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ROYAL ACADEMY OF DRAMATIC ART, 16-18 CHENIES STREET, CAMDEN, LONDON

PLANT NOISE IMPACT ASSESSMENT

Technical Report: R5909-1 Rev 2

Date: 6th October 2015

For: Royal Academy of Dramatic Art
16-18 Chenies Street
London
WC1E 7EX

24 Acoustics Document Control Sheet

Project Title: Royal Academy of Dramatic Art, 16-18 Chenies Street, Camden, London
Plant Noise Impact Assessment

Report Ref: R5909-1 Rev 2

Date: 6th October 2015

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For and on behalf of 24 Acoustics Ltd				

Document Status and Approval Schedule

Revision	Description	Prepared By	Approved By
0	Approved for Issue	John Edhouse	Steve Gosling
1	Approved for Issue	John Edhouse	Steve Gosling
2	Approved for Issue	John Edhouse	Steve Gosling

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EXECUTIVE SUMMARY

24 Acoustics Ltd has been instructed by the Royal Academy of Dramatic Art to undertake an assessment of the noise impact associated with proposed plant at 16-18 Chenies Street, London.

A survey of background noise measurements was undertaken between 2nd and 8th September 2015.

Noise limit criteria have been established following guidance provided by the local planning authority, Camden Council.

Based on the outline mechanical services plan, the assessment has indicated that noise from the proposed plant will meet the defined noise level criteria for day, evening and night time periods. Further review and calculations should be undertaken during detailed design to specify any additional mitigation measures necessary to meet the defined noise limit criteria.

CONTENTS

1.0 INTRODUCTION

1.1 24 Acoustics Ltd has been instructed by the Royal Academy of Dramatic Art to undertake a noise impact assessment at 16-18 Chenies Street, Camden, London in relation to proposed plant associated with extension and refurbishment works at the site. Planning permission is sought to install ventilation and air conditioning plant. Proposals include removal of several existing plant units at the site and replacement with new systems.

1.2 Background noise measurements have been undertaken at the site between 2nd and 8th September 2015. This report has assessed the impact of noise from proposed plant at the nearest sensitive properties.

1.3 All noise levels in this report are quoted in dB relative to 20 μPa.

2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 The Royal Academy of Dramatic Art, 16-18 Chenies Street is located in a mixed residential and commercial area of Camden, London. Chenies Street bounds the site to the north west. The existing building comprises five storeys including a basement level. The building contains a mixture of uses including; office areas, teaching areas, theatre spaces, rehearsal rooms.

2.2 It is proposed to demolish and rebuild at the rear of 18 Chenies Street and demolish and extend at the rear of 16 Chenies Street. Air handling and air conditioning plant at the existing site has been reviewed and a new scheme replacing and upgrading services plant to the site has been provided in outline. It is understood that the new plant units will be located externally at basement level at the rear of 18 Chenies Street and at first floor roof level to the rear of 16 Chenies Street. In addition, air handling units to provide ventilation will be located internally at third floor level to the rear of 16 Chenies Street and internally at basement level at the rear of 18 Chenies Street.

2.3 The nearest residential properties adjacent to the proposed plant are located north east at 25 Ridgmount Street (Receptor 1) and to the south at the top floor level of Rossetti Court (Receptor 2). The majority of surrounding properties to the site comprise offices. The nearest offices to the proposed plant are located west in Whittington House, 19-30 Alfred Place (Receptor 3) and south at 23 Ridgemount Place (Receptor 4). Noise from road traffic is the dominant source of background noise at the nearest sensitive properties, however, noise from plant associated with properties at Chenies Street and adjacent properties also contribute to the surrounding noise environment.

2.4 Figure 1 shows the site location and receptor locations. Figure 2 shows the proposed basement plan. Figure 3 shows the proposed first floor plan. Figure 4 shows the proposed third floor plan.

3.0 DEVELOPMENT SITE PLANNING CONSENT AND CONDITIONS

NPPF

3.1 The National Planning Policy Framework (NPPF) [Reference 1] was published by the Department for Communities and Local Government in 2012. For noise, the NPPF policy states that planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions, while recognising that many developments will create some noise.

3.2 The NPPF refers to the Noise Policy Statement for England (NPSE) [Reference 2] which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term vision 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' which is supported by the following aims.

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life.

Local Planning Authority – Camden Council

3.3 The Local Planning Authority, Camden Council, advises that noise arising from plant and machinery should be assessed in line with DP28 of Camden's Development Policies [Reference 3].

3.4 Table E of DP28 details noise limits for plant which should not be exceeded at the nearest sensitive properties. Table E states that for plant which does not have a distinctive tonal or impulsive noise character, noise from the plant should be 5 dB below the background noise level (L_{A90}) 1 metre from the nearest sensitive facade. For noise which does have a distinctive tonal or impulsive nature the plant noise level must be set 10 dB below the background noise level (L_{A90}) 1 metre from the nearest sensitive façade. The daytime period is assessed between 0700-1900 hours, evening period between 1900-2300 hours and night time period between 2300-0700 hours.

British Standard 4142:2014

3.5 BS 4142:2014 [Reference 4] provides a method for rating the effects of industrial and commercial sound on residential areas. The standard advocates a comparison between the typical measured L_{A90} background noise level and L_{Aeq} noise level from the source being considered. The standard states that a difference between the rating level and the background level of around +10 dBA is an indication of a significant adverse impact, depending on the context and a difference of around +5 dBA is likely to be an indication of an adverse impact again depending on the context. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact (depending upon the context).

4.0 ASSESSMENT METHODOLOGY

4.1 The following assessment methodology has been used:

i. A background noise survey has been undertaken to determine existing levels of background noise at the nearest sensitive properties during proposed plant operating hours;
ii. Calculations of the noise level from plant at the nearest noise sensitive properties;
iii. An assessment of the likely noise impact has been undertaken in accordance with Local Planning Authority criteria and the guidance of BS 4142.

5.0 AMBIENT NOISE MEASUREMENTS

Background Survey

5.1 Noise measurements were undertaken to determine the existing background noise level at the nearest sensitive properties. Noise monitoring equipment was located at roof level of 18 Chenies Street immediately adjacent to residential properties to the east. This location is considered representative of the background noise levels at the nearest noise sensitive properties in the surrounding area. Measurements were undertaken in samples of 5 minutes in terms of the overall free-field A-weighted L_{eq}, L_{90} and $L_{max,f}$ noise levels. Noise measurements were undertaken between 2nd and 8th September 2015.

5.2 The survey location is shown in Figure 1. The survey was undertaken with the following instrumentation:

- Rion NL32 Class 1 accuracy sound level meter;
- Bruel and Kjaer Type 4231 Class 1 accuracy acoustic calibrator.

5.3 The instrumentation was calibrated before and after the survey in accordance with the manufacturer's instructions. No significant drift in calibration was recorded. All instrumentation was fitted with environmental weather shields during the survey.

5.4 Weather conditions during the survey were mostly fine and dry. Short periods of rain occurred on the 3rd September. Measurements relating to these short periods of rain have been removed from the data prior to analysis. Wind speeds were typically lower than 5 m/s during the measurements.

5.5 The results of the background noise survey are summarised below in Table 1 and shown graphically in Appendix B.

Date	Daytime Level (07:00 - 19:00) dB	Evening Level (19:00 – 23:00) dB	Night-time Level (23:00 – 07:00) dB
	Minimum $L_{A90, 1\ hour}$	Minimum $L_{A90, 1\ hour}$	Minimum $L_{A90, 15\ min}$
Wed 2nd Sept	54	53	52
Thu 3rd Sept	54	53	52
Fri 4th Sept	54	53	52
Sat 5th Sept	54	53	52
Sun 6th Sept	53	52	52
Mon 7th Sept	54	53	52
Tue 8th Sept	55	-	-
Noise Level	**54**	**53**	**52**

Table 1: Measured Noise Levels, 16-18 Chenies Street – Free field conditions

5.6 Background noise measurements are considered representative of noise levels at the nearest sensitive properties. Noise from road traffic noise and existing plant were the dominant sources of background noise in the surrounding area, however, nearby commercial activities also contributed to background noise levels.

Assessment

5.7 If plant does not contain a distinctive or tonal in noise character, based upon the requirements of the Local Planning Authority (as described in Section 3.4), noise from the plant should not exceed the following level as measured at 1m from the nearest noise sensitive window:

07:00 – 19:00 hours	49 dB $L_{Aeq, 1\ hour}$
19:00 – 23:00 hours	48 dB $L_{Aeq, 1\ hour}$
23:00 – 07:00 hours	47 dB $L_{Aeq, 15\ min}$

6.0 CALCULATIONS AND NOISE IMPACT ASSESSMENT

6.1 The proposed plant at basement level at the rear of 18 Chenies Street comprises an internally installed air handling unit and externally installed VRV air conditioning unit and cooling DX unit. The plant will be located in a basement level light well. In addition a refectory kitchen air extract fan located internally will vent via ducting that extends to roof level. Details of the kitchen extract fan are not yet available, however, provision for attenuators either side of the fan have been allowed to reduce noise levels.

6.2 The proposed plant at 16 Chenies Street comprises two internally installed air handling units at third floor level for theatre and library areas. Plant is also proposed externally at first floor roof level at the rear of 16 Chenies Street and comprises two air handling units, two VRV air conditioning units and a cooling DX unit. The rooftop topography and adjacent buildings provides significant acoustic screening from plant at first floor roof level to the nearest receptors.

6.3 It is understood that the air handling units and kitchen extract fan will operate during daytime and evening periods. The VRV plant units have the potential to operate during daytime, evening and night time periods.

6.4 The location of proposed plant units is shown in Figures 2, 3 and 4.

6.5 The mechanical services plan has to date been designed in outline only and may change during the detailed design process. Not all plant units have been specified in detail and therefore manufacturers' noise information is not available at this point for all proposed plant units including the AHU's and refectory air extract fan.

6.6 Noise levels for the proposed air conditioning plant (VRV units and cooling DX units) have been taken from manufacturers' information as shown below.

Model	**Sound Pressure Level at 1m (dB) per Octave Band Frequency (Hz)**								**dBA**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
VRV Unit, Daikin REYQ 28 P8	67	64	63	60	59	54	46	43	63
VRV Unit, Daikin REYQ 20 P9	66	64	63	59	57	53	46	43	62
Cooling Coil DX, Daikin RXYQ 14 P9	66	64	63	58	53	50	45	48	60
Cooling Coil DX, Daikin RXYQ 12 P9	65	66	63	58	54	47	41	34	60

Table 2: Plant sound pressure levels at 1m - Manufacturer's noise data

6.7 Indicative noise levels from equivalent AHU's and air extract fans have been assumed in calculations based on equivalent plant units as shown in Table 3. Once equipment has been specified in detail, calculations should be updated and include any relevant mitigation measures to ensure noise limit criteria at the nearest sensitive properties are achieved.

Model	Sound Pressure Level at 1m (dB) per Octave Band Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
AHU extract duct level	76	71	63	53	45	47	44	48	60
AHU combined duct and case level	77	69	62	66	51	50	47	50	65
AHU combined duct and case level	62	64	61	59	60	59	57	51	65

Table 3: Plant sound pressure levels at 1m

6.8 Calculations have been undertaken to determine the noise level from proposed plant at the nearest sensitive properties based on the mechanical services outline design as described above. Due to the relatively large distances between proposed plant units at the site and significant acoustic screening from surrounding buildings calculations have included the closest proposed plant units only to each receptor location. Plant units not included in each respective calculation are considered insignificant to the overall resultant noise level due to distance and screening corrections.

6.9 In this instance noise from the proposed plant will be continuous and contain no distinctive tones when assessed at the nearest sensitive property due to the high level of ambient noise from road traffic and existing plant which will assist in masking noise from the plant and comprises a similar noise character. For this reason it is not considered necessary to apply a penalty correction for noise character.

6.10 Calculations results are summarised in Table 4 and are shown in full in Appendix C.

Location	Calculated Noise Level L_{Aeq}, dB		
	Daytime Level (07:00 - 19:00)	Evening Level (19:00 – 23:00)	Night-time Level (23:00 – 07:00)
Receptor 1: 25 Ridgemount Street	41	41	40
Receptor 2: Rossetti Court	47	47	19
Receptor 3: Whittington House	45	45	43
Receptor 4: 23 Ridgemount Place	40	40	37

Table 4: Calculation Results Summary

6.11 Provision for attenuators should be made to reduce noise levels from the AHU air intakes/extracts, especially for unit located on the third floor level at the rear of 16 Chenies Street. Calculations indicate noise levels from proposed plant should be capable of achieving determined noise limits based on local planning authority criteria, however, further calculations should be undertaken to confirm the specification of any necessary mitigations measures once detail design of services plant is confirmed. Additional mitigation measures maybe required if changes to plant size and type or location are made.

6.12 On the above basis, assuming appropriate mitigation measures are installed, calculations indicate that noise levels from proposed plant will meet the defined noise level criteria as described in Section 5.7 for day, evening and night time periods. Further calculations should be undertaken following the detailed design stage to specify relevant mitigation measures.

7.0 CONCLUSIONS

7.1 24 Acoustics Ltd has been instructed by the Royal Academy of Dramatic Art to undertake an assessment of the noise impact associated with proposed plant at The Royal Academy of Dramatic Art, 16-18 Chenies Street, London.

7.2 Assessment of noise from the plant has been undertaken following background noise measurements at the site undertaken between 2nd and 8th September 2015.

7.3 Noise limit criteria have been established following guidance provided by the local planning authority, Camden Council.

7.4 Based on the outline mechanical services plan, the assessment has indicated that noise from the proposed plant will meet the defined noise level criteria for day, evening and night time periods. Further review and calculations should be undertaken during detailed design to specify any additional mitigation measures necessary to meet the defined noise limit criteria.

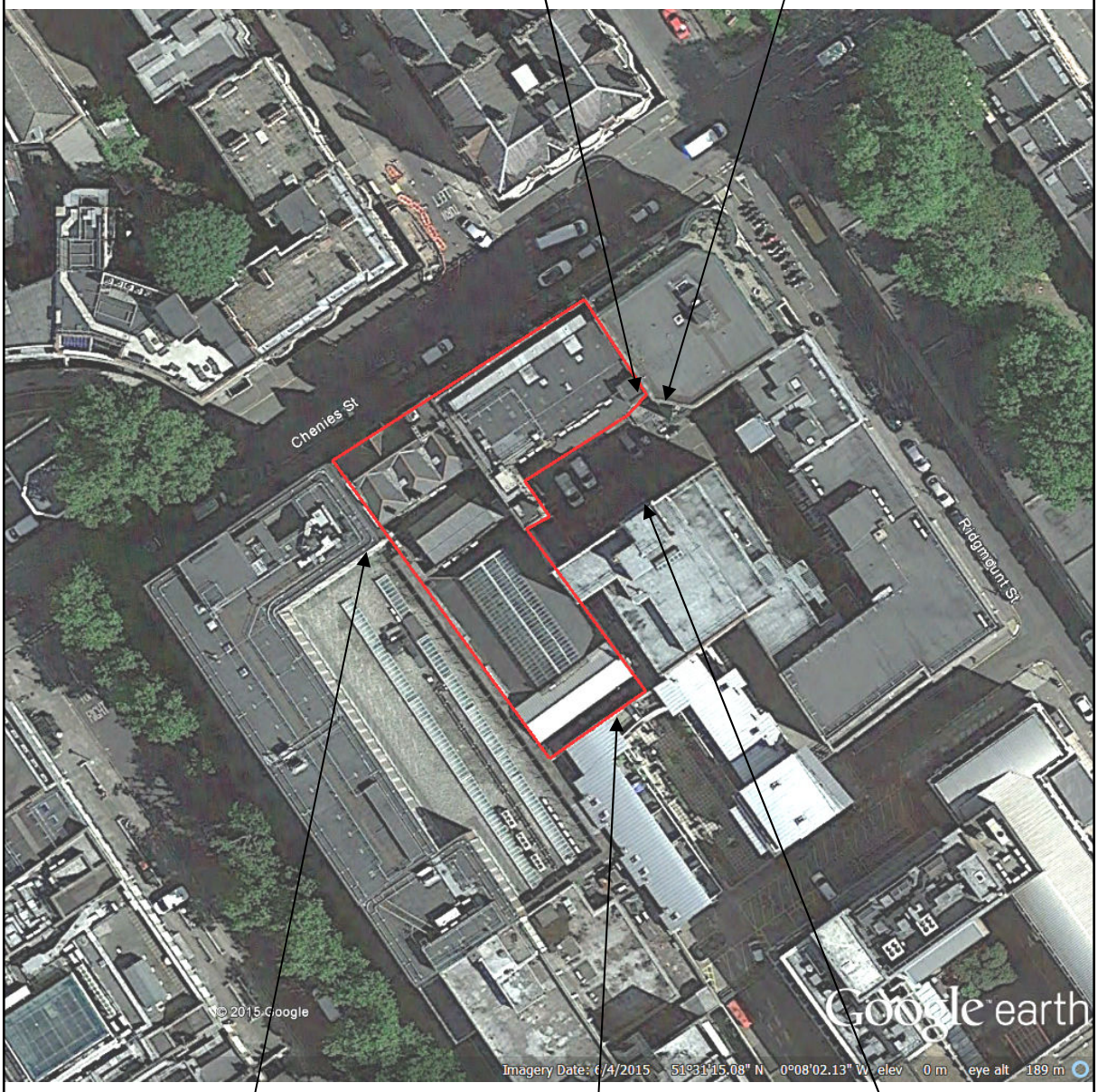
REFERENCES

1. National Planning Policy Framework, Department for Communities and Local Government, 2012.

2. Noise Policy Statement for England, Defra, 2010.

3. London Borough of Camden. Local Development Framework, Development Policies (DP28 – Noise and Vibration), 2010.

4. British Standards Institution. British Standard 4142: Methods for rating and assessing industrial and commercial sound, 2014.



Project: 16-18 Chenies Street	**Description:** Site location and noise measurement locations	
DWG No: Figure 1	**Scale:** N.T.S.	**Rev:** A
Date: September 2015	**Drawn By:** JE	**Job No:** 5909-1

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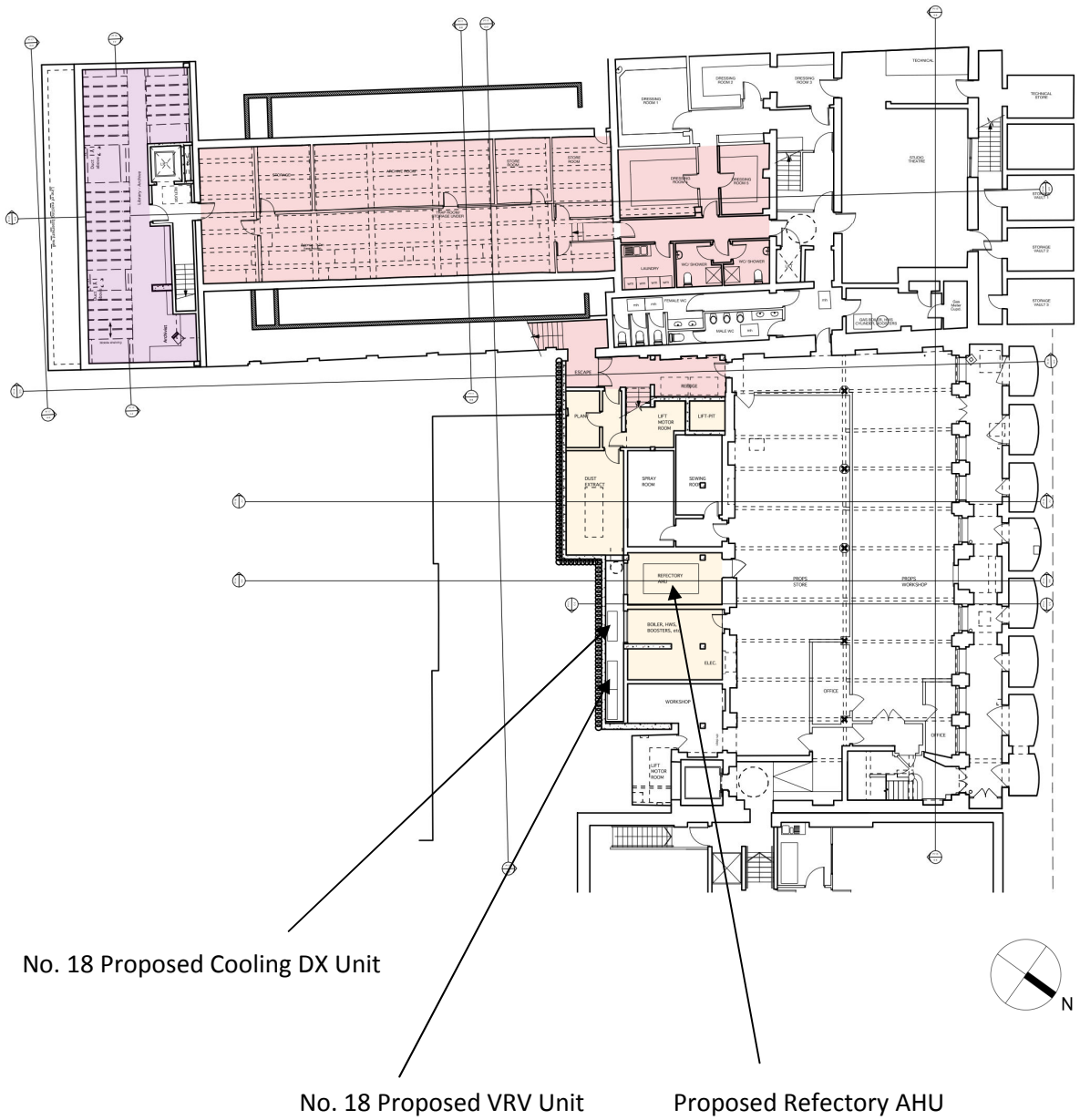

Project: 16-18 Chenies Street	**Description:** Proposed Basement Level Plan	
DWG No: Figure 2	**Scale:** N.T.S.	**Rev:** A
Date: September 2015	**Drawn By:** JE	**Job No:** 5909-1

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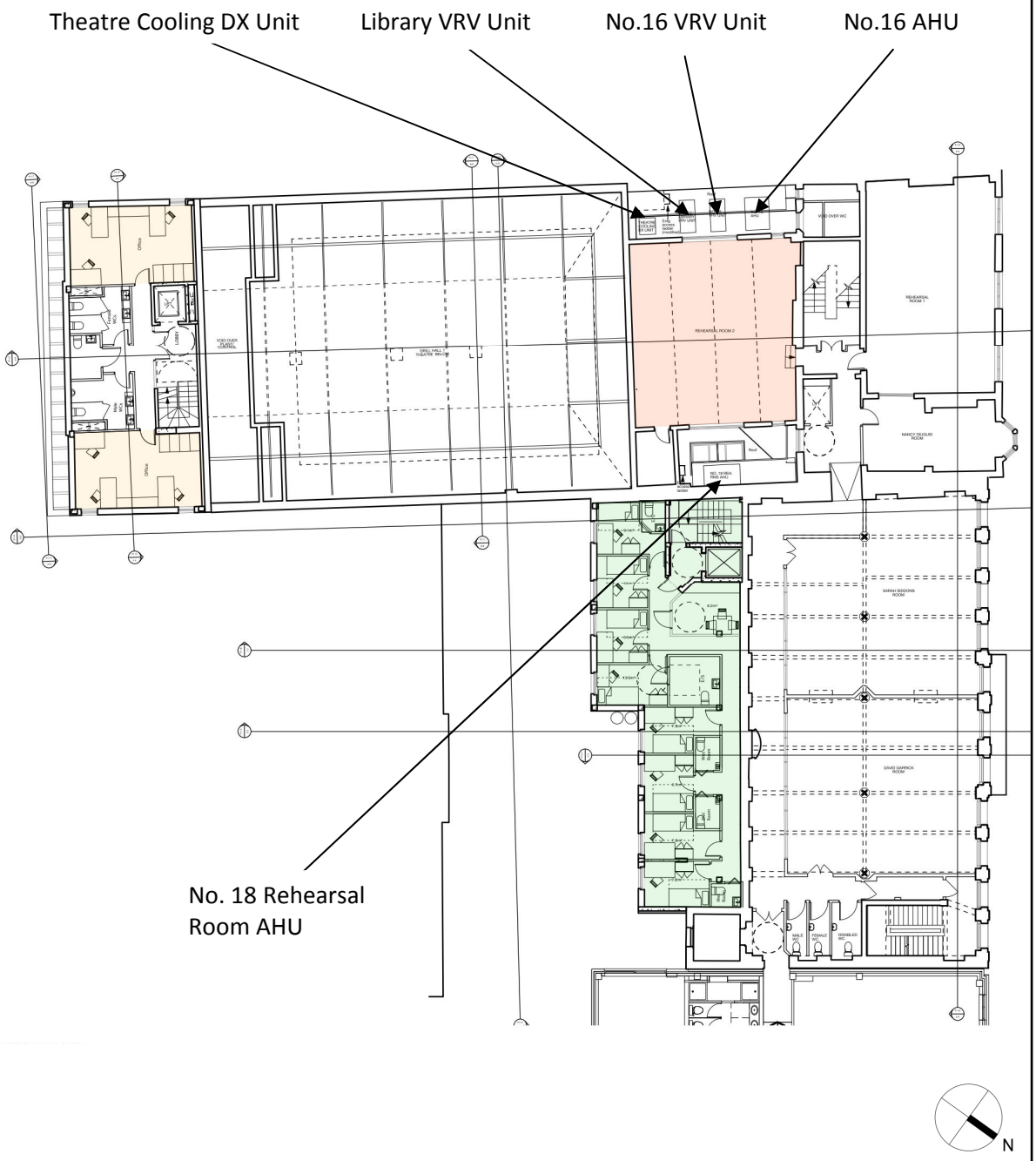

Project: 16-18 Chenies Street	**Description:** Proposed First Floor Level Plan	
DWG No: Figure 3	**Scale:** N.T.S.	**Rev:** A
Date: September 2015	**Drawn By:** JE	**Job No:** 5909-1

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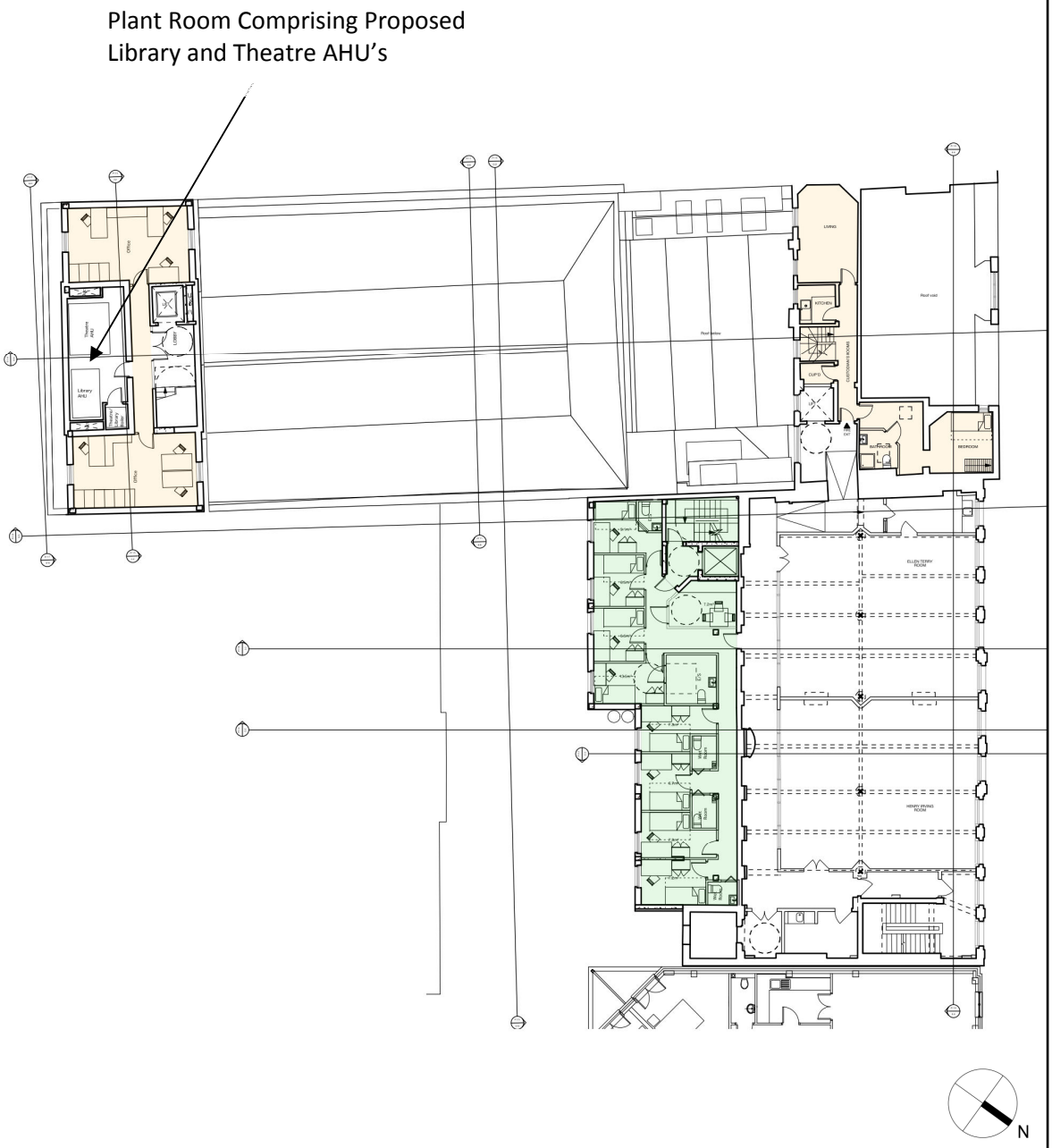

Project: 16-18 Chenies Street	**Description:** Proposed Third Floor Level Plan		24Acoustics www.24acoustics.co.uk
DWG No: Figure 4	**Scale:** N.T.S.	**Rev:** A	
Date: September 2015	**Drawn By:** JE	**Job No:** 5909-1	

APPENDIX A: NOISE UNITS

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in important by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dB(A) weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dB(A) is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dB(A). The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dB(A) corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

i) The L_{Amax} noise level

This is the maximum noise level recorded over the measurement period.

ii) The L_{Aeq} noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 [1] as the " value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time internal, T, has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

APPENDIX B: AMBIENT NOISE MEASUREMENT RESULTS

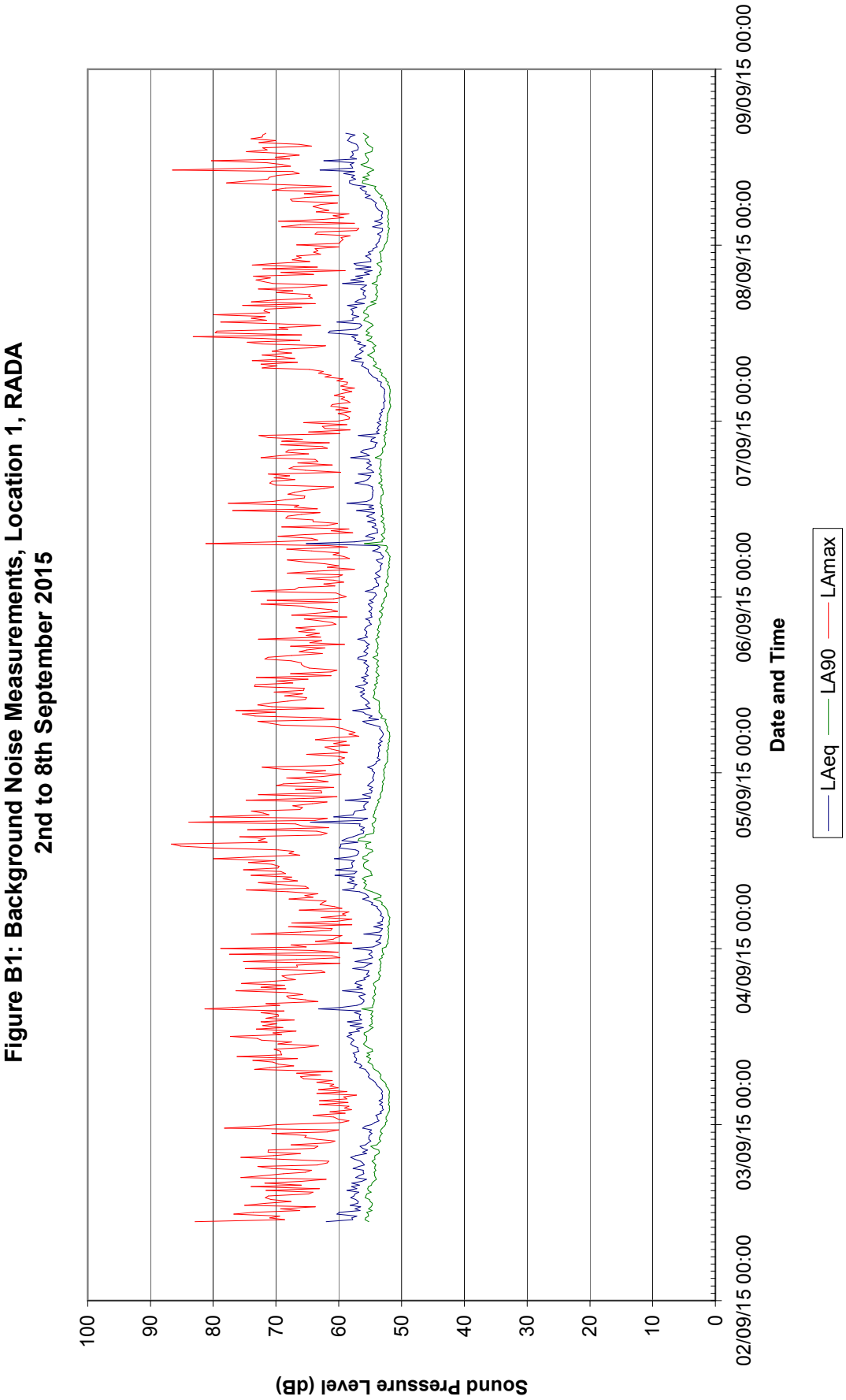

Figure B1: Background Noise Measurements, Location 1, RADA
2nd to 8th September 2015

APPENDIX C1: PLANT NOISE CALCULATIONS, RECEPTOR 1, 25 RIDGMOUNT STREET

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp, at 1m										
1) Daikin REYQ 28 P8	67	64	63	60	59	54	46	43	**63**	Manufacturers data at 1m
2) Daikin RXYQ 14 P9	66	64	63	58	53	50	45	48	**60**	Manufacturers data at 1m
3) Refectory AHU Dalair PL/3	76	71	63	53	45	47	44	48	**60**	Indicative AHU noise levels, exract duct level at 1m
4) Refectory Air Extract Fan	62	64	61	59	60	59	57	51	**65**	Indicative extract fan noise levels, duct level at 1m
Distance Loss										
1) Daikin REYQ 28 P8	-18	-18	-18	-18	-18	-18	-18	-18		Distance to nearest window = 8m
2) Daikin RXYQ 14 P9	-19	-19	-19	-19	-19	-19	-19	-19		Distance to nearest window = 9m
3) Refectory AHU Dalair PL/3	-22	-22	-22	-22	-22	-22	-22	-22		Distance to nearest window = 12m
4) Refectory Air Extract Fan	-24	-24	-24	-24	-24	-24	-24	-24		Distance to nearest window = 15m
Screening										
1) Daikin REYQ 28 P8	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from basement light well
2) Daikin RXYQ 14 P9	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from basement light well
3) Refectory AHU Dalair PL/3	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from basement light well
4) Refectory Air Extract Fan	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from rooftop
Directivity & Other Losses										
1) Daikin REYQ 28 P8	0	0	0	0	0	0	0	0		None
2) Daikin RXYQ 14 P9	0	0	0	0	0	0	0	0		None
3) Refectory AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
4) Refectory Air Extract Fan	0	0	0	0	0	0	0	0		None
Levels at nearest sensitive window										
1) Daikin REYQ 28 P8	44	40	39	36	34	28	20	17	**38**	Noise level from plant unit
2) Daikin RXYQ 14 P9	42	39	38	33	27	23	18	21	**35**	Noise level from plant unit
3) Refectory AHU Dalair PL/3	49	43	35	25	16	17	14	18	**32**	Noise level from plant unit
4) Refectory Air Extract Fan	33	34	31	29	29	27	25	19	**34**	Noise level from plant unit
Total - Daytime and Evening									**41**	Combined level from plant at receptor window (Plant items 1,2,3 & 4)
Total - Night-time									**40**	Combined level from plant at receptor window (Plant items 1 & 2)

APPENDIX C2: PLANT NOISE CALCULATIONS, RECEPTOR 2, ROSSETTI COURT

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp, at 1m										
1) Library AHU Dalair PL/3	76	71	63	53	45	47	44	48	**60**	Indicative AHU noise levels, exract duct level at 1m
2) Theatre AHU Swegon RX	76	71	63	53	45	47	44	48	**60**	Indicative AHU noise levels, exract duct level at 1m
3) Rehearsal AHU Dalair PL/3	77	69	62	66	51	50	47	50	**65**	Indicative AHU noise levels, duct and case level at 1m
4) No. 16 AHU Dalair PL/3	77	69	62	66	51	50	47	50	**65**	Indicative AHU noise levels, duct and case level at 1m
5) No. 16 VRV Unit Daikin REYQ 28 P8	67	64	63	60	59	54	46	43	**63**	Manufacturers data at 1m
6) Library VRV unit Daikin REYQ 20 P9	66	64	63	59	57	53	46	43	**62**	Manufacturers data at 1m
7) Cooling DX Daikin RXYQ 12 P9	65	66	63	58	54	47	41	34	**60**	Manufacturers data at 1m
Distance Loss										
1) Library AHU Dalair PL/3	-16	-16	-16	-16	-16	-16	-16	-16		Distance to nearest window = 6.5m
2) Theatre AHU Swegon RX	-16	-16	-16	-16	-16	-16	-16	-16		Distance to nearest window = 6.5m
3) Rehearsal AHU Dalair PL/3	-31	-31	-31	-31	-31	-31	-31	-31		Distance to nearest window = 35m
4) No. 16 AHU Dalair PL/3	-31	-31	-31	-31	-31	-31	-31	-31		Distance to nearest window = 36m
5) No. 16 VRV Unit Daikin REYQ 28 P8	-31	-31	-31	-31	-31	-31	-31	-31		Distance to nearest window = 34m
6) Library VRV unit Daikin REYQ 20 P9	-30	-30	-30	-30	-30	-30	-30	-30		Distance to nearest window = 33m
7) Cooling DX Daikin RXYQ 12 P9	-30	-30	-30	-30	-30	-30	-30	-30		Distance to nearest window = 31m
Screening										
1) Library AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
2) Theatre AHU Swegon RX	0	0	0	0	0	0	0	0		None
3) Rehearsal AHU Dalair PL/3	-11	-12	-14	-18	-20	-22	-22	-22		Screening from buildings and rooftop
4) No. 16 AHU Dalair PL/3	-11	-12	-14	-18	-20	-22	-22	-22		Screening from buildings and rooftop
5) No. 16 VRV Unit Daikin REYQ 28 P8	-11	-12	-14	-18	-20	-22	-22	-22		Screening from buildings and rooftop
6) Library VRV unit Daikin REYQ 20 P9	-11	-12	-14	-18	-20	-22	-22	-22		Screening from buildings and rooftop
7) Cooling DX Daikin RXYQ 12 P9	-11	-12	-14	-18	-20	-22	-22	-22		Screening from buildings and rooftop
Directivity & Other Losses										
1) Library AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
2) Theatre AHU Swegon RX	0	0	0	0	0	0	0	0		None
3) Rehearsal AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
4) No. 16 AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
5) No. 16 VRV Unit Daikin REYQ 28 P8	0	0	0	0	0	0	0	0		None
6) Library VRV unit Daikin REYQ 20 P9	0	0	0	0	0	0	0	0		None
7) Cooling DX Daikin RXYQ 12 P9	0	0	0	0	0	0	0	0		None
Levels at nearest sensitive window										
1) Library AHU Dalair PL/3	60	55	47	37	29	31	28	32	**44**	Noise level from plant unit
2) Theatre AHU Swegon RX	60	55	47	37	29	31	28	32	**44**	Noise level from plant unit
3) Rehearsal AHU Dalair PL/3	35	26	17	17	0	-3	-6	-3	**17**	Noise level from plant unit
4) No. 16 AHU Dalair PL/3	35	26	17	17	0	-3	-6	-3	**17**	Noise level from plant unit
5) No. 16 VRV Unit Daikin REYQ 28 P8	25	21	18	11	8	1	-7	-10	**15**	Noise level from plant unit
6) Library VRV unit Daikin REYQ 20 P9	25	22	19	11	7	1	-6	-9	**14**	Noise level from plant unit
7) Cooling DX Daikin RXYQ 12 P9	24	24	19	10	4	-5	-11	-18	**14**	Noise level from plant unit
Total - Daytime and Evening									**47**	Combined level from plant at receptor window (Plant items 1-7)
Total - Night-time									**19**	Combined level from plant at receptor window (Plant items 5-7)

APPENDIX C3: PLANT NOISE CALCULATIONS, RECEPTOR 3, WHITTINGTON HOUSE

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp, at 1m										
1) Rehearsal AHU Dalair PL/3	77	69	62	66	51	50	47	50	**65**	Indicative AHU noise levels, duct and case level at 1m
2) No. 16 AHU Dalair PL/3	77	69	62	66	51	50	47	50	**65**	Indicative AHU noise levels, duct and case level at 1m
3) No. 16 VRV Unit Daikin REYQ 28 P8	67	64	63	60	59	54	46	43	**63**	Manufacturers data at 1m
4) Library VRV unit Daikin REYQ 20 P9	66	64	63	59	57	53	46	43	**62**	Manufacturers data at 1m
5) Cooling DX Daikin RXYQ 12 P9	65	66	63	58	54	47	41	34	**60**	Manufacturers data at 1m
Distance Loss										
1) Rehearsal AHU Dalair PL/3	-25	-25	-25	-25	-25	-25	-25	-25		Distance to nearest window = 17m
2) No. 16 AHU Dalair PL/3	-15	-15	-15	-15	-15	-15	-15	-15		Distance to nearest window = 5.5m
3) No. 16 VRV Unit Daikin REYQ 28 P8	-15	-15	-15	-15	-15	-15	-15	-15		Distance to nearest window = 5.5m
4) Library VRV unit Daikin REYQ 20 P9	-15	-15	-15	-15	-15	-15	-15	-15		Distance to nearest window = 5.5m
5) Cooling DX Daikin RXYQ 12 P9	-15	-15	-15	-15	-15	-15	-15	-15		Distance to nearest window = 5.5m
Screening										
1) Rehearsal AHU Dalair PL/3	-11	-12	-14	-18	-20	-22	-22	-22		Screening from buildings and rooftop
2) No. 16 AHU Dalair PL/3	-7	-7	-8	-9	-10	-12	-12	-12		Minor screening from buildings and rooftop
3) No. 16 VRV Unit Daikin REYQ 28 P8	-7	-7	-8	-9	-10	-12	-12	-12		Minor screening from buildings and rooftop
4) Library VRV unit Daikin REYQ 20 P9	-7	-7	-8	-9	-10	-12	-12	-12		Minor screening from buildings and rooftop
5) Cooling DX Daikin RXYQ 12 P9	-7	-7	-8	-9	-10	-12	-12	-12		Minor screening from buildings and rooftop
Directivity & Other Losses										
1) Rehearsal AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
2) No. 16 AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
3) No. 16 VRV Unit Daikin REYQ 28 P8	0	0	0	0	0	0	0	0		None
4) Library VRV unit Daikin REYQ 20 P9	0	0	0	0	0	0	0	0		None
5) Cooling DX Daikin RXYQ 12 P9	0	0	0	0	0	0	0	0		None
Levels at nearest sensitive window										
1) Rehearsal AHU Dalair PL/3	41	32	23	23	6	3	0	3	**23**	Noise level from plant unit
2) No. 16 AHU Dalair PL/3	55	47	39	42	26	23	20	23	**41**	Noise level from plant unit
3) No. 16 VRV Unit Daikin REYQ 28 P8	45	42	40	36	34	27	19	16	**39**	Noise level from plant unit
4) Library VRV unit Daikin REYQ 20 P9	44	42	40	35	32	26	19	16	**38**	Noise level from plant unit
5) Cooling DX Daikin RXYQ 12 P9	43	44	40	34	29	20	14	7	**36**	Noise level from plant unit
Total - Daytime and Evening									**45**	Combined level from plant at receptor window (Plant items 1-5)
Total - Night-time									**43**	Combined level from plant at receptor window (Plant items 3-5)

APPENDIX C4: PLANT NOISE CALCULATIONS, RECEPTOR 4, 23 RIDGEMOUNT PLACE

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp, at 1m										
1) Daikin REYQ 28 P8	67	64	63	60	59	54	46	43	**63**	Manufacturers data at 1m
2) Daikin RXYQ 14 P9	66	64	63	58	53	50	45	48	**60**	Manufacturers data at 1m
3) Refectory AHU Dalair PL/3	76	71	63	53	45	47	44	48	**60**	Indicative AHU noise levels, exract duct level at 1m
4) Refectory Air Extract Fan	62	64	61	59	60	59	57	51	**65**	Indicative extract fan noise levels, duct level at 1m
Distance Loss										
1) Daikin REYQ 28 P8	-21	-21	-21	-21	-21	-21	-21	-21		Distance to nearest window = 11m
2) Daikin RXYQ 14 P9	-21	-21	-21	-21	-21	-21	-21	-21		Distance to nearest window = 11m
3) Refectory AHU Dalair PL/3	-21	-21	-21	-21	-21	-21	-21	-21		Distance to nearest window = 11m
4) Refectory Air Extract Fan	-24	-24	-24	-24	-24	-24	-24	-24		Distance to nearest window = 15m
Screening										
1) Daikin REYQ 28 P8	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from basement light well
2) Daikin RXYQ 14 P9	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from basement light well
3) Refectory AHU Dalair PL/3	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from basement light well
4) Refectory Air Extract Fan	-5	-6	-6	-6	-7	-8	-8	-8		Minor screening from rooftop
Directivity & Other Losses										
1) Daikin REYQ 28 P8	0	0	0	0	0	0	0	0		None
2) Daikin RXYQ 14 P9	0	0	0	0	0	0	0	0		None
3) Refectory AHU Dalair PL/3	0	0	0	0	0	0	0	0		None
4) Refectory Air Extract Fan	0	0	0	0	0	0	0	0		None
Levels at nearest sensitive window										
1) Daikin REYQ 28 P8	41	37	36	33	31	25	17	14	**36**	Noise level from plant unit
2) Daikin RXYQ 14 P9	40	37	36	31	25	21	16	19	**33**	Noise level from plant unit
3) Refectory AHU Dalair PL/3	50	44	36	26	17	18	15	19	**33**	Noise level from plant unit
4) Refectory Air Extract Fan	33	34	31	29	29	27	25	19	**34**	Noise level from plant unit
Total - Daytime and Evening									**40**	Combined level from plant at receptor window (Plant items 1,2,3 & 4)
Total - Night-time									**37**	Combined level from plant at receptor window (Plant items 1 & 2)