mitigation measures will be required.

The required mitigation measures are discussed in the following sections. All mitigation measures should be installed in combination.

7.1 Acoustic Enclosure

An acoustic enclosure is required on each of the following units:

- Plant Group 2: Mitsubishi Unit PURY-P600YSLM-A11,
- Plant Group 2: Daikin Unit EMRQ16AAY1.

The two units can either be enclosed separately, or placed together in a single housing. The required spectral performance of the enclosure(s) is shown in Table 7.1.

	Required Attenuation (dB) in each Frequency Band							
Mitigation	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Louvred Enclosure	5	5	6	11	19	21	17	15

Table 7.1: Required Attenuation from Enclosure

7.2 Acoustic Screen

In addition to the enclosure detailed above, we would recommend introducing an acoustic barrier such that line of sight between Plant Group 2 Units (3 No. Condensers, 1 No. Extract Fan Termination) and residential receivers is completely blocked.

In order to maximise the attenuation provided by the surrounding screen, we would recommend the following advice is followed:

- The screen should completely block line of sight between Plant Group 2 units and residential windows,
- The screen should be formed of sufficiently dense material, minimum recommended density 20 kg/m^2.

- The barrier should be constructed from the structural surface of the main roof, with no gaps around the foot of the barrier,
- If constructed from panels, an airtight seal should be formed at all junctions,

7.3 Attenuator Schedule

Finally, we would recommend installing attenuators on the atmosphere site of certain ducted plant units.

The ducted plant units requiring attenuation are as follows:

- Sports Hall AHU: Intake and Exhaust,
- Changing Rooms AHU: Exhaust Only,
- All MVHR Units (Plant Groups 3, 4 and 5): Exhaust Only.

The required performance for each attenuator is shown in the Attenuator Schedule in Appendix C.

8.0 NOISE IMPACT ASSESSMENT

An assessment has been undertaken for the closest identified residential window, as shown in the site plan.

Taking into account all necessary acoustic corrections including corrections for distance, reflections and proposed mitigation, the resulting noise level at the modelled residential window would be as shown in Table 8.1. Cumulative calculations are shown in Appendix B.

Receiver	Operating Hours Criterion	Noise Level at Receiver [*due to plant installation*]
Residential Window	36 dB(A)	36 dB(A)

Table 8.1: Noise levels and criteria at receiver

As shown in Table 8.1 and Appendix B, the proposed plant installation would be expected to meet the set criterion, provided mitigation measures are installed as stated herein.

9.0 CONCLUSION

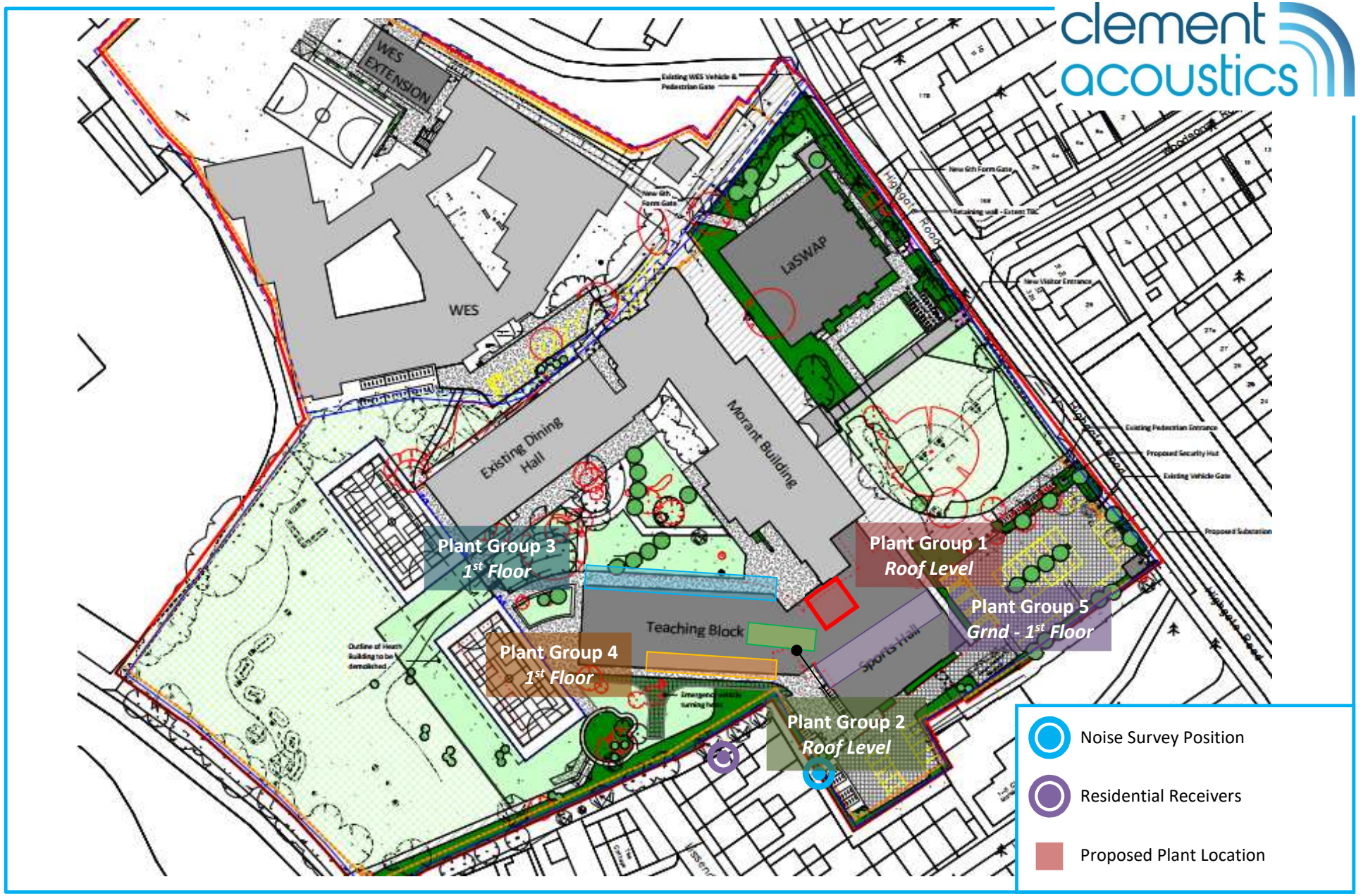
An noise impact assessment of proposed plant units has been undertaken for the Teaching Block at Parliament Hill School, Highgate Road, Camden. The results of a previously undertaken survey have enabled criteria to be set for noise emissions from the proposed plant in order to protect the amenity of nearby receivers.

A noise impact assessment has then been undertaken using manufacturer noise data to predict the noise levels due to the current proposal at nearby noise sensitive receivers.

Calculations show that noise emissions from the proposed plant units would meet the set requirements provided certain mitigation measures are installed.

Report by	Checked by
Duncan Martin MIOA	**John Smethurst MIOA**

10883-SP1A Indicative site plan indicating noise monitoring position and nearest noise sensitive receiver **Date:** 25 January 2019

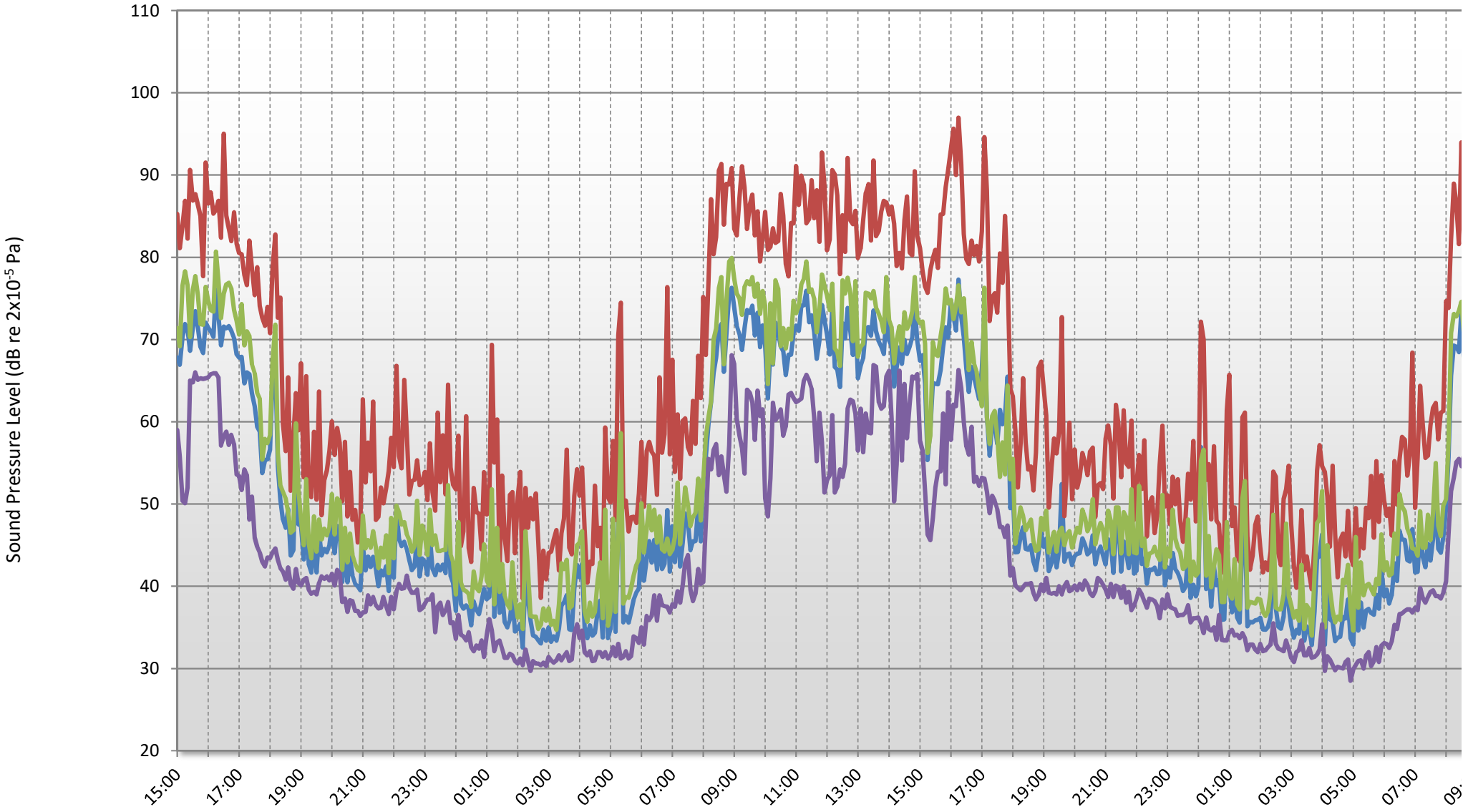


10883-SP1B Indicative site plan indicating proposed plant layout

Date: 25 January 2019

Parliament Hill School, Highgate Road, Camden

Environmental Noise Time History
2 October to 4 October 2018



APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B

10883

Parliament Hill School - Teaching Block

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Nearest Residential Receiver
Source: Proposed plant installation

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Calculated Receiver Noise Levels with Proposed Mitigation									
Group 1 - Sports AHU Supply	22	25	29	17	10	12	16	21	25
Group 1 - Sports AHU Discharge	26	29	28	23	19	18	21	25	29
Group 1 - Changing Rooms AHU Supply	18	14	30	23	21	18	5	-5	27
Group 1 - Changing Rooms AHU Discharge	25	22	25	18	13	11	16	23	25
Group 2 - Mitsubishi Unit PURY-P600YSLM-A11	42	37	32	24	10	0	0	0	27
Group 2 - Mitsubishi Unit PUHZ-RP100-VKA	28	29	21	18	16	11	4	-1	21
Group 2 - Daikin Unit EMRQ16AAY1	32	29	27	19	10	3	0	0	22
Group 2 - Chemical Extract Fan VB14	43	35	32	13	11	11	13	12	26
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 4 - Nuaire MVHR XBC 55 Extract	23	22	26	7	4	4	3	2	18
Group 4 - Nuaire MVHR XBC 55 Supply	20	19	26	14	13	8	0	0	20
Group 4 - Nuaire MVHR XBC 55 Extract	23	22	26	7	4	4	3	2	18
Group 4 - Nuaire MVHR XBC 55 Supply	20	19	26	14	13	8	0	0	20
Group 4 - Nuaire MVHR XBC 55 Extract	23	22	26	7	4	4	3	2	18
Group 4 - Nuaire MVHR XBC 55 Supply	20	19	26	14	13	8	0	0	20
Group 5 - Nuaire MVHR XBC 55 Extract	25	24	26	8	6	7	6	5	19
Group 5 - Nuaire MVHR XBC 55 Supply	22	21	26	15	15	11	3	0	21
Group 5 - Nuaire MVHR XBC 65 Extract	24	28	21	12	6	5	1	0	17
Group 5 - Nuaire MVHR XBC 65 Supply	20	26	23	18	15	9	0	0	21
Group 5 - Nuaire MVHR XBC 15 Extract	14	16	7	4	2	1	0	0	9
Group 5 - Nuaire MVHR XBC 15 Supply	11	7	6	8	13	5	0	0	15
Sound pressure level at receiver	**46**	**41**	**40**	**31**	**27**	**24**	**24**	**28**	**36**

Design Criterion	**36**

BS 8233 ASSESSMENT CALCULATION

Receiver: Inside Nearest Residential Window
Source: Proposed plant installation

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound pressure level outside window	46	41	40	31	27	24	24	28	36
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**31**	**26**	**25**	**16**	**12**	**9**	**9**	**13**	**21**

Design Criterion	**30**

10883: Parliament Hill
APPENDIX C: ATTENUATOR SCHEDULE

Revision: 0	Date: 21/09/2017	Comments: None											
Attenuator Ref.	Description	No. Of	Dimensions (mm)			Max Pressure Drop Pa	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
			W	H	L		63	125	250	500	1k	2k	4k	8k
01	Sports AHU – Supply (Atmospheric Side)	1	Sized to not exceed maximum pressure drop		1200*	60	4	9	17	26	31	30	23	16
02	Sports AHU – Discharge (Atmospheric Side)	1	Sized to not exceed maximum pressure drop		1200*	60	4	9	17	26	31	30	23	16
03	Changing Rooms AHU – Extract (Atmospheric Side)	1	Sized to not exceed maximum pressure drop		1500*	60	5	11	21	33	37	36	27	18
04-13	Atmospheric Extract Connection for All MVHR Units	10	Sized to not exceed maximum pressure drop		900*	60	2	4	9	15	17	14	10	8

*Indicative Lengths