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EXTERNAL CONDENSER UNIT ACOUSTIC ASSESSMENT REPORT

Project: 1 Rosebery Avenue, London EC1

Client: Liza Wong

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Our reference: 90079

Revision: 0

1. INTRODUCTION

1.1 A noise survey has been carried out adjacent to the commercial/office property at 1 Rosebery Avenue, London, EC1. The noise survey and assessment report is required to accompany a retrospective Planning Application for the installation of air conditioning equipment on the rear facades at the property. A total of 8 external condenser units have been installed which are located on the rear walls of the property. Seven of the units are located across the lower areas of the south façade of the property. There is also a single unit located on the west façade. No. 1 Rosebery Avenue are commercial premises at ground and lower ground level with residential apartments on the floors above. As the air conditioning units serve commercial/office premises they are only required to operate during normal office hours (allowing for over-run assumed to be 7am to 7pm), on week-days, and this forms the basis of the noise assessment. There are residential properties <u>above</u> in No.1 Rosebery Avenue and the nearest neighbouring areas for assessment purposes are the rear windows of these properties. The south façade of No.1 Rosebery Avenue faces the playground area of Christopher Hatton Primary School. The playground itself is shielded from many of the units by the existing boundary wall and fence. The noise impact of the condenser units on the playground area is also considered.

1.2 In initial site inspection and review of noise data indicated that the existing installation would not completely satisfy the requirements of London Borough of Camden (LBC) Environmental Noise Policy due to their proximity and configuration with respect to neighbouring residential windows etc. In this report a revised layout is proposed such that the proposed installation does meet with the requirements of the (LBC) Environmental Noise Policy. In addition to the relocation of the installed units, additional noise attenuation measures in the form of acoustic hoods are to be incorporated.

1.3 The site location and surroundings are given in Figure 1 below:

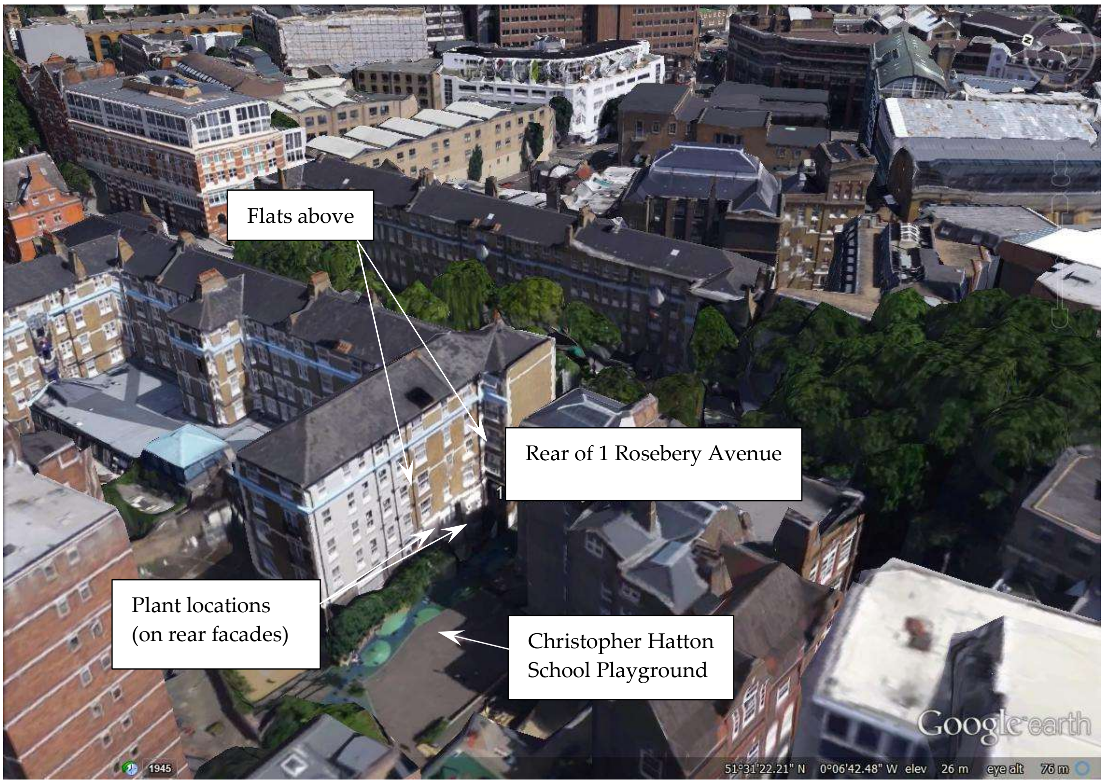

Figure 1: Site Location (© Google Maps)

2.0 NOISE MEASUREMENTS

2.1 Environmental noise measurements were carried out from Tuesday 21st to Tuesday 28th July 2020. Sound level measurement equipment was installed at the rear of the property (near to the closest neighbouring windows) and used to log noise levels over the seven-day period. The measurement equipment is listed below in Table 1.0.

Table 1.0 Environmental Noise Measurement Instrumentation

No.	Description
1.	Larson Davis Model 812 Sound Level Meter.
1.	Larson Davis Model 2541 1/2" Diameter Condenser Microphone.
2.	Larson Davis Model CAL200 Sound Level Meter Calibrator.

2.2 All acoustic equipment conforms to the relevant parts of BS EN 60651:1994 (equivalent to BS 5969:1981) for the requirements of Type 1 acoustic accuracy. Additionally, the relevant equipment conforms to the specifications contained within BS EN 60804:1994 (equivalent to BS 6698:1976) for integrating sound level meters.

2.3 In order to verify the correct operation of the equipment on site, an acoustic calibrator was applied during the course of the measurements. A maximum change of 0.1 dB(A) was noted, this can be considered as an insignificant change. The calibrator complies with the specifications of IEC 942:2003. The noise measurement equipment was previously laboratory calibrated in January 2020.

2.4 Fast meter response was used for all measurements carried out during the course of the survey.

2.5 Noise levels are expressed in terms of continuous equivalent noise levels (L_{Aeq}) over an appropriate time period. The use of L_{Aeq} allows non-steady and non-continuous noise to be assessed and compared to the existing noise climate. L_{Aeq} is referred to as the ambient noise level. In addition to this background noise levels have also been measured and are expressed as L_{A90}. A full explanation of terminology commonly used in the measurement and assessment of noise levels is given in Appendix B at the end of this report.

3.0 RESULTS

3.1 Noise level measurements were carried out at 15-minute intervals during the survey period. Ambient (L_{Aeq}) and background (L_{A90}) noise levels were measured. Minimum noise levels for the day-time (07:00 to 19:00 hrs), evening time period (19:00 to 23:00 hrs) and night time period (23:00 to 07:00 hrs) have been determined.

Table 2: Summary Results

	Day	Evening	Night
L_{A90}	49.4(44.0)*	47.1	42.9
L_{Aeq}	54.9	52.1	47.6

*Note: The lowest day time background noise level measured during the survey period was 44.0 dB(A) and occurred at 6pm on Wednesday 22nd July 2020.

3.2 Although the survey was not attended on a full time basis, it was noted that during site visits that the area at the rear of 1 Rosebery Avenue is dominated by noise from passing traffic. A full listing of 15-minute interval data for the period is given in the graph at the end of this report (Figure A1). A photograph showing the noise monitor in position close to the south façade of No.1 Rosebery Avenue is shown in Figure A2.

3.3 Noise level data for the installed units are given as 54 dB(A), 55 dB(A) and 45dB(A) respectively in heating mode when measured at 1m (See attached data sheets shown in Figure A.3 Mitsubishi PUHZ-P100VHA4, MUZ-GF60VE & MSZ-SF25VE).

3.4 The nearest neighbouring areas for assessment are (a) the rear windows of the neighbouring first floor flats above in No.1 Rosebery Avenue and (b) the school playground adjacent to the south facade. The existing installation on the south facade is shown A4 with the proposed revised layout in Figure A5. To provide further noise reduction, all but one of the units will be fitted with an acoustic hood[1] which will shield these units from neighbouring windows above. Calculated noise levels for the proposed installation/layout are as follows:

Unit 1: Revised Location with Acoustic Hood

Unit 1			63	125	250	500	1k	2k	4k	8k	A
1. Mitsubishi MUZGF25VE											
1.1	SPL at 1m		51	45	45	42	41	37	29	18	
A-weighting			-26	-16	-9	-3	0	1	1	-1	
SPL dBA			25	29	36	39	41	38	30	17	45
Barrier		0.1	-7	-8	-9	-10	-11	-12	-14	-14	

[1] The proposed acoustic hoods would be formed from timber panel, approximately 25mm thick, which is fitted over and fixed to the wall of No.1 Rosebery Avenue.

Reflection from walls		3	3	3	3	2	2	1	1	
Distance Correction	7m	-17	-17	-17	-17	-17	-17	-17	-17	
SPL at Window		**4**	**7**	**13**	**15**	**15**	**11**	**0**	**-13**	**20**

Units 2 & 3: Revised Location with Acoustic Hoods

Units 2 & 3			63	125	250	500	1k	2k	4k	8k	A
2. Mitusbishi PUHZP100VHA4											
2.1	SPL at 1m		57	56	55	49	50	45	42	32	
3. Mitusbishi MUZGF60VE											
3.1	SPL at 1m		55	61	56	52	50	47	39	32	
	Total		59	62	59	54	53	49	44	35	
A-weighting			-26	-16	-9	-3	0	1	1	-1	
SPL dBA			33	46	50	51	53	50	45	34	58
Barrier		0.1	-7	-8	-9	-10	-11	-12	-14	-14	
Reflection from walls			3	3	3	3	2	2	1	1	
Distance Correction		7m	-17	-17	-17	-17	-17	-17	-17	-17	
SPL at Window			**12**	**24**	**27**	**27**	**27**	**23**	**15**	**4**	**33**

Unit 4 & 5: Revised Location with Acoustic Hoods

Units 4 & 5			63	125	250	500	1k	2k	4k	8k	A
4. Mitusbishi PUHZP100VHA4											
4.1	SPL at 1m		57	56	55	49	50	45	42	32	
5. Mitusbishi MUZGF50VE											
5.1	SPL at 1m		50	56	51	47	45	42	34	27	
	Total		58	59	56	51	51	47	43	33	
A-weighting			-26	-16	-9	-3	0	1	1	-1	
SPL dBA			32	43	47	48	51	48	44	32	56
Barrier		0.1	-7	-8	-9	-10	-11	-12	-14	-14	
Reflection from walls			3	3	3	3	2	2	1	1	
Distance Correction		7m	-17	-17	-17	-17	-17	-17	-17	-17	
SPL at Window			**11**	**21**	**25**	**24**	**25**	**21**	**14**	**2**	**31**

Unit 6: Revised Location with Acoustic Hood

Unit 6			63	125	250	500	1k	2k	4k	8k	A
6. Mitusbishi MUZGF60VE											
6.1	SPL at 1m		55	61	56	52	50	47	39	32	
	Total		55	61	56	52	50	47	39	32	
A-weighting			-26	-16	-9	-3	0	1	1	-1	
SPL dBA			29	45	47	49	50	48	40	31	55
Barrier		0.1	-7	-8	-9	-10	-11	-12	-14	-14	

Reflection from walls		3	3	3	3	2	2	1	1	
Distance Correction	6m	-16	-16	-16	-16	-16	-16	-16	-16	
SPL at Window		**9**	**24**	**25**	**26**	**25**	**22**	**11**	**2**	**32**

Unit 7 & 8: Revised Location with Acoustic Hoods

Units 7 & 8			63	125	250	500	1k	2k	4k	8k	A
7. Mitsubishi PUHZP100VHA4											
7.1	SPL at 1m		57	56	55	49	50	45	42	32	
8. Mitusbishi MUZGF60VE											
8.1	SPL at 1m		55	61	56	52	50	47	39	32	
	Total		59	62	59	54	53	49	44	35	
A-weighting			-26	-16	-9	-3	0	1	1	-1	
SPL dBA			33	46	50	51	53	50	45	34	58
Barrier		0.1	-7	-8	-9	-10	-11	-12	-14	-14	
Reflection from walls			3	3	3	3	2	2	1	1	
Distance Correction		6m	-16	-16	-16	-16	-16	-16	-16	-16	
SPL at Window			**14**	**26**	**28**	**28**	**28**	**25**	**16**	**5**	**34**

3.5 Furthermore, as the condenser units are now to be located at lower level, the screening and acoustic barrier effect associated with the existing retaining wall will be greater and as such will provide additional screening (both acoustic and visual). Noise levels associated with the operation of the newly positioned condenser units will be as follows:

Christopher Hatton Primary School Playground

Units 7 & 8			63	125	250	500	1k	2k	4k	8k	A
7. Mitsubishi PUHZP100VHA4											
7.1	SPL at 1m		57	56	55	49	50	45	42	32	
8. Mitusbishi MUZGF60VE											
7.1	SPL at 1m		55	61	56	52	50	47	39	32	
	Total		59	62	59	54	53	49	44	35	
A-weighting			-26	-16	-9	-3	0	1	1	-1	
SPL dBA			33	46	50	51	53	50	45	34	58
Barrier		0.3	-9	-10	-12	-14	-16	-18	-18	-18	
Reflection from walls			3	3	3	3	2	2	1	1	
Distance Correction		4.5m	-13	-13	-13	-13	-13	-13	-13	-13	
SPL in Playground			**14**	**26**	**27**	**27**	**26**	**21**	**15**	**4**	**33**

3.6 The London Borough of Camden Local Plan (Adopted Version) Policy A4 "Noise and Vibration" states that *"The Council will seek to ensure that noise and vibration is controlled and managed"*. Furthermore, the policy states that *"Developments should have regard to Camden's Noise and Vibration Thresholds (Appendix 3)"*. Appendix 3; Table C "Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)" is listed below. In Table C;

- NOEL refers to "No Observed Effect Level"
- LOAEL refers to "Lowest Observed Adverse Effect Level"
- SOAEL refers to "Significant Observed Adverse Effect Level"

Each of these terms are described in greater detail in the National Planning Policy Framework and Planning Practice Guidance"

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 9 dB below and 5 dB above background	"Rating level" greater than 5 dB above background
Dwellings	Outside bedroom window (façade)	Night	"Rating level" 10dB* below background and no events	"Rating level" between 9 dB below and 5 dB above	"Rating level" greater than 5 dB above background and/or

		exceeding 57 dB L_{Amax}	background or noise events between 57 dB and 88 dB L_{Amax}	events exceeding 88 dB L_{Amax}

** 10 dB should be increased to 15 dB if the noise contains audible tonal elements (day or night) …*

3.7 The proposed air conditioning equipment does not attract the + 5 dB(A) correction referred to in *"paragraph 8 of BS4142"* (i.e. contains no distinguishable discrete continuous note or distinct impulses). For unrestricted day-time operation (i.e. 7am to 7pm weekdays), the lowest background noise level measured was 44.0 dB(A) and it therefore follows that the criterion to meet is 34.0 dB(A)[2].

3.8 Examination of the results shown in paragraphs 3.4 and 3.5 above confirms that the relocated condenser units can now be operated during day-time hours and meet with the specific requirements of LBC Environmental Noise Policy.

4.0 CONCLUSION

4.1 A noise measurement survey and assessment has been carried out on the external air conditioning condensing plant installed on the rear walls of the commercial property at 1 Rosebery Avenue, London, EC1.

[2] These levels being below the LOAEL as referred to in Appendix 3: Noise Thresholds of Camden Policy A4 and as such fall into the "Green" category *where noise is considered to be an acceptable level.*

4.2 By relocating the installed external air conditioning condenser units and applying additional noise control measures, the installation is shown to meet with the London Borough of Camden's acoustic criteria.

APPENDIX A: GRAPHS AND FIGURES.

Figure A1: Environmental Noise Measurement Data – 21st to 28th July 2020

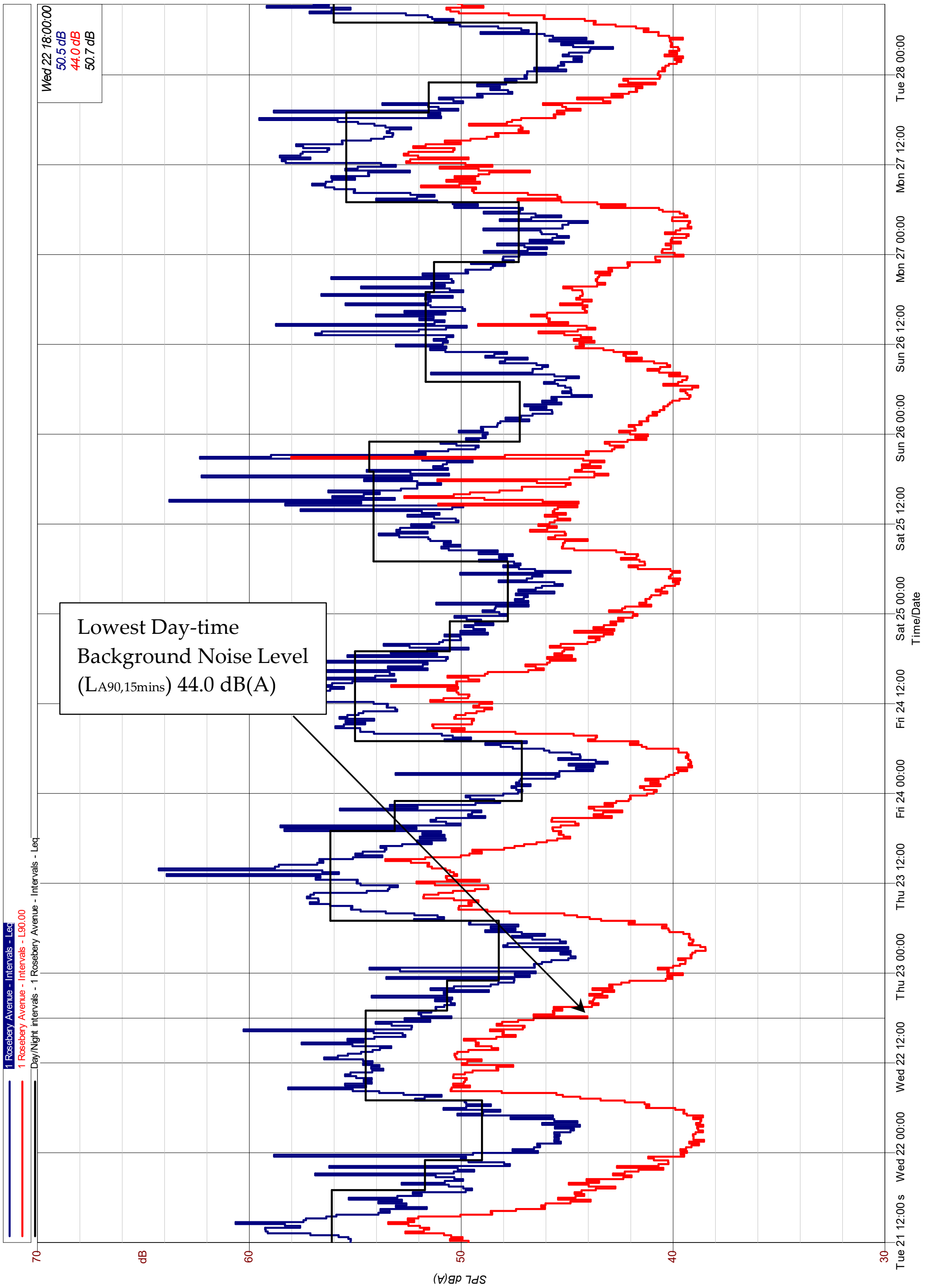

Figure A2: Noise Monitoring Equipment at rear of 1 Rosebery Avenue

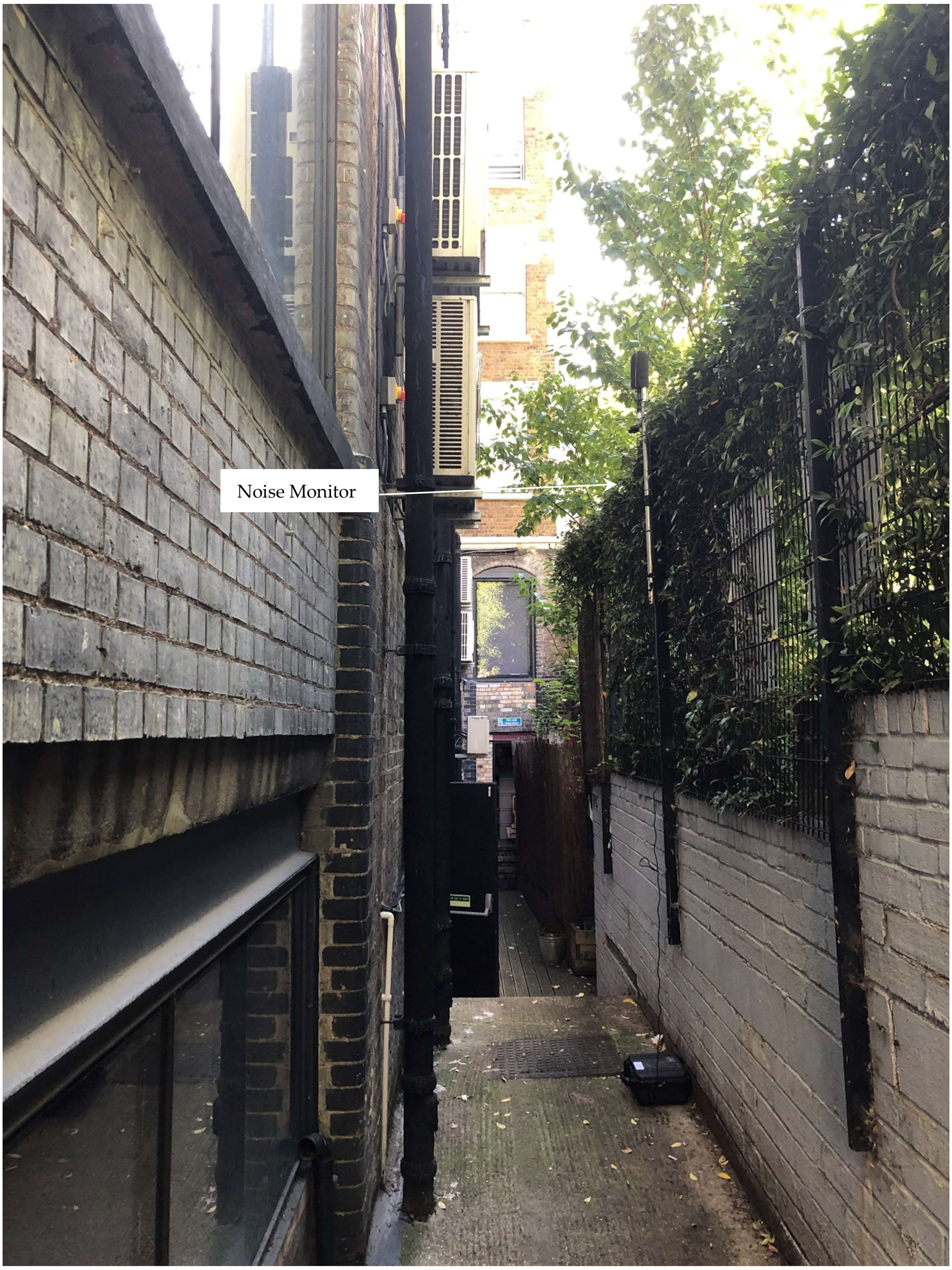

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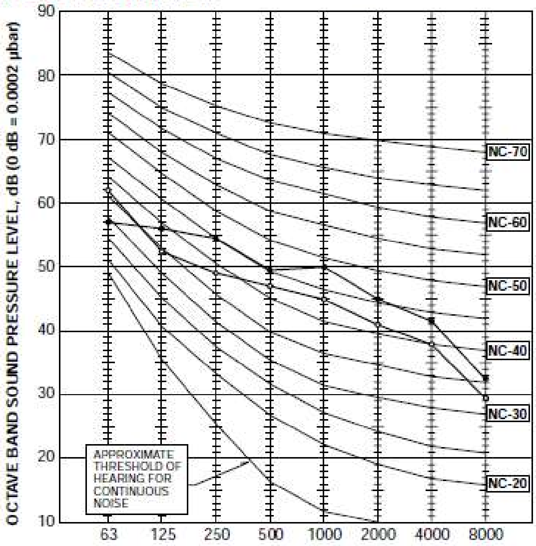
Figure A3: Equipment Noise Data

Mitsubishi PUHZ-P100VHA4, MUZ-GF60VE & MSZ-SF25VE

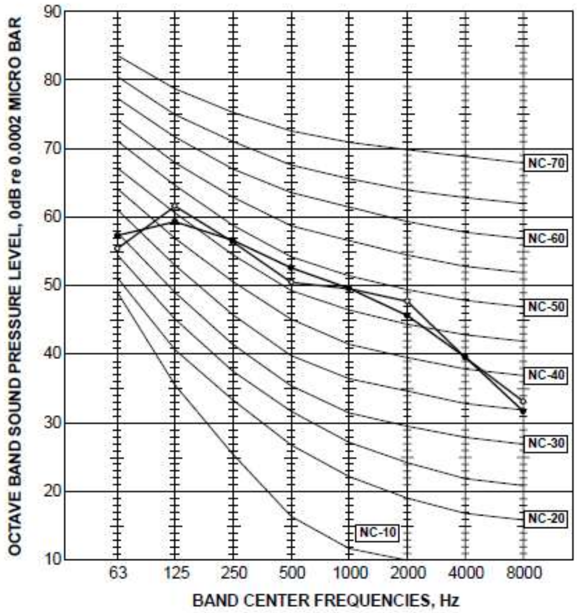
PUHZ-P100VHA2.UK
PUHZ-P100VHA3.UK
PUHZ-P100VHA3R1.UK
PUHZ-P100VHA3R2.UK
PUHZ-P100VHA4.UK
PUHZ-P100YHA.UK
PUHZ-P100YHAR1.UK
PUHZ-P100YHA2.UK

MODE	SPL(dB)	LINE
COOLING	50	○—○
HEATING	54	●—●



MUZ-GF60VE

FUNCTION	SPL(dB(A))	LINE
COOLING	55	●—●
HEATING	55	○—○



MSZ-SF25VE

FAN SPEED	FUNCTION	SPL(dB(A))	LINE
Super High	COOLING	42	●—●
	HEATING	45	○—○

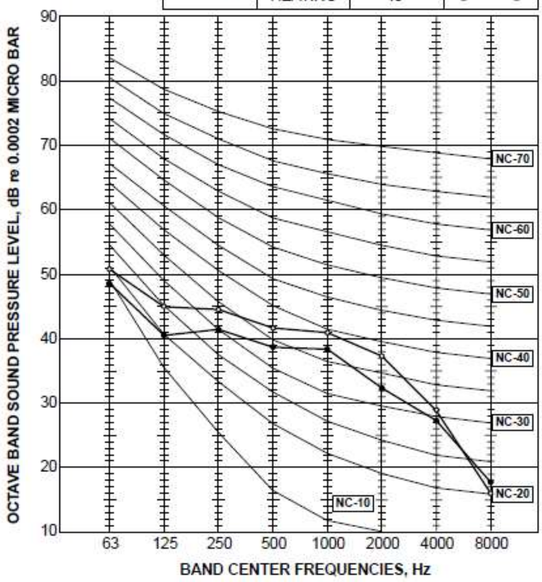


Figure A4: Layout Drawing (Existing)

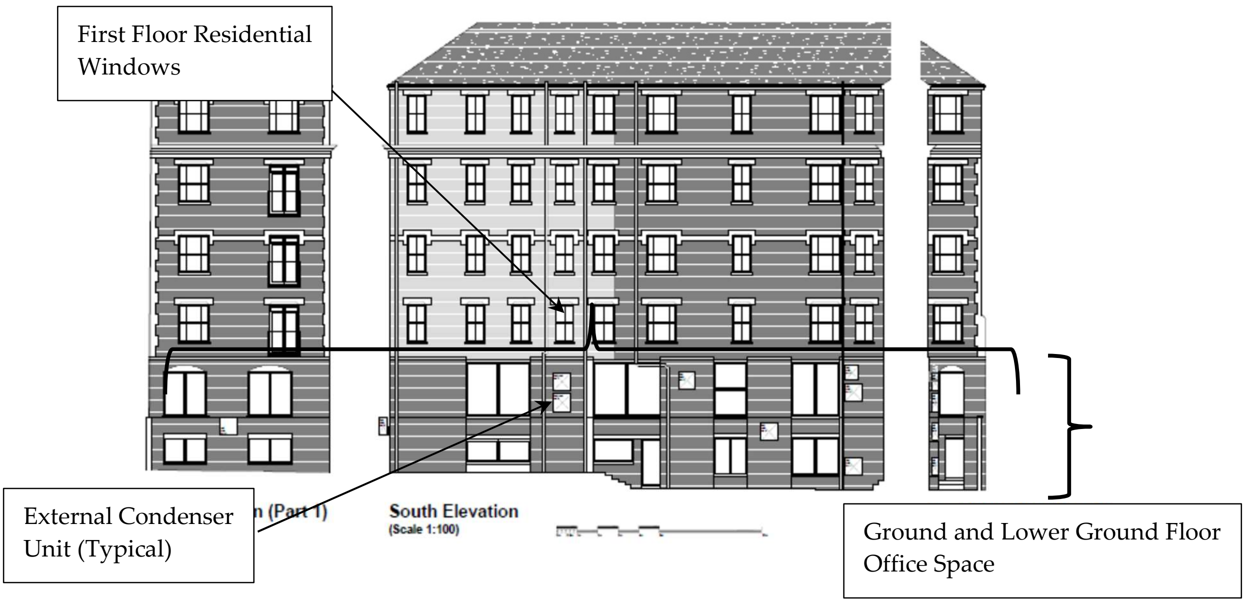
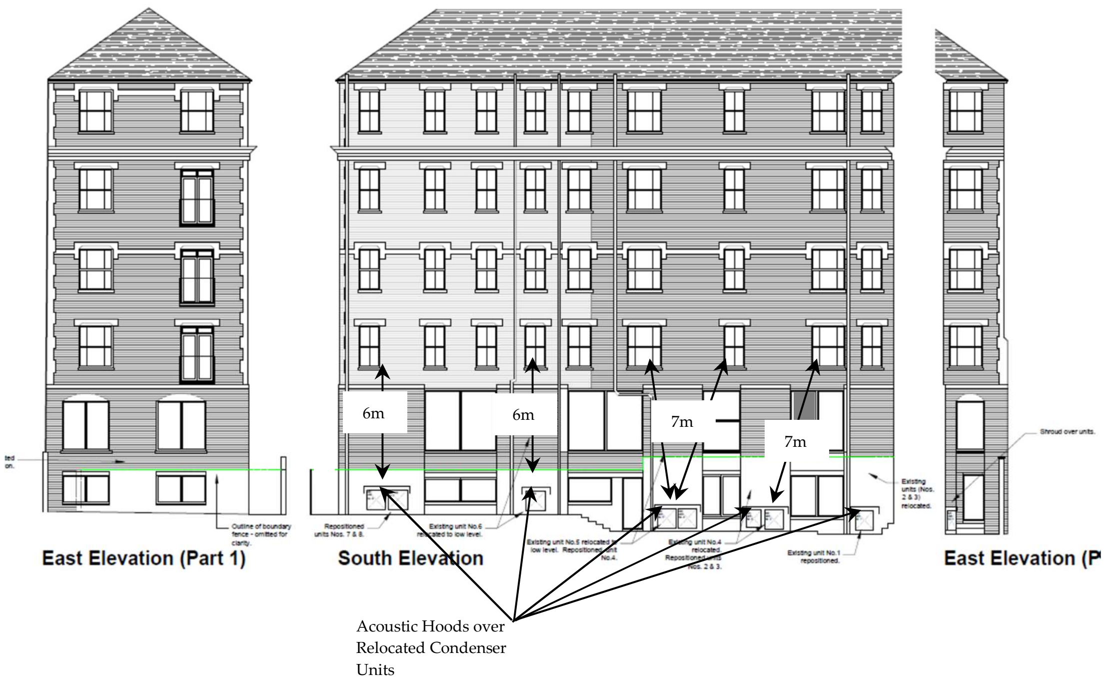


Figure A5: Layout Drawing (Proposed)



APPENDIX B: GLOSSARY OF NOISE TERMS AND UNITS.

1.0 Noise

1.1 The sounds that we hear are as a result of successive air pressure changes. These air pressure changes are generated by vibrating sources, such as train engines or wheels, and they travel to a receiver, i.e. the human ear, as air pressure waves.

1.2. The human ear is capable of detecting a vast range of air pressures, from the lowest sound intensity that the normal ear can detect (about 10^{-12} watts/m^2) to the highest that can be withstood without physical pain (about 10 watts/m^2). If we were to use a linear scale to represent this range of human sensitivity it would encompass more than a billion units. Clearly this would be an unmanageable scale yielding unwieldy numbers.

1.3. The scale can be compressed by converting it to a logarithmic or Bel scale, the number of Bels being the logarithm to the base 10 of one value to another (as applied by Alexander Graham Bell to measure the intensity of electric currents). The Bel scale gives a compressed range of 0 to 12 units which in practice is a little too compressed. A more practical operating range of 0 to 120 is obtained by multiplying by 10, ie. 10 x Bel, which produces the scale units known as decibels or dB.

1.4. Examples of typical sound intensity levels within the decibel range of 0 to 120 dB are listed below:

Commercial four-engine jet aircraft at 100m	120dB
Riveting of steel plate at 10m	105dB
Pneumatic drill at 10m	90dB

Circular wood saw at 10m	80dB
Heavy road traffic at 10m	75dB
Male speech, average, at 10m	50dB
Whisper at 10m	25dB
Threshold of hearing, 100Hz	0dB

1.5. Due to this logarithmic scale noise levels have to be combined logarithmically rather than arithmetically. For example, two equal sound sources of 70 dB each, when operated simultaneously, do not produce a combined level of 140 dB but instead result in a level of 73 dB, ie. A rise of 3dB for each doubling of sound intensity. Subjectively, a 3dB change does not represent a doubling or halving of loudness; to make a sound appear twice as loud requires an increase in sound pressure level of about 10dB.

1.6. The subjective loudness of noise can be measured by applying a filter or weighting which equates to the frequency response of the human ear. This is referred to as an A-weighting and when applied results in noise levels expressed as dB(A).

1.7. dB(A) noise levels can be measured using a variety of noise indices. The index which correlates best with human response due to machinery noise is the L_{Aeq} this is the A-weighted L_{eq} which is referred to as the 'equivalent continuous noise level' and is a measure of the total sound energy generated by a fluctuating sound signal within a given time period.