ACAACOUSTICS

Acoustic assessment of proposed mechanical equipment at The Water House, London, N6 6HQ

Report Reference: 170522-R001B

Date: August 2017

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Site Address:	The Water House Millfield Lane London N6 6HQ
Client:	KSR Architects LLP
Report Reference:	170522-R001B

Revision:	**Description:**	**Revision Date:**	**Author:**
-	First issue	19/06/2017	Rob Cant MIOA
B	Second Issue – inclusion of additional mechanical equipment in assesment	04/08/2017	Tommy Burn BSc(hons) AMIOA

CONTENTS

0. SUMMARY

- ACA Acoustics Limited have been commissioned to assess noise emissions from proposed new mechanical equipment to be installed at The Water House, Millfield Lane, London, N6 6HQ.

- The assessment is required to provide evidence that noise emissions from the equipment will not be detrimental to the amenity of nearby noise sensitive properties and complies with the requirements of London Borough of Camden Council. London Borough of Camden Council's requirement, applicable at this site, is that the rating level of sound from the equipment shall ideally not exceed 10dB below the existing background LA90 outside nearby noise-sensitive properties.

- Whilst on site the author identified closest non-associated, noise-sensitive properties as residential dwellings further along Millfield Lane and to the rear of properties on Fitzroy Park. Closest properties are approximately 22m from the proposed equipment location.

- A survey has been carried out in the vicinity to establish existing background sound levels. Representative background sound levels overnight, during the survey, were measured at LAF90 40dB. Based on results of the sound level survey and London Borough of Camden Council's requirement, the overall sound level limit for the equipment to outside nearest noise-sensitive windows is set at ≤ 30dBA.

- Calculations using manufacturer's sound level data for the new equipment confirm that the cumulative specific sound level for all the new plant operating will be LAeq 27dB outside nearest openable noise-sensitive windows, equating to a rating level of LAr 30dB. This is at least 10dBA below the background sound level, and achieves London Borough of Camden Council's acoustic criteria. The assessment includes benefit of noise-control treatments as set out in this report.

1. INTRODUCTION

Two extraction fans, two new MVHR units and an external condenser and an AHU are to be installed at The Water House, Millfield Lane, London, during renovations of an existing residential property.

ACA Acoustics Limited has been commissioned to carry out an assessment of sound emissions from the proposed new mechanical equipment and, where necessary, make recommendation to reduce sound levels to ensure that the amenity of nearby noise-sensitive properties is not compromised.

This report presents results of the sound level survey and assessment.

2. LONDON BOROUGH OF CAMDEN COUNCIL'S ACOUSTIC REQUIREMENTS

London Borough of Camden Council's policies relating to noise are set out in the new Local Plan, which is due to be adopted on 26th June when it will replace the current Local Development Framework policies. The Inspector's report on the Local Plan was published on 15 May 2017 and concludes that the plan is 'sound' subject to modifications being made to the Plan. While the determination of planning applications should continue to be made in accordance with the existing development plan until formal adoption, substantial weight may now be attached to the relevant policies of the emerging plan as a material consideration following publication of the Inspector's report, subject to any relevant recommended modifications in the Inspector's report.

Appendix 2 of the Local Plan provides detailed noise thresholds to determine the potential acoustic impact of new development.

In Summary, London Borough of Camden requires an assessment to be carried out in accordance with British Standard 4142:2014 and the results compared against noise-related conditions set out in Table C of the Appendix, as shown in Table 1 below:

Existing Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (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
Dwellings	Outside between window (façade)	Night	Rating level 10dB below background and no events exceeding 57dB LAmax	Rating level between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax	Rating level greater than 5dB above background and/or events exceeding 88dB LAmax

Table 1: London Borough of Camden Noise Limits

The scope of BS 4142:2014 advises that "*this British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature … to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*". BS 4142:2014 is commonly used to assess the potential for loss of amenity due to noise from mechanical services equipment and is considered appropriate for this application.

The assessment method of BS 4142:2014 corrects the specific sound level from the source under investigation to account for characteristics that could make the sound more intrusive to obtain a rating level. This rating level is compared against the prevailing background sound level outside the noise-sensitive property. Section 11 of BS 4142:2014 provides a commentary of the assessment result and advises that:

a) The greater the difference between the rating level and the background sound level, the greater the magnitude of the impact;
b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context;
d) The lower the rating level is 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. 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.

Assessment results shown within Appendix A of Camden's new Local Plan are shown to be more stringent than those set out in the British Standard and can therefore be taken to ensure a robust assessment. Compliance with the "Green" criteria or lower half of the "Amber" range will generally ensure no loss of amenity to nearby residents, albeit, the context of the development must also be considered on a project-by-project basis which can alter the initial assessment result. This is discussed in more detail in Section 4 below.

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

A planning application is being prepared, to include the installation of new mechanical equipment at The Water House, Millfield Lane, London. The proposed equipment will serve a residential dwelling and so have the potential to operate at any time over a full 24-hour period.

The surrounding area is a predominantly to residential dwellings. Closest noise-sensitive windows, used in this assessment, have been taken to be to the rear of a property on Fitzroy Park, nominally 22m from the equipment location with direct line-of-sight. Marked-up image from Google Earth is provided in Figure 1 below.

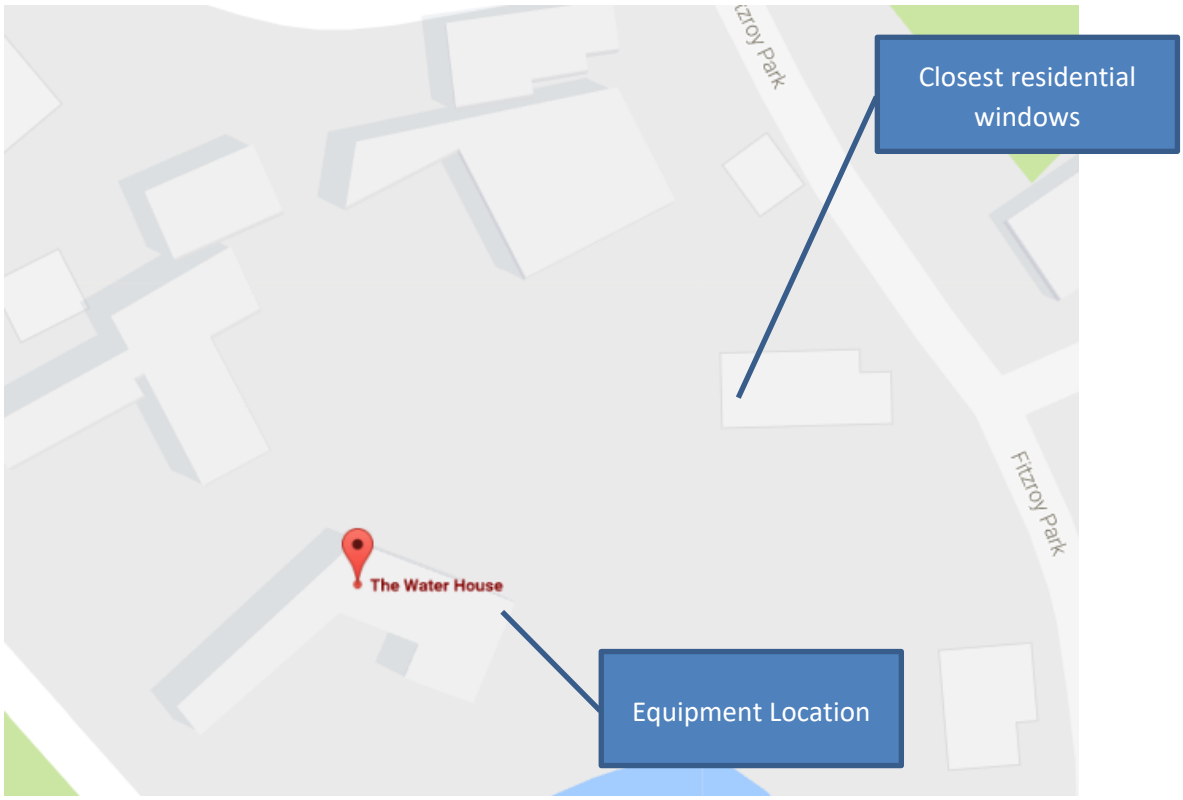

Figure 1: Site layout

4. SOUND LEVEL SURVEY

To assess sound levels from the mechanical services equipment it is necessary to establish sound levels in the vicinity. Details of the sound level survey carried out by ACA Acoustics Limited are provided below.

The sound level survey measurement position was selected to be equivalent to the nearest residential windows to the rear of the site, adjacent to the boundary with the property on Fitzroy Park. The site was considered secure and therefore an unattended survey was carried out over a 24-hour period between 6th and 7th June 2017. During the survey the weather included dry and calm periods.

The following equipment was used during the survey; the sound level meter was calibrated before and checked after the survey measurements with no change noted:

Equipment	Serial Number	Calibration Certificate
Rion sound level meter type NL-31 Class 1 complete with weatherproof and lockable outdoor environmental kit	00431030	1512668
NTi Audio calibrator type CAL200 94/114dB. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	11441	160915

Table 2: Equipment used

Results of the survey are provided in graphical form in Figure 2 on the following page.

In accordance with BS 4142:214, the prevailing background sound level is not necessarily taken to be the lowest recorded values, but rather the level that best represents the typical background sound level during a defined period. Commentary to Section 8 of the Standard discusses this further, noting that '*the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes.*' This acknowledges that continuous sound levels are likely to be of less significance, compared with short-term, transient events, which may result in greater levels of awakening and sleep disturbance. In this instance, the source sound is mechanical equipment which would not result in short-term high-noise events but rather a continuous low 'hum'. Therefore, in accordance with the Standard levels to the start and end of the night time period are likely to be the most significant.

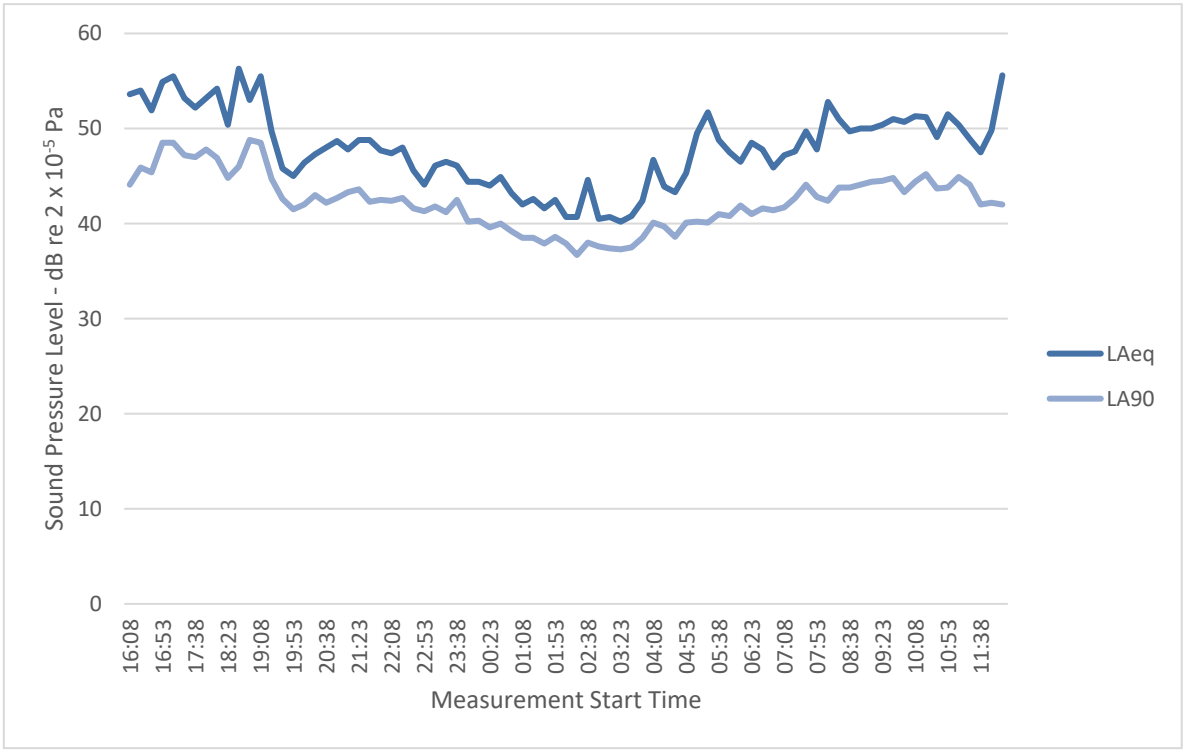

Figure 2: Sound level survey results

A statistical analysis of the measured sound levels has been carried out, generally following suggested guidance contained in Section 8 of the Standard. Distribution of the measured LA90 sound levels over the night time-period are shown in Figure 3 below.

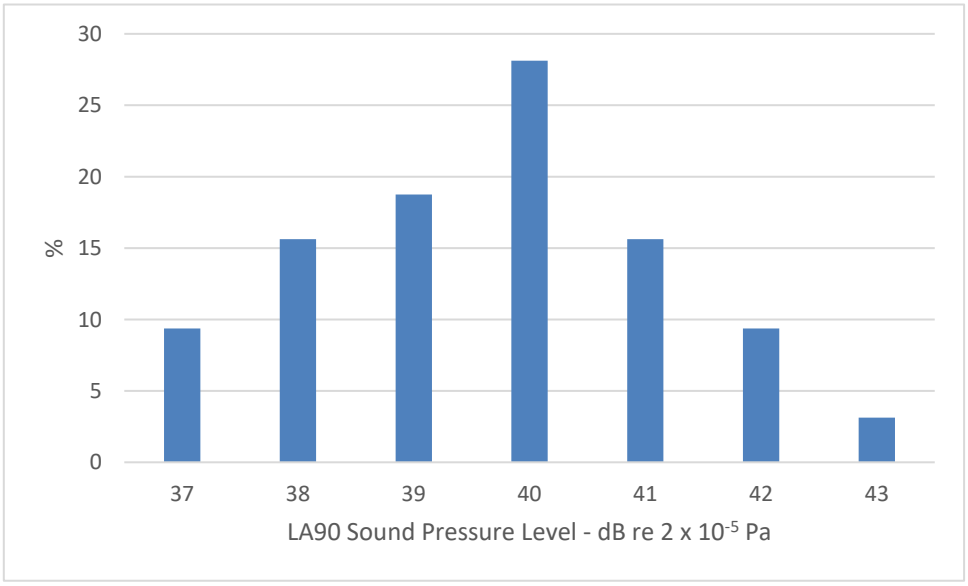

Figure 3: Statistical analysis of measured night time LA90 results

The values recorded by ACA Acoustics Limited are used as basis for acoustic design such that sound levels from the proposed new equipment are ≤30dBA outside the closest noise sensitive windows; this is at least 10dBA below the representative night time background sound level and at least 7dBA below the lowest measured background sound level. From results in Figure 3 it can be seen this will ensure noise from the new equipment is at least 10dBA below the lowest measured background sound level between 5am through to 1am, with only the times during the middle of the night when the background sound level drops slightly.

Confirmation of the background sound level used in the assessment is shown in **Error! Reference source not found.** below.

Survey Date	Existing Measured Background LA90, 15 min
6th to 7th June 2017	40dB

Table 3: Summary background sound level survey results

5. ACOUSTIC ASSESSMENT

The development includes the installation of two new MVHR units along with an external condensing unit. Confirmation of the equipment models used in the assessment is provided in Table 4 below. No information has been provided for other mechanical equipment, including a boiler and kitchen extract fan. These are anticipated to be low-noise, normal domestic-type, and therefore have been assumed to comply with the required criteria.

Description	Equipment Model
Ground Floor MVHR	Nuaire MRXBOX95AB-WH2
First Floor MVHR	Nuaire MRXBOX95B-LP1
Condensing Unit	Fujitsu AJY045LCLAH
Kitchen Extract Fan	LN2 GPE800
Loft Extract Fan	Nuaire DE5-ES
Swimming pool AHU	Heatstar XF EC2000 Superplus

Table 4: Proposed new mechanical equipment

Sound emissions from the mechanical equipment can be determined from manufacturer's published data. For the condensing unit the manufacturer provides sound power levels as single-figure dBA values only; typical octave band spectra have been used in the assessment, based on similar units to achieve the published single-figure value. Note that alterations in equipment selections may be possible, so long as sound power levels for the new item does not exceed levels used in the calculation model as shown in Appendix A.

A computer model has been used to calculate the noise contribution from the proposed plant to outside nearest noise-sensitive windows. The calculation model for the MVHR units uses ductwork system losses detailed in CIBSE Guide B5 and environmental corrections taken from ISO 9613-2:1996. The model for the condensers uses the assessment method set out in ISO 9613-2:1996.

The cumulative calculated specific sound level from the equipment to outside the closest noise sensitive windows is shown in Table 5. Summary print-outs from the calculation models are included in Appendix A.

Receptor Location	Calculated Equipment Sound Levels
Closest noise-sensitive windows	27dBA

Table 5: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Assessment of the calculated specific sound levels in accordance with BS 4142:2014 is provided in Table 6 below.

Description		Relevant Clause	Commentary
Calculated specific sound level to closest noise-sensitive windows	LAeq 27dB	7.1 7.3.6	Refer calculation sheets in Appendix A.
Background sound level	LA90 40dB	8.1.3 8.3	Representative night time background sound level.
Acoustic feature correction	+3dB	9.2	Calculations do not indicate any tonal element however mechanical equipment is often described as having a distinguishable characteristic. Therefore, in accordance with Section 9.2 a correction of +3dB is applied to account for these adverse characteristics.
Rating level	LAr 30dB		
Excess of rating level over background sound level	**-10dB**	**11**	**Assessment indicates negligible likelihood of adverse impact**

Table 6: BS 4142:2014 Assessment for all plant operating simultaneously

Table 6 shows that the overall rating level of the proposed new plant will be at least 13BA below the background LA90 sound level with all plant operating simultaneously to outside the closest noise-sensitive properties. During the earlier daytime period the background sound level is higher to be higher than the level used in the assessment and thus calculated levels would be even further below the prevailing background level at these times.

BS 4142:2014 requires an assessment to consider the context of the development, rather than simply adhering to numerical figures. The specific sound level of the new plant has been calculated to be at least 13dBA below the representative background sound level and 10dBA below the lowest measured background sound level to outside these closest noise-sensitive properties. At these levels noise from the new equipment should be subjectively inaudible to nearby occupants.

Considering the specific numerical value, allowing for a reduction of 15dBA through partially open windows, as described in BS 8233:2014, this equates to a level inside closest residential properties

from the new plant of 12dBA; significantly below the guideline sound level to bedrooms of LAeq 30dB set out in BS 8233:2014.

The author considers that the context of the assessment does not alter the initial estimate of the impact, and that sound levels from the new mechanical equipment should not be detrimental to the amenity of any residential occupiers in the vicinity. The calculation model includes benefit of noise control treatments to the equipment; discussion of suitable noise mitigation measures is provided in Section 6 of this report.

6. NOISE AND VIBRATION CONTROL TREATMENTS

Note that consideration of non-acoustic aspects including, but not limited to structural calculations, airflow and pressure drop, and construction material are outside the scope of ACA Acoustics Limited and should be considered by others accordingly. Alternative methods of attenuation to those detailed below may be acceptable, for example relocation of noisy equipment to other, less sensitive, areas of the development. Full details of any alternative scheme, including working drawings and expected attenuation should be submitted and approved prior to manufacture.

As discussed in Section 5 above, the calculated model includes benefit of noise control treatments to the new equipment.

For the MVHR, AHU, and extract fan units it is recommended duct-mounted silencers are installed to both the inlet and exhaust ductwork between the unit and external louvres for the MVHR units and AHU, and to the atmospheric side of the extract fans. Schedule of minimum insertion loss performance for the attenuators along with description of typical silencer to comply with the specified performance is provided in Appendix B. Note that the dimensions and free-area shown are nominal and the successful supplier should confirm their own selections to meet the minimum specified insertion loss performance at the system airflow rates.

The duct-mounted attenuators are readily available from most acoustic hardware suppliers, including Allaway Acoustics Limited (contact Chris Williams – Tel: 01992 550825).

For the condenser, it is recommended this is installed within a high-performance acoustic enclosure, such as those supplied by Environ Technologies Limited's (contact Simon Parker – Tel: 0870 383 3344) or equivalent. The enclosure may be clad or screened with trellis and planting or other finish as preferred aesthetically, so long as the acoustic and airflow performance is not affected.

7. CONCLUSION

New mechanical services equipment associated with a residential dwelling is to be installed at The Water House, Millfield Lane, London.

ACA Acoustics have undertaken a background sound level survey in the vicinity and calculated sound emissions from the proposed new equipment using manufacturer's published data.

The calculated cumulative rating level with all new equipment operating is at least 10dBA below the prevailing background sound level to outside the closest noise-sensitive properties. At this level, the new equipment fully complies with London Borough of Camden's requirements and will not be detrimental to the amenity of nearby residents.

The assessment includes benefit of noise control treatments set out in this report and no further mitigation measures would be required.

APPENDIX A

Acoustic Calculations

Calculation Sheet

Ground Floor MVHR Inlet to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Ground Floor MVHR Inlet									
Sound Power Levels		**55.0**	**52.0**	**51.0**	**55.0**	**45.0**	**39.0**	**34.0**	**33.0**
Silencer									
Attenuator - ATT1-GF MVHR									
Width (m)	0.2								
Height (m)	0.2								
% Free Area (%)	100.0								
Face Velocity (m/s)	1.5								
		-2.0	*-2.0*	*-4.0*	*-15.0*	*-26.0*	*-19.0*	*-19.0*	*-13.0*
Bend Loss									
Levels after bend		**53.0**	**50.0**	**46.0**	**38.0**	**16.1**	**17.1**	**12.1**	**17.0**
End Reflection - Rect Flush									
		-10.7	*-6.0*	*-2.6*	*-0.9*	*-0.2*	*-0.1*	*0.0*	*0.0*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**13.6**	**16.7**	**17.1**	**11.6**	**-8.8**	**-7.1**	**-11.7**	**-8.5**
		-28.9	*-28.9*	*-28.9*	*-28.9*	*-28.9*	*-29.1*	*-29.6*	*-31.4*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**13.6**	**16.7**	**17.1**	**11.6**	**-8.8**	**-7.1**	**-11.7**	**-8.5**

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Calculation Sheet

Ground Floor MVHR Exhaust to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Ground Floor MVHR Exhaust									
Sound Power Levels		**64.0**	**59.0**	**59.0**	**67.0**	**56.0**	**51.0**	**44.0**	**41.0**
Silencer									
Attenuator - ATT2-GF MVHR									
Width (m)	0.2								
Height (m)	0.2								
% Free Area (%)	100.0								
Face Velocity (m/s)	1.5								
		-2.0	*-2.0*	*-4.0*	*-15.0*	*-26.0*	*-19.0*	*-19.0*	*-13.0*
Bend Loss									
Levels after bend		**62.0**	**56.0**	**53.0**	**49.0**	**27.0**	**29.0**	**22.0**	**25.0**
End Reflection - Rect Flush									
		-10.7	*-6.0*	*-2.6*	*-0.9*	*-0.3*	*-0.1*	*0.0*	*0.0*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**22.9**	**23.0**	**24.3**	**22.8**	**2.2**	**5.0**	**-1.7**	**-0.5**
		-28.9	*-28.9*	*-28.9*	*-28.9*	*-28.9*	*-29.1*	*-29.6*	*-31.4*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**22.9**	**23.0**	**24.3**	**22.8**	**2.2**	**5.0**	**-1.7**	**-0.5**

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Calculation Sheet

First Floor MVHR Inlet to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - First Floor MVHR Inlet									
Sound Power Levels		**49.0**	**51.0**	**54.0**	**49.0**	**41.0**	**37.0**	**25.0**	**16.0**
Silencer									
Attenuator - ATT3-FF MVHR									
Width (m)	0.2								
Height (m)	0.2								
% Free Area (%)	100.0								
Face Velocity (m/s)	0.7								
		-2.0	*-2.0*	*-4.0*	*-15.0*	*-26.0*	*-19.0*	*-19.0*	*-13.0*
Bend Loss									
Levels after bend		**47.0**	**48.0**	**48.0**	**31.0**	**12.0**	**15.0**	**3.0**	**0.0**
End Reflection - Rect Flush									
		-10.8	*-8.6*	*-4.9*	*-0.8*	*5.8*	*0.4*	*0.5*	*0.0*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**7.0**	**11.4**	**16.2**	**4.2**	**-7.5**	**-9.1**	**-20.7**	**-25.5**
		-28.9	*-28.9*	*-28.9*	*-28.9*	*-28.9*	*-29.1*	*-29.6*	*-31.4*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**7.0**	**11.4**	**16.2**	**4.2**	**-7.5**	**-9.1**	**-20.7**	**-25.5**

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Calculation Sheet

First Floor MVHR Exhaust to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - First Floor MVHR Exhaust									
Sound Power Levels		**55.0**	**61.0**	**63.0**	**63.0**	**61.0**	**57.0**	**48.0**	**39.0**
Silencer									
Attenuator - ATT4-FF MVHR									
Width (m)	0.2								
Height (m)	0.2								
% Free Area (%)	100.0								
Face Velocity (m/s)	0.7								
		-2.0	*-2.0*	*-4.0*	*-15.0*	*-26.0*	*-19.0*	*-19.0*	*-13.0*
Bend Loss									
Levels after bend		**53.0**	**58.0**	**57.0**	**45.0**	**32.0**	**35.0**	**26.0**	**23.0**
End Reflection - Rect Flush									
		-13.5	*-9.6*	*-5.1*	*-2.0*	*-0.5*	*-0.2*	*-0.1*	*0.0*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**10.3**	**20.3**	**25.0**	**17.0**	**6.2**	**10.3**	**1.7**	**-2.6**
		-28.9	*-28.9*	*-28.9*	*-28.9*	*-28.9*	*-29.1*	*-29.6*	*-31.4*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**10.3**	**20.3**	**25.0**	**17.0**	**6.2**	**10.3**	**1.7**	**-2.6**

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Calculation Sheet

Kitchen Extract Discharge to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Kitchen Extract Discharge									
Sound Power Levels		**83.0**	**79.0**	**72.0**	**67.0**	**66.0**	**63.0**	**60.0**	**55.0**
Silencer									
Attenuator - ATT5-Cooker Hood									
Width (m)	0.2								
Height (m)	0.2								
% Free Area (%)	100.0								
Face Velocity (m/s)	5.5								
		-2.0	*-2.0*	*-4.0*	*-15.0*	*-25.6*	*-18.9*	*-18.8*	*-13.0*
Rect Unlined Duct Losses									
Levels after duct		**80.7**	**76.7**	**67.7**	**51.7**	**40.1**	**43.8**	**40.9**	**41.7**
Bend Loss									
Levels after bend		**80.7**	**75.7**	**65.7**	**48.7**	**37.2**	**40.8**	**37.9**	**38.7**
Rect Unlined Duct Losses									
Levels after duct		**78.9**	**74.2**	**64.2**	**47.2**	**35.7**	**39.3**	**36.4**	**37.2**
Bend Loss									
Levels after bend		**78.9**	**73.2**	**62.2**	**44.3**	**32.9**	**36.4**	**33.5**	**34.3**
End Reflection - Rect Flush									
		-15.0	*-9.7*	*-5.1*	*-1.5*	*2.8*	*0.7*	*0.5*	*0.1*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**34.6**	**30.9**	**23.5**	**7.1**	**-2.9**	**-4.9**	**-12.0**	**-15.1**
		-31.9	*-31.9*	*-31.9*	*-31.9*	*-31.9*	*-32.1*	*-32.6*	*-34.4*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**34.6**	**30.9**	**23.5**	**7.1**	**-2.9**	**-4.9**	**-12.0**	**-15.1**

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Calculation Sheet

AHU - Exhaust Air to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - AHU - Exhaust Air									
Sound Power Levels		**67.7**	**69.5**	**67.7**	**69.1**	**66.3**	**68.1**	**65.3**	**56.0**
Silencer									
Attenuator - ATT6-AHU Exhaust									
Width (m)	0.5								
Height (m)	0.5								
% Free Area (%)	35.0								
Face Velocity (m/s)	5.7								
		-10.9	*-18.7*	*-24.5*	*-31.1*	*-31.9*	*-28.9*	*-20.8*	*-13.9*
Rect Unlined Duct Losses									
Levels after duct		**55.9**	**50.4**	**42.6**	**37.6**	**34.0**	**38.8**	**44.1**	**41.7**
End Reflection - Rect Flush									
		-13.4	*-8.2*	*-3.9*	*-1.2*	*0.0*	*-0.1*	*0.0*	*0.0*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**10.4**	**11.4**	**8.9**	**7.4**	**5.7**	**11.2**	**16.8**	**12.8**
		-31.9	*-31.9*	*-31.9*	*-31.9*	*-31.9*	*-32.1*	*-32.6*	*-34.4*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**10.4**	**11.4**	**8.9**	**7.4**	**5.7**	**11.2**	**16.8**	**12.8**

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Calculation Sheet

AHU - Fresh Air to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - AHU - Fresh Air									
Sound Power Levels		**65.6**	**66.2**	**63.8**	**64.5**	**61.7**	**63.4**	**60.9**	**52.4**
Silencer									
Attenuator - ATT6-AHU Intake									
Width (m)	0.5								
Height (m)	0.5								
% Free Area (%)	35.0								
Face Velocity (m/s)	5.7								
		-7.9	*-13.8*	*-21.4*	*-26.8*	*-27.6*	*-28.9*	*-24.3*	*-15.8*
Rect Unlined Duct Losses									
Levels after duct		**57.2**	**52.2**	**42.1**	**37.5**	**33.9**	**34.3**	**36.4**	**36.4**
End Reflection - Rect Flush									
		-13.4	*-8.3*	*-3.9*	*-1.2*	*0.0*	*0.1*	*0.0*	*0.0*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**12.6**	**11.7**	**5.3**	**2.0**	**-2.2**	**-3.7**	**-3.9**	**-6.6**
		-31.9	*-31.9*	*-31.9*	*-31.9*	*-31.9*	*-32.1*	*-32.6*	*-34.4*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**12.6**	**11.7**	**5.3**	**2.0**	**-2.2**	**-3.7**	**-3.9**	**-6.6**

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Calculation Sheet

Loft Extract Fan to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Loft Extract Fan									
Noise Levels		**89.0**	**87.0**	**72.0**	**67.0**	**61.0**	**56.0**	**51.0**	**45.0**
Silencer									
Attenuator - ATT7-Loft fan									
Width (m)	0.4								
Height (m)	0.4								
% Free Area (%)	35.0								
Face Velocity (m/s)	7.1								
		-8.0	*-14.0*	*-21.8*	*-26.0*	*-23.2*	*-19.1*	*-14.9*	*-13.6*
Bend Loss									
Levels after bend		**81.0**	**72.0**	**48.7**	**41.0**	**38.5**	**37.0**	**35.2**	**30.8**
Circ Unlined Duct Losses									
Levels after Loss		**80.8**	**71.8**	**48.5**	**40.8**	**38.3**	**36.8**	**35.0**	**30.6**
End Reflection - Rect Flush									
		-15.0	*-9.7*	*-5.0*	*-1.1*	*0.9*	*1.4*	*1.1*	*0.9*
External Grille Directivity									
ISO 9613 Calculation									
Direct Lp		**36.4**	**29.4**	**9.8**	**3.9**	**0.4**	**-4.0**	**-10.0**	**-18.1**
		-32.0	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.2*	*-32.7*	*-34.6*
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**36.4**	**29.4**	**9.8**	**3.9**	**0.4**	**-4.0**	**-10.0**	**-18.1**

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Calculation Sheet

Condenser to Fitzroy Park

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Condenser									
Sound Power Levels		**75.0**	**71.0**	**68.0**	**67.0**	**63.0**	**58.0**	**58.0**	**48.0**
Noise Control Treatments									
Treatment - AE1									
		-14.0	*-16.0*	*-23.0*	*-30.0*	*-37.0*	*-39.0*	*-38.0*	*-39.0*
ISO 9613 Calculation									
Horiz. Distance (m)	22.0								
Source Height (m)	3.5								
Receiver Height (m)	2.5								
Barrier - No Barrier									
Distance to Barrier (m)	-								
Barrier Height (m)	-								
Screening at (m)	-								
Q Factor - Junction									
Direct Lp		**32.1**	**26.1**	**16.1**	**8.1**	**-2.9**	**-10.1**	**-9.6**	**-22.4**
External Receiver									
External Receiver - Fitzroy Park									
Sound Pressure, Lp		**32.1**	**26.1**	**16.1**	**8.1**	**-2.9**	**-10.1**	**-9.6**	**-22.4**

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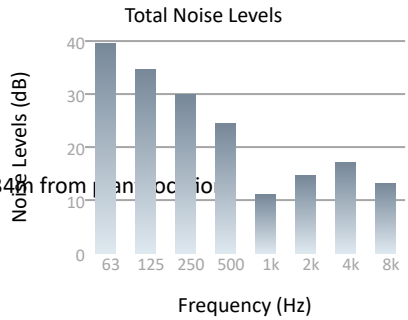
The Water House, London N6

Project Name	The Water House, London N6
Project Reference	170522
Reference	Fitzroy Park
Description	Residential property on Fitzroy Park, nominally 34m from [illegible]
Noise Limit	27
dBA	26.9



Noise Sources

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Ground Floor MVHR Inlet	1	13.6	16.7	17.1	11.6	-8.8	-7.1	-11.7	-8.5
Ground Floor MVHR Exhaust	1	22.9	23	24.3	22.8	2.2	5	-1.7	-0.5
Condenser	1	32.1	26.1	16.1	8.1	-2.9	-10.1	-9.6	-22.4
First Floor MVHR Inlet	1	7	11.4	16.2	4.2	-7.5	-9.1	-20.7	-25.5
First Floor MVHR Exhaust	1	10.3	20.3	25	17	6.2	10.3	1.7	-2.6
Kitchen Extract Discharge	1	34.6	30.9	23.5	7.1	-2.9	-4.9	-12	-15.1
AHU - Exhaust Air	1	10.4	11.4	8.9	7.4	5.7	11.2	16.8	12.8
AHU - Fresh Air	1	12.6	11.7	5.3	2	-2.2	-3.7	-3.9	-6.6
Loft Extract Fan	1	36.4	29.4	9.8	3.9	0.4	-4	-10	-18.1

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APPENDIX B

Typical Noise Control Treatments

The Water House, London N6

Schedule of Noise Control Treatments

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
ATT1-GF MVHR	Ground Floor MVHR Inlet	200dia 625L	2	2	4	15	26	19	19	13
ATT2-GF MVHR	Ground Floor MVHR Exhaust	200dia 625L	2	2	4	15	26	19	19	13
ATT3-FF MVHR	First Floor MVHR Inlet	200dia 625L	2	2	4	15	26	19	19	13
ATT4-FF MVHR	First Floor MVHR Exhaust	200dia 625L	2	2	4	15	26	19	19	13
AE1	Condenser Enclosure	Environlite Acoustic Enclosure	14	16	23	30	37	39	38	39
ATT5-Cooker Hood		200dia 625L	2	2	4	15	26	19	19	13
ATT6-AHU Exhaust		1200L 35% Free Area c/w Melinex	11	19	25	34	41	30	21	14
ATT6-AHU Intake		900L 35% Free Area	8	14	22	30	40	34	26	16
ATT7-Loft fan		900L 35% Free Area	8	14	22	30	40	34	26	16

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