NOISE IMPACT ASSESSMENT

Client: - ANVA Ltd

Project: - 71 Great Titchfield Street

Issue Date: - November 2018
Reference: - Qt11570
Revision: - 001

Qt Acoustics Ltd
Whitecroft,
Prospect Road,
Ash Vale
Surrey,
GU12 5EL.
Tel: - 01252 444948
Email: - consult@qtacoustics.co.uk

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Qt Acoustics were appointed by ANVA Ltd to review the acoustic impact of the relocation of mechanical services plant serving the ground floor restaurant "Bellaria" and so as to facilitate an extension of the upper floors of the property used for residential purposes and located at 71 Great Titchfield Street, London, W1W 6RB.

This report demonstrates that the proposed relocation of mechanical plant with the proposed acoustic mitigation measures are in compliance with the local authority planning policy.

Environmental noise monitoring of the site has been undertaken and representative noise levels have been recorded to allow assessment in accordance with local planning requirements. Noise level calculations have been performed to predict the noise rating level of the proposed mechanical services plant in relation to the local planning conditions for noise emission.

Relevant standards in the form of model planning conditions from Westminster City Council (WCC) have been considered. A comprehensive noise control package has been selected in order to provide sufficient mitigation of the proposed plant so as to provide a low impact to neighbouring noise sensitive properties and comply with the model planning conditions.

1.0 Introduction

It is proposed to extend the residential accommodation on upper floors of 71 Great Titchfield Street to incorporate an additional 4th floor and cycle store at 1st floor level. In order to facilitate the newly proposed cycle store it is therefore necessary to relocate the existing mechanical services plant serving the restaurant located at ground-floor & basement level of the building. The existing mechanical services plant equipment is to be retained without alteration but relocated from ground floor roof to 1st floor roof level.

The property is in an area of mixed residential and commercial use.

Qt Acoustics have therefore been commissioned to undertake a detailed environmental noise assessment of the site in line with local planning conditions.

2.0 Objectives

The objectives of this assessment are:

- To establish, by means of environmental noise monitoring, the existing noise climate of the site.
- To measure the existing L_{A90} (background noise level) at a location representative of the noise climate currently experienced at neighbouring noise sensitive properties.
- To propose suitable plant noise emission criteria based on relevant Standards and Planning Requirements.
- To perform predicted noise level calculations of the proposed plant incorporating any acoustic mitigation measures to provide a detailed assessment of the noise impact on neighbouring noise sensitive properties and specifically in relation to local planning condition requirements.

This report presents the results of the noise survey and the subsequent impact assessment of the mechanical services plant with any associated acoustic mitigation measures.

3.0 Site Description

The site is located at 71 Great Titchfield Street, London, W1W 6RB and falls within the boundary of Westminster City Council (WCC). 71 Great Titchfield Street is used for commercial restaurant purposes at basement & ground floor levels with upper floors used for residential purposes.

Mechanical services plant serving the restaurant is currently located on the ground floor roof, to the rear of the property and overlooking a rear light-well area shared with other surrounding properties and containing many items of mechanical services plant serving neighbouring properties. Internal access stairways serving the residential properties within 71 Great Titchfield Street are located to the rear of the property and as such the noise sensitive residential properties located within 71 Great Titchfield Street do not contain windows to the rear elevation of the property and are not impacted by external noise emission from the mechanical services plant.

Surrounding properties are generally commercial in nature with noise sensitive commercial properties being identified in the adjacent Grange Langham Court Hotel at 31-35 Langham Street.

The nearest noise sensitive properties are located as follows: -

- **Residential A – 2nd Floor of Grange Langham Court Hotel, Window to the rear located adjacent to plant location.**
- **Residential B – 4th Floor of Grange Langham Court Hotel, Window to the rear located adjacent to exhaust fan duct discharge location.**

71 Great Titchfield Street is located in the Westminster area of London and between Euston Road and Oxford Street and in close proximity to Regent Street.

Please see Appendix D for a map of the area.

4.0 Acoustic Criteria

Local authority planning conditions and relevant British Standards are relevant in noise impact assessments. Criteria relating to noise emission from mechanical services plant is detailed below.

4.1 Local Authority Specific Planning Conditions.

Westminster City Council (WCC) have advised the model planning policy for this proposed mechanical services would be:-

*"**POLICY ENV 7: CONTROLLING NOISE FROM PLANT, MACHINERY AND INTERNAL ACTIVITY***
(A) Where development is proposed, the City Council will require the applicant to demonstrate that this will be designed and operated so that any noise emitted by plant and machinery and from internal activities, including noise from amplified or unamplified music and human voices, will achieve the following standards in relation to the existing external noise level at the nearest noise sensitive properties, at the quietest time during which the plant operates or when there is internal activity at the development.

***1)** where the existing external noise level exceeds WHO Guideline levels of LAeq,12hrs 55dB daytime (07.00- 19.00); LAeq,4hrs 50dB evening (19.00-23.00); LAeq,8hrs 45dB night-time (23.00-07.00):*

Either
(a) and where noise from the proposed development will not contain tones or be intermittent sufficient to attract attention, the maximum emission level (LAeq15min) should not exceed 10 dB below the minimum external background noise at the nearest noise sensitive properties. The background noise level should be expressed in terms of LA90,15min.
or
(b) and where noise emitted from the proposed development will contain tones, or will be intermittent sufficient to attract attention, the maximum emission level (LAeq15min) should not exceed 15 dB below the minimum external background noise at the nearest noise sensitive properties. The background noise level should be expressed in terms of LA90,15min.

***2)** where the external background noise level does not exceed the above WHO Guideline levels, policy ENV 7(A)(1)(a) and (b) will apply except where the applicant is able to demonstrate to the City Council that the application of slightly reduced criteria of no more than 5 dB will provide sufficient protection to noise sensitive properties:*

Either
(a) where noise emitted from the proposed development will not contain tones or be intermittent sufficient to attract attention, the maximum emission level (LAeq15min) should not exceed 5dB below the minimum external background noise level at the nearest noise sensitive properties. The background noise levels should be expressed in terms of LA 90, 15min.
or
(b) where noise emitted from the proposed development will contain tones or will be intermittent sufficient to attract attention, the maximum emission level (LAeq15min) should not exceed 10 dB below the minimum external background noise level at the nearest noise sensitive properties. The background noise levels should be expressed in terms of LA 90, 15min."

5.0 Environmental Noise Survey

5.1 Instrumentation

The environmental nose survey was undertaken using the following equipment:-
NTI Audio XL2 Serial No. A2A-08390-E Class 1 integrating and data logging sound level meter conforming to the relevant sections of BS EN 61672-1:2013
NTI Audio M2230 microphone monitoring assembly comprising of MA220 pre-amp - serial no. 1973 and microphone capsule serial number 9158 class 1 conforming to the relevant sections of BS EN 61672-1:2013.

Full calibration certificates are provided within Appendix H.

5.2 Measurement Position

Our survey concluded that the nearest/most impacted noise sensitive property (Marked as "A" within figure 5.2.1) is located to the rear of 71 Great Titchfield Street, at 2nd floor level and incorporates a window overlooking the rear light well area nominally 4 metres from the proposed plant location. The noise monitoring instrumentation was located at 1st Floor roof level, to the rear of 71 Great Titchfield Street and in close proximity to the neighbouring noise sensitive windows.

Figure 5.2.1 – Noise Monitoring Position and Nearest Residential Properties (Note SLM = Sound Level Meter Noise Monitoring Position)

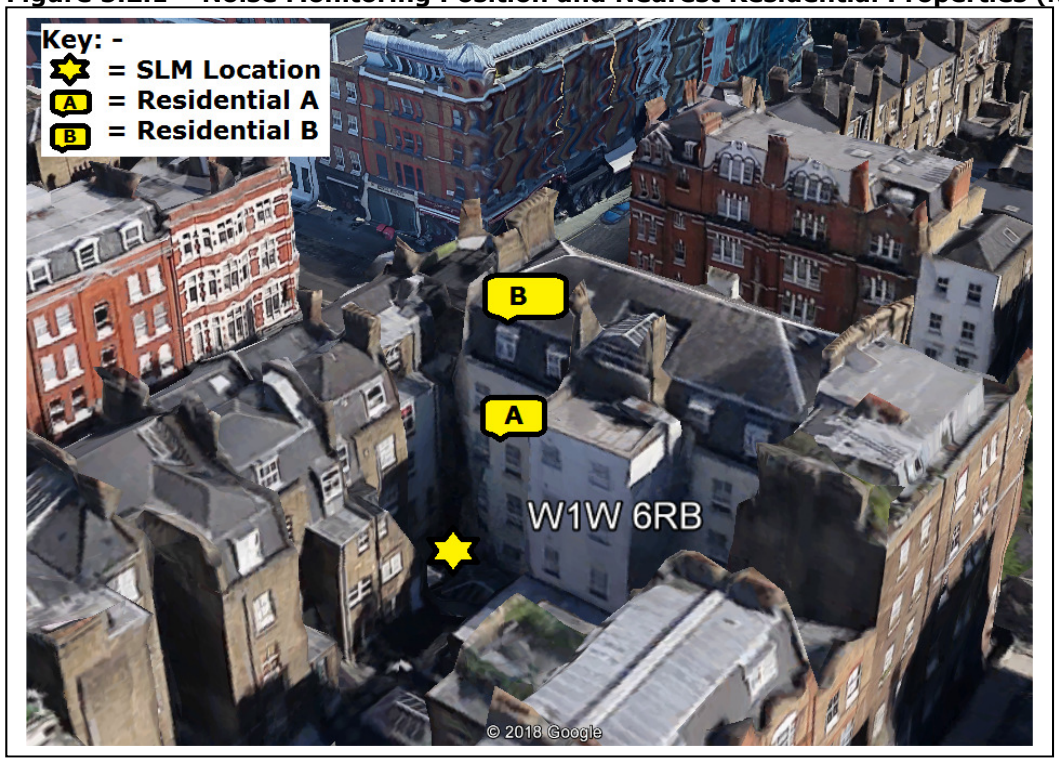
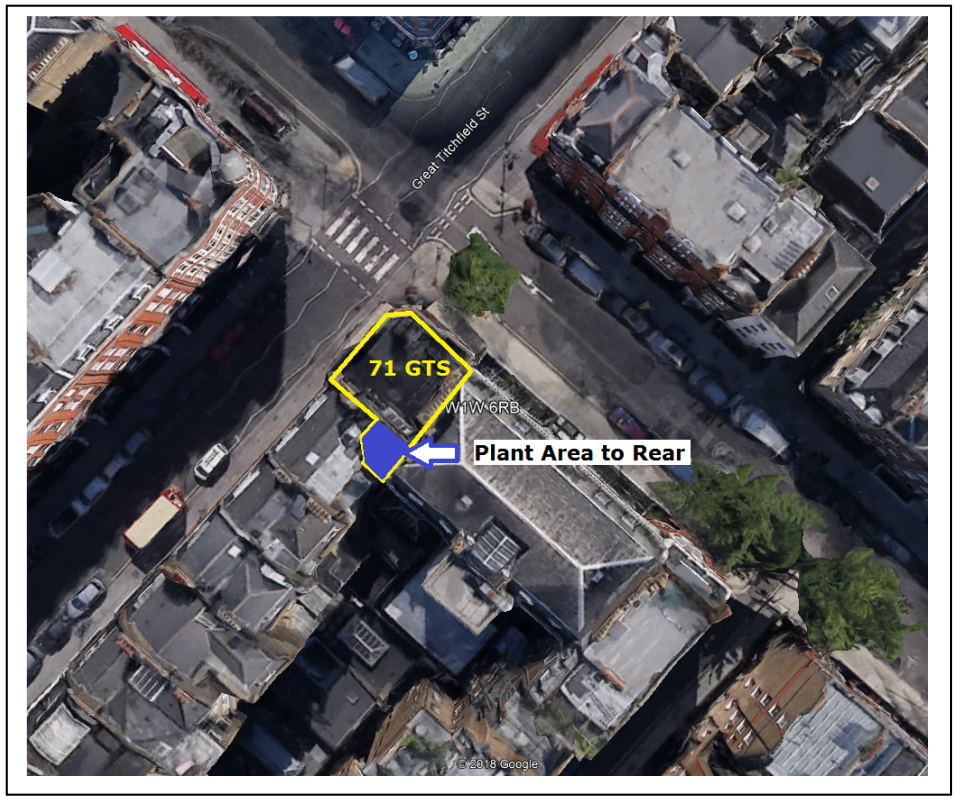


Figure 5.2.2 – Position of Mechanical Plant and Aerial View of 71 Great Titchfield Street (71 GTS).



Additional noise sensitive properties were identified around 71 Great Titchfield Street but are either at a greater distance or benefit from being in the acoustic shadow of the building.

5.3 Measurement Procedure

The noise monitoring equipment was configured to monitor consecutive 15 minute samples of the site noise level over a period of 57-hours. Measurements were logged concurrently for the ambient sound level ($L_{Aeq,15\ min}$), background Noise Level ($L_{A90,15\ min}$) and $L_{A10,15\ min}$ (Often used as a traffic noise percentile). The noise monitoring was predominantly an unattended test and as such the sound level meter was also configured to record a continuous audio sample of the entire test duration to assist with identification of any extraneous noise sources.

The microphone monitoring assembly was located at a height of 1.5 metres above the first-floor flat roof level and at a distance of nominally 3.5 metres from any neighbouring façade (in this instance that of the nearest noise sensitive property). The sound level meter manufacturer's windshield and bird spike assembly were used in order to minimise risk of external interference.

The environmental noise monitoring was performed from 14:15 hours on Monday 22nd October 2018 to 22:25 hours on Wednesday 24th October

2018 with additional attended noise monitoring between 22:25 and 23:25 hours on Wednesday 24th October 2018.

It was not possible to shut-down the existing mechanical services equipment serving the restaurant and as such noise monitoring recorded generally between the hours of around 08:00 to 22:30 were impacted by existing plant noise and are not used for assessment of residual background noise level purposes. Following discussion with Anthony Robinson the Environmental Health Officer appointed to the case by WCC; it was agreed that the residual background noise level should be established by short-term attended test and so as to provide a period when the existing equipment was definitively not in operation. As such this report presents the noise data recorded over the entire period with formal assessment of the residual background noise level during sample periods immediately prior to plant switch on and/or immediately post equipment shut-down.

A field calibration check of the sound level meter and microphone monitoring assembly was undertaken before and after the noise measurement. No deviation was recorded and a microphone sensitivity of 36.4 mV/Pa maintained.

The procedure, measurements and interpretation were all undertaken in accordance with BS7445, parts 1&2. All provided sound pressure level measurements are referenced to $2x10^{-5}$ Pa.

5.4 Weather Conditions

The noise monitoring period was without precipitation and the ground surface was dry. The weather conditions were recorded for the duration of the noise monitoring period and indicated stable weather suitable for test purposes. The details are provided below:-

Test	Temperature	Wind Speed	Wind Direction	Cloud Cover
	°C	m/s		%
Maximum	17	4.3	NNE	50%
Minimum	6	0.0	WNW	0%

As such the prevailing weather conditions during the noise monitoring period are deemed to be suitable for the purpose of environmental noise testing and would not result in excessive external interference to measurement.

5.5 Site Noise Climate

The area surrounding 71 South Street is predominantly commercial in nature with noise sensitive windows located to the rear of the site and serving the adjacent Grange Langham Court hotel at 33-35 Langham Street.

The main noise source within the area is traffic noise from the surrounding road network. Whilst Great Titchfield Street is not a high traffic street the road network density within this area of London results in an underlying noise from vehicle movements.

Neighbouring commercial properties located near to the site contain large quantities of mechanical services plant and contribute to the noise climate in the area. The light-well area to the rear of the property contains around 6-8 air conditioning condensing units and 2 off ventilation fans associated with neighbouring properties.

Mechanical services plant associated with the ground floor restaurant was the dominant noise source during periods of plant operation and generally between 08:00 hours through to 22:30 hours.

Intermittent noise from over ground rail was not detectable at the site although main line rail track and underground stations are nearby nominally 400 metres away.

Intermittent aircraft noise was identified and presumed from Heathrow and London City airport, other air traffic was also present in the form of helicopter movements across London.

6.0 Measurement Result Summary

A 57-hour part attended noise test was undertaken at 1st floor roof level of and to the rear of 71 Great Titchfield Street and in close proximity to the nearest noise sensitive property facade. The full results are provided in graphical and numerical format within Appendix B & C. A summary of the results is provided in table 6.1 & 6.2 below NOTE: - For the purposes of assessment of planning policy the average L_{Aeq} results have been based on periods when the existing (and to be relocated and attenuated) mechanical services plant was not operating.

Table 6.1 Summary of Minimum Background Noise Levels – Day/Eve/Night

Time Period	Lowest Background Noise Level
	$L_{A90, 15min}$
Day-Time (07:00-08:00 hrs)	45 dB
Evening (22:00-23:00 hrs)	40 dB
Night (23:00-07:00 hrs)	40 dB

The proposed plant is to be operated generally to suit the requirements of the restaurant and primary ventilation & air-conditioning plant is to operate between the hours of 0800-2300 and the cold-room external refrigeration condenser 24 hours a day.

Table 6.2 Summary of Average Noise Levels – Day/Eve/Night

Time Period	Average Noise Level (Existing Plant Not Operating)	WHO/WCC Env 7 Policy Criteria
	$L_{Aeq, T}$	$L_{Aeq, T}$
Day-Time (07:00-19:00 hrs) T=12 hours	48.7 dB	55 dB
Evening (19:00-23:00 hrs) T = 4 hours	43.7 dB	50 dB
Night (23:00-07:00 hrs) T = 8 hours	44.5 dB	45 dB

From table 6.2 we can determine that existing noise levels at the rear of the site do not exceed the test criteria as set out within WCC Policy ENV7. We can therefore determine that limiting noise criteria as defined within section A2a of Policy ENV7 of the WCC adopted UDP applies on the basis that the plant is not considered tonal or intermittent in nature sufficient to attract attention. This section requires the mechanical services plant to be demonstrably 5 dB(A) quieter than the existing lowest measured background noise level (L_{A90}) over the periods of plant operation.

In order to comply with the requirements of the planning condition of 5 dB below lowest measured background noise level the following limits should be applied to any noise generated by the proposed mechanical services when extrapolated to the nearest noise sensitive property:-

Table 6.3 – Plant Noise Limits – WCC adopted UDP ENV7 A2a Planning Condition

Time Period	Plant Noise Limits
	$L_{Aeq, 15min}$
Plant Operating Hours (0800-2300 hrs)	35 dB *
Plant Operating Hours (24 hrs)	35 dB *

* In accordance with planning policy guidance detailed within section 4.1 – noise that is considered to be tonal in nature should be **5 dB** quieter than detailed within table 6.3.

7.0 Plant Noise Emission

The existing mechanical services plant has been measured to generate a noise level of around 55-60 dB(A) at 1 metre outside of neighbouring noise sensitive property windows or nominally 15-20 dB above the residual background noise level and as such is considered excessive and sufficiently above the residual noise level to attract justifiable complaint.

It is proposed to relocate the existing mechanical services plant in the same location of the site in plan view but raised by nominally 2.8 metres to facilitate space for the addition of a cycle store. The relocation of said mechanical services plant has negligible effect on the equipment noise level as experienced at neighbouring noise sensitive windows but due to the high noise level and potential for complaint; is to incorporate acoustic mitigation treatment to satisfy planning policy requirements. The proposed relocation of the mechanical services plant is to be generally in accordance with the 2nd floor roof plan drawing provided within Appendix E and is to incorporate acoustic mitigation treatment to reduce noise emission to neighbouring noise sensitive properties. This section summarises the plant, typical acoustic mitigation treatment that is to be installed and provides a noise impact assessment with reference to the planning condition requirements.

7.1 Plant Information and Operation

The proposed plant is to be installed on the proposed 1st floor roof and within a dedicated plant compound & housing and generally as per the attached 2nd floor roof plan provided within Appendix E.

The operating hours of the mechanical services plant varies subject to the requirements of the restaurant and as such the equipment has been split into 2 categories: -

- Category 1 – Primary Ventilation & Air Conditioning Plant to operate between the hours of 0800 to 2300 to provide essential ventilation and temperature control of kitchen & restaurant space.
- Category 2 – Cold-room external condensing unit to operate 24-hours a day to maintain food stuff temperatures.

7.1.1 The proposed mechanical services plant consists of the of the following equipment:-

Category 1 Items

- **Item 1** – Daikin RZQS140D7V1 External Air Conditioning Condensing Unit – 54 dB(A) @ 1 metre [1]
  [1] The Manufacturer's published noise levels in octave bands are provided within Appendix F.
- **Item 2** – Flakt Woods 56JM/20/4/6/28 Kitchen Extract Fan – 36 dB(A) @ 3 metres Case Radiated SPL & 60 dB(A) @ 3 metres from Fan Outlet [2]
- **Item 3** – Vent-Axia QP200B make-up air fan – 36 dB(A) @ 3 metres from Fan Inlet [2]

Category 2 Items

- **Item 4** – CR18TN3MR Cold-room Condensing Unit – 68 dB SWL(A) [3]
  [1] The Manufacturer's published noise levels in octave bands are provided within Appendix F.
  [2] The Manufacturer's published in-duct noise levels in octave bands are provided within Appendix F.
  [3] The Manufacturer's published sound power levels are provided within Appendix F, spectral data is based on prior noise monitoring of similar units held on file by Qt Acoustics.

7.2 Acoustic Mitigation Treatment

The relocated mechanical services plant has been reviewed and noise level calculations performed to predict the acoustic impact on the nearest neighbouring noise sensitive property windows. In order to reduce the acoustic impact an acoustic mitigation package has been developed and the following minimum standards for the acoustic mitigation package are to be incorporated: -

Plant Compound: -

A plant compound is to be formed of a pre-fabricated panel structure comprising of 140-150mm thick insulated wall panel system such as Kingspan KS1000 system and of not less than 14 kg/m^2 surface density.

Plant Item 1 – Daikin RZQS140D7V1 External Air Conditioning Condensing Unit. The equipment is to be installed using proprietary rubber-in-shear type vibration isolation mounts to reduce vibration transmission into the building structure and selected to suit the equipment weight. The equipment is to be housed within the plant compound and attenuated inlet & exhaust air paths are to be incorporated and formed by adoption of duct type attenuators offering the following minimum specification and attenuation:-

Item 1 Attenuator Specification	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Inlet Air Attenuator - Insertion Loss (dB)	6	11	19	33	43	41	36	28
Exhaust Air Attenuator - Insertion Loss (dB)	6	11	19	33	43	41	36	28

Performance typical of 25-27% free area attenuator of 900mm long. Expected cross-section to be 1350mm W x 1350mm H minimum and to be sized suit A/C unit & coldroom condenser airflow requirements.

Plant Item 2 – Flakt Woods 56JM/20/4/6/28 Kitchen Extract Fan.

- The fan is to be installed within the plant compound and within a bespoke acoustic fan box enclosure manufactured from proprietary 50mm high-density acoustic panel-work complete with internal absorption & incorporating internal flexible duct connections & 25mm deflection spring type vibration isolators and enclosure offering the following minimum specification: -

Item 2 Acoustic Enclosure Specification	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Exhaust Fan Acoustic Enclosure Minimum Noise Reduction (dB)	11	17	22	28	33	40	41	37

Performance typical of a 50mm high density proprietary acoustic panel-work enclosure with internal absorption faces.

- The fan outlet duct connection is to incorporate a duct attenuator located immediately off the acoustic fan box and within the exhaust duct and offering the following minimum specification and attenuation: -

Item 2 Attenuator Specification	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Exhaust Air Attenuator - Insertion Loss (dB)	7	17	29	39	40	29	20	12

Performance typical of a 40-43% free Area duct attenuator of nominally 2400mm long and incorporating Melinex lining. Nominal dimensions 700mm W x 700mm D x2400mm L (TBC by specialist supplier for desired air volume flow).

- The fan inlet duct connection is to incorporate a duct attenuator located immediately off the acoustic fan box and within the extract duct (whilst the extract duct does not have a direct noise path to outside it is considered good practice to reduce internal noise levels within the kitchen area). The attenuator is to offer the following minimum specification and attenuation: -

Item 2 Attenuator Specification	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Extract Air Attenuator - Insertion Loss (dB)	4	9	16	23	23	18	14	13

Performance typical of a circular attenuator of 560mm internal diameter 1120mm long with internal pod and Melinex lining. (TBC by specialist supplier for desired air volume flow).

Plant Item 3 – Vent-Axia QP200B make-up air fan. The equipment is to be installed using proprietary rubber-in-shear type vibration isolation mounts to reduce vibration transmission into the building structure and selected to suit the equipment weight. The equipment is to be housed within the plant compound and the fresh air inlet air path is to incorporate a duct mounted attenuator offering the following minimum specification: -

Item 3 Attenuator Specification	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Fresh Air Inlet Attenuator - Insertion Loss (dB)	2	4	6	17	27	24	22	14

Performance typical of a circular attenuator of 200mm internal diameter 900mm long. (TBC by specialist supplier for desired air volume flow).

Plant Item 4 – CR18TN3MR Cold-room Condensing Unit. The equipment is to be installed using proprietary rubber-in-shear type vibration isolation mounts to reduce vibration transmission into the building structure and selected to suit the equipment weight. The equipment is to be housed within the plant compound and attenuated inlet & exhaust air paths are to be incorporated and formed by adoption of duct type attenuators offering the following minimum specification and attenuation:-

Item 4 Attenuator Specification	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Inlet Air Attenuator - Insertion Loss (dB)	6	11	19	33	43	41	36	28
Exhaust Air Attenuator - Insertion Loss (dB)	6	11	19	33	43	41	36	28

Performance typical of 25-27% free area attenuator of 900mm long. Expected cross-section to be 1350mm W x 1350mm H minimum and to be sized suit A/C unit & Coldroom condenser airflow requirements.

Vibration Control
All plant items are to be installed using vibration isolation mounts and as defined within the above relevant plant sections and in accordance with CIBSE guidelines.

7.3 Plant Noise Assessment

Plant noise levels with appropriate acoustic mitigation treatment, as detailed within section 7.2, and with plant located as per Appendix E have been calculated for the proposed periods of operation and extrapolated to 1 metre from the nearest noise sensitive property windows. The calculations have been performed with the plant operating at full speed and in the noisier heating mode in the instance of the AC unit and as such represent a worst case scenario and one that is only occasionally experienced in practice. A full and detailed set of calculations are provided within Appendix G.

Our calculations indicate the following predicted noise levels: -

Noise Sensitive Receptor	Predicted Noise Level $L_{Aeq,T}$ dB	
	0800-2300 hrs	2300-0800 hrs
Residential A	28 dB(A)	21 dB(A)
Residential B	28 dB(A)	14 dB(A)

7.3.1 WCC Model Planning Criteria

The proposed plant is not considered to contain impulsive sounds. It is generally inverter speed controlled to slowly vary plant operating speeds in line with building requirements or during start-up and shut-down. As such it would not regularly cycle on and off or rapidly change speed so as to cause intermittent or impulsive type sounds. The acoustic mitigation treatment has been selected so as to remove, where reasonably practicable, the tonality of the individual item of plant. The low level of the specific sound when extrapolated to noise sensitive properties in relation to the typical background noise level (of not less than 12 dB below the lowest background noise level) will provide a level of masking of any residual plant tonality or other acoustic characteristics. We consider the proposed plant complete with acoustic mitigation to not be tonal in nature sufficient to attract attention. As such the model planning criteria indicated by WCC requires the plant to be 5 dB below the lowest background noise level when extrapolated to the nearest or most affected noise sensitive property as set out within table 6.3.

Our detailed calculations (provided within Appendix G) indicate that with the package of noise control treatment (as detailed within section 7.2) the requirements of WCC can be achieved for plant operation of the mechanical services equipment over the intended periods of use.

Table 7.3.2 – Plant Noise WCC Planning Condition & Predicted Noise Levels

Location & Time Period	Planning Noise Limit	Calculated Plant Noise
	$L_{AR,\ 15min}$	$L_{AR,\ 15min}$
Residential A – Plant Operation 0800-2300 hrs	35 dB(A)	28 dB(A)
Residential A – Plant Operation 2300-0800 hrs	35 dB(A)	21 dB(A)
Residential B – Plant Operation 0800-2300 hrs	35 dB(A)	28 dB(A)
Residential B – Plant Operation 2300-0800 hrs	35 dB(A)	14 dB(A)

As such this report clearly demonstrates compliance with the planning criteria.

7.3.2 BS8233:2014 – Neighbouring Commercial

Neighbouring commercial windows used for offices are located equidistant to "Residential A" locations on the opposite side of the rear lightwell area. As such predicted noise levels are calculated to be in the region of 28 dB(A) outside windows during day-time periods. Allowing for the typical 15 dB noise reduction through an openable window provides a predicted noise level of 13 dB(A) inside adjacent commercial office spaces as a result of the relocated mechanical services plant and hence is considered to not impact on neighbouring commercial property use.

8.0 Conclusions

Qt acoustics have performed environmental noise monitoring at the site in order to establish representative background noise levels for the proposed plant operating periods. Relevant standards in the form of the model planning conditions from WCC have been considered. A comprehensive noise control package has been selected in order to provide sufficient mitigation of the relocated mechanical services plant. This provides a low impact to neighbouring noise sensitive properties and complies with the model planning conditions.

Appendix A. Glossary of Terms

Decibel (dB)
Adopted as the common unit of measurement in acoustics. The unit of the decibel is dimensionless and is used in acoustics for sound measurements to define the ratio between the measured pressure level and a reference pressure level – typically $2x10^{-5}$ N/m^2 or the threshold of hearing.

"A" Weighting
Arithmetic correction for different frequencies to closer represent the typical sensitivity of the human ear to sound. Suited to low level noises of around 40 phon (close to 40 dB(A)) and provides an simple single figure weighted indication of the perceived level of loudness by a human.

Noise Percentile Level - L_N
Statistical Analysis of the noise level where "N" can be from 0.1% to 99.9% and represents the noise level exceeded for "N" percent of the measurement time. Commonly used with "A-Weighting" as above and measured over a set period of time 't' e.g. $L_{A99,15\ min}$ indicates the noise level exceeded for 99% of the measurement period of 15 minutes. See below for commonly used noise percentiles.

$L_{A90,t}$ or Background Noise Level
The A-Weighted noise level exceeded for 90% of the time 't' and is referred to as the "background noise level" for BS4142 type noise assessments and quoted to the nearest whole dB.

$L_{A10,t}$
The A-Weighted noise level exceeded for 10% of the time 't' and is referred to as the "traffic noise level".

$L_{Aeq,t}$
The A-Weighted equivalent continuous sound pressure over the measurement period of time 't' and is referred to as the "traffic noise level".

$L_{Amax,t}$
The A-Weighted instantaneous maximum sound pressure that occurred during the measurement period of time 't'.

Assessment Position
Unless otherwise stated is a location 1 metre from the façade of the nearest noise sensitive property.

Specific Sound Source
The noise source being assessed within this report (typically the proposed mechanical services plant equipment).

Specific Sound Level
The equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval.

Ambient Sound Level
Equivalent continuous A-Weighted sound pressure level of the totally encompassing sound in a given situation at a given time at the assessment location over a given time interval.

Rating Level, $L_{ar,Tr}$
The Specific Sound Level with any adjustment for characteristic features of the sound such as tonality or impulsivity.

Residual Sound
The ambient sound remaining at the assessment location when the specific sound source is supressed to such a degree that it does not contribute to the ambient sound.

Appendix B. Table of Environmental Noise Monitoring Results

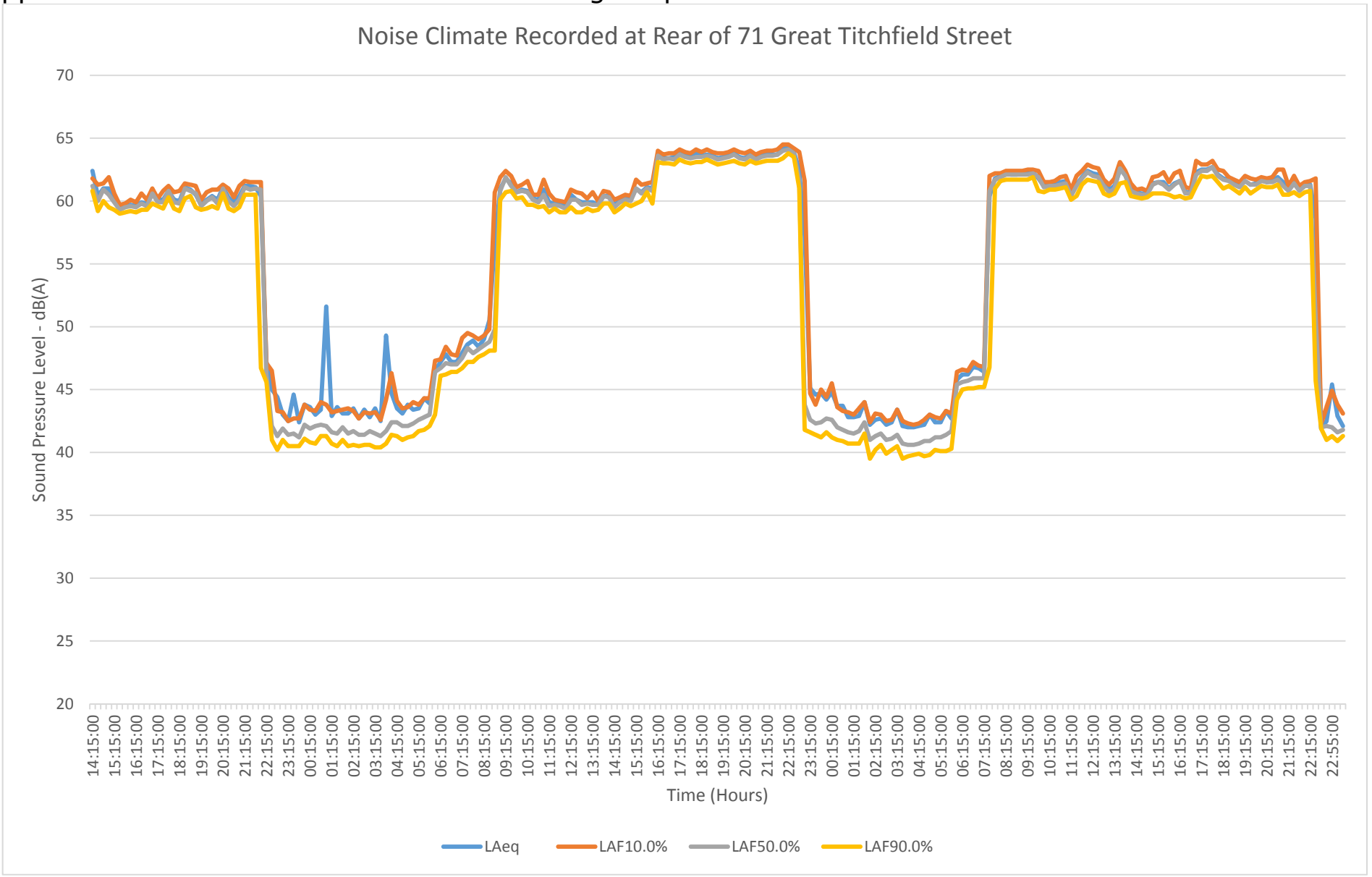
Date	Time	LAeq	LAF10.0%	LAF50.0%	LAF90.0%
22/10/2018	14:15:00	62.4	61.8	61.2	60.8
22/10/2018	14:30:00	60.4	61.3	60	59.2
22/10/2018	14:45:00	61	61.4	60.9	60
22/10/2018	15:00:00	61	61.9	60.5	59.5
22/10/2018	15:15:00	60.1	60.6	59.9	59.3
22/10/2018	15:30:00	59.5	59.7	59.3	59
22/10/2018	15:45:00	59.6	59.8	59.5	59.1
22/10/2018	16:00:00	59.7	60.1	59.6	59.2
22/10/2018	16:15:00	59.6	59.9	59.5	59.1
22/10/2018	16:30:00	59.9	60.6	59.8	59.3
22/10/2018	16:45:00	59.8	60.1	59.6	59.3
22/10/2018	17:00:00	60.6	61	60.6	59.8
22/10/2018	17:15:00	60.1	60.2	59.9	59.6
22/10/2018	17:30:00	60.1	60.8	59.9	59.4
22/10/2018	17:45:00	60.8	61.2	60.8	60.3
22/10/2018	18:00:00	60.1	60.7	59.9	59.4
22/10/2018	18:15:00	60	60.8	59.8	59.2
22/10/2018	18:30:00	61.1	61.4	61	60.2
22/10/2018	18:45:00	60.9	61.3	60.8	60.4
22/10/2018	19:00:00	60.5	61.2	60.6	59.5
22/10/2018	19:15:00	59.7	60.1	59.6	59.3
22/10/2018	19:30:00	60.1	60.7	60	59.4
22/10/2018	19:45:00	60.4	60.9	60.3	59.6
22/10/2018	20:00:00	60.1	60.9	59.8	59.4
22/10/2018	20:15:00	61.1	61.3	61	60.6
22/10/2018	20:30:00	60.3	61	60	59.4
22/10/2018	20:45:00	59.9	60.3	59.6	59.2
22/10/2018	21:00:00	60.4	61.2	60.1	59.5
22/10/2018	21:15:00	61.2	61.6	61.1	60.5
22/10/2018	21:30:00	61.2	61.5	60.9	60.5
22/10/2018	21:45:00	61.1	61.5	61	60.5
22/10/2018	22:00:00	60.4	61.5	60.9	46.7
22/10/2018	22:15:00	47.2	47.1	46.2	45.6
22/10/2018	22:30:00	45	46.5	42.1	41
22/10/2018	22:45:00	44.4	43.3	41.3	40.2
22/10/2018	23:00:00	43	43.2	41.9	41
22/10/2018	23:15:00	42.5	42.5	41.4	40.5
22/10/2018	23:30:00	44.6	42.7	41.5	40.5
22/10/2018	23:45:00	42.4	42.7	41.2	40.5
23/10/2018	00:00:00	43.8	43.8	42.2	41.1
23/10/2018	00:15:00	43.6	43.4	41.9	40.8
23/10/2018	00:30:00	43	43.3	42.1	40.7
23/10/2018	00:45:00	43.4	44	42.2	41.3
23/10/2018	01:00:00	51.6	43.8	42.1	41.3
23/10/2018	01:15:00	42.9	43.2	41.6	40.7
23/10/2018	01:30:00	43.6	43.3	41.5	40.5
23/10/2018	01:45:00	43.1	43.4	42	41
23/10/2018	02:00:00	43.1	43.5	41.5	40.5
23/10/2018	02:15:00	43.5	43.3	41.7	40.6
23/10/2018	02:30:00	42.7	42.7	41.4	40.5
23/10/2018	02:45:00	43.4	43.2	41.4	40.6
23/10/2018	03:00:00	42.8	43.1	41.7	40.6
23/10/2018	03:15:00	43.5	43.2	41.5	40.4
23/10/2018	03:30:00	42.5	42.6	41.3	40.4
23/10/2018	03:45:00	49.3	44.2	41.7	40.7
23/10/2018	04:00:00	44.7	46.3	42.4	41.4
23/10/2018	04:15:00	43.5	44.1	42.4	41.3
23/10/2018	04:30:00	43.1	43.5	42.1	41
23/10/2018	04:45:00	43.8	43.6	42.1	41.2
23/10/2018	05:00:00	43.4	44	42.3	41.3

23/10/2018	05:15:00	43.5	43.8	42.6	41.7
23/10/2018	05:30:00	44.3	44.3	42.8	41.8
23/10/2018	05:45:00	43.9	44.3	43	42.1
23/10/2018	06:00:00	46.5	47.3	46.4	43
23/10/2018	06:15:00	47.2	47.4	46.7	46.1
23/10/2018	06:30:00	47.8	48.4	47.1	46.2
23/10/2018	06:45:00	47.2	47.8	47	46.4
23/10/2018	**07:00:00**	**47.2**	**47.7**	**47**	**46.4**
23/10/2018	**07:15:00**	**47.9**	**49.1**	**47.5**	**46.7**
23/10/2018	**07:30:00**	**48.6**	**49.5**	**48.3**	**47.2**
23/10/2018	**07:45:00**	**48.9**	**49.3**	**47.9**	**47.2**
23/10/2018	**08:00:00**	**48.4**	**49**	**48.2**	**47.6**
23/10/2018	**08:15:00**	**49**	**49.3**	**48.5**	**47.8**
23/10/2018	**08:30:00**	**50.5**	**49.8**	**48.8**	**48.1**
23/10/2018	**08:45:00**	**56.7**	**60.7**	**49.8**	**48.1**
23/10/2018	09:00:00	61	61.9	60.8	60.1
23/10/2018	09:15:00	61.8	62.4	61.9	60.7
23/10/2018	09:30:00	61.4	62	61.2	60.8
23/10/2018	09:45:00	60.7	61.1	60.7	60.2
23/10/2018	10:00:00	60.9	61.3	60.8	60.3
23/10/2018	10:15:00	60.8	61.6	60.7	59.7
23/10/2018	10:30:00	60.2	60.5	60.1	59.7
23/10/2018	10:45:00	60.1	60.5	59.9	59.5
23/10/2018	11:00:00	60.9	61.7	60.5	59.6
23/10/2018	11:15:00	59.9	60.6	59.6	59.1
23/10/2018	11:30:00	59.8	60.1	59.7	59.4
23/10/2018	11:45:00	59.7	60	59.6	59.1
23/10/2018	12:00:00	59.6	59.9	59.4	59.1
23/10/2018	12:15:00	60.5	60.9	60.1	59.5
23/10/2018	12:30:00	60.1	60.7	60.1	59.1
23/10/2018	12:45:00	59.9	60.6	59.7	59.1
23/10/2018	13:00:00	59.9	60.2	59.8	59.4
23/10/2018	13:15:00	59.9	60.7	59.7	59.2
23/10/2018	13:30:00	59.7	60	59.7	59.3
23/10/2018	13:45:00	60.4	60.8	60.4	59.8
23/10/2018	14:00:00	60.4	60.7	60.3	59.8
23/10/2018	14:15:00	59.7	60.1	59.5	59.1
23/10/2018	14:30:00	60	60.3	59.9	59.4
23/10/2018	14:45:00	60.2	60.5	60.1	59.8
23/10/2018	15:00:00	60.1	60.4	60	59.6
23/10/2018	15:15:00	61	61.7	61	59.8
23/10/2018	15:30:00	60.7	61.3	60.6	60
23/10/2018	15:45:00	61.1	61.4	61	60.7
23/10/2018	16:00:00	61	61.5	60.8	59.8
23/10/2018	16:15:00	63.7	64	63.6	63.1
23/10/2018	16:30:00	63.4	63.7	63.3	63
23/10/2018	16:45:00	63.4	63.8	63.4	63
23/10/2018	17:00:00	63.5	63.8	63.3	62.9
23/10/2018	17:15:00	63.8	64.1	63.7	63.3
23/10/2018	17:30:00	63.6	63.9	63.5	63.1
23/10/2018	17:45:00	63.5	63.8	63.4	63
23/10/2018	18:00:00	63.9	64.1	63.5	63.1
23/10/2018	18:15:00	63.6	63.9	63.5	63.1
23/10/2018	18:30:00	63.7	64.1	63.6	63.3
23/10/2018	18:45:00	63.6	63.9	63.5	63.1
23/10/2018	19:00:00	63.4	63.8	63.3	62.9
23/10/2018	19:15:00	63.5	63.8	63.4	63
23/10/2018	19:30:00	63.6	63.9	63.5	63.1
23/10/2018	19:45:00	63.8	64.1	63.7	63.2
23/10/2018	20:00:00	63.5	63.9	63.4	63
23/10/2018	20:15:00	63.4	63.8	63.3	62.9
23/10/2018	20:30:00	63.7	64	63.6	63.2
23/10/2018	20:45:00	63.4	63.7	63.3	63
23/10/2018	21:00:00	63.6	63.9	63.5	63.1

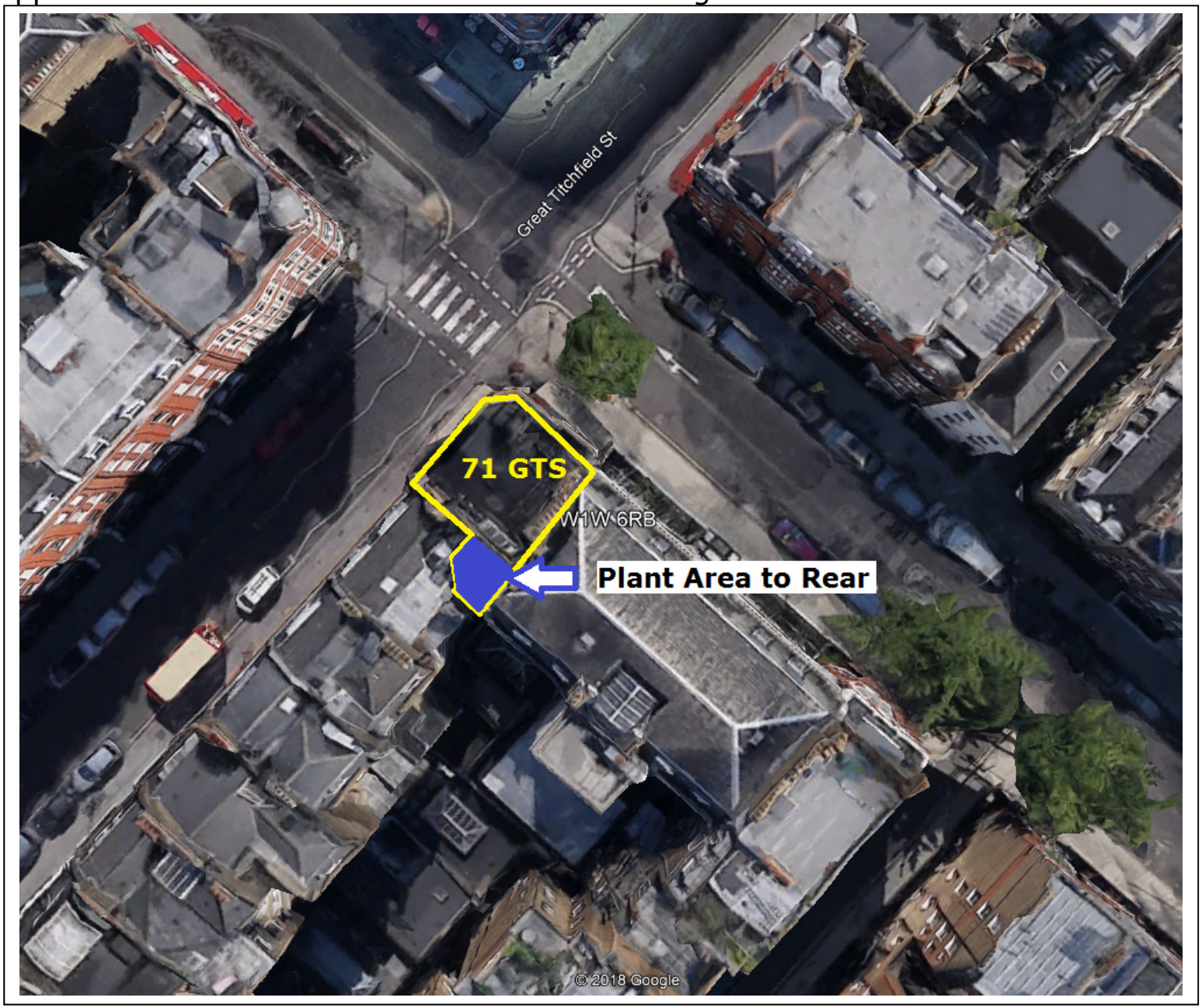
23/10/2018	21:15:00	63.7	64	63.6	63.2
23/10/2018	21:30:00	63.7	64	63.6	63.2
23/10/2018	21:45:00	63.7	64.1	63.7	63.2
23/10/2018	22:00:00	64.2	64.5	64	63.4
23/10/2018	22:15:00	64.2	64.5	64.1	63.8
23/10/2018	22:30:00	63.9	64.2	63.8	63.5
23/10/2018	22:45:00	62.5	63.9	61.7	61
23/10/2018	**23:00:00**	**57.2**	**61.6**	**43.8**	**41.8**
23/10/2018	**23:15:00**	**45.1**	**44.7**	**42.6**	**41.6**
23/10/2018	**23:30:00**	**44.6**	**43.8**	**42.3**	**41.4**
23/10/2018	**23:45:00**	**44.7**	**45**	**42.4**	**41.2**
24/10/2018	**00:00:00**	**44.2**	**44.4**	**42.7**	**41.6**
24/10/2018	00:15:00	44.8	45.5	42.6	41.2
24/10/2018	00:30:00	43.7	43.6	42	41
24/10/2018	00:45:00	43.7	43.3	41.8	40.9
24/10/2018	01:00:00	42.8	43.2	41.6	40.7
24/10/2018	01:15:00	42.8	43	41.5	40.7
24/10/2018	01:30:00	42.9	43.5	41.7	40.7
24/10/2018	01:45:00	44	44	42.4	41.5
24/10/2018	02:00:00	42.2	42.4	41	39.5
24/10/2018	02:15:00	42.6	43.1	41.3	40.2
24/10/2018	02:30:00	42.7	43	41.5	40.6
24/10/2018	02:45:00	42.2	42.5	41	39.9
24/10/2018	03:00:00	42.4	42.6	41.1	40.2
24/10/2018	03:15:00	43.4	43.4	41.4	40.5
24/10/2018	03:30:00	42.1	42.5	40.7	**39.5**
24/10/2018	03:45:00	42	42.3	40.6	39.7
24/10/2018	04:00:00	42	42.2	40.6	39.8
24/10/2018	04:15:00	42.1	42.3	40.7	39.9
24/10/2018	04:30:00	42.2	42.6	40.9	39.7
24/10/2018	04:45:00	43	43	40.9	39.8
24/10/2018	05:00:00	42.4	42.8	41.2	40.2
24/10/2018	05:15:00	42.4	42.7	41.2	40.1
24/10/2018	05:30:00	43.3	43.3	41.4	40.1
24/10/2018	05:45:00	42.7	43.1	41.7	40.3
24/10/2018	06:00:00	45.8	46.4	45.4	44.2
24/10/2018	06:15:00	46.2	46.6	45.6	45
24/10/2018	06:30:00	46.2	46.5	45.7	45.1
24/10/2018	06:45:00	46.8	47.2	45.9	45.1
24/10/2018	**07:00:00**	**46.7**	**46.9**	**45.9**	**45.2**
24/10/2018	**07:15:00**	**46.4**	**46.8**	**45.9**	**45.2**
24/10/2018	**07:30:00**	**60.4**	**62**	**60.8**	**46.8**
24/10/2018	07:45:00	61.8	62.2	61.7	61
24/10/2018	08:00:00	62	62.2	61.9	61.6
24/10/2018	08:15:00	62.2	62.4	62.1	61.7
24/10/2018	08:30:00	62.1	62.4	62.1	61.7
24/10/2018	08:45:00	62.1	62.4	62.1	61.7
24/10/2018	09:00:00	62.2	62.4	62.1	61.7
24/10/2018	09:15:00	62.2	62.5	62.1	61.7
24/10/2018	09:30:00	62.3	62.5	62.2	61.9
24/10/2018	09:45:00	61.8	62.4	61.9	60.8
24/10/2018	10:00:00	61.2	61.5	61.1	60.7
24/10/2018	10:15:00	61.3	61.5	61.2	60.9
24/10/2018	10:30:00	61.3	61.6	61.2	60.9
24/10/2018	10:45:00	61.5	61.9	61.3	61
24/10/2018	11:00:00	61.6	62	61.4	61.1
24/10/2018	11:15:00	60.5	60.9	60.4	60.1
24/10/2018	11:30:00	61.3	62	61.2	60.4
24/10/2018	11:45:00	61.9	62.4	61.8	61.3
24/10/2018	12:00:00	62.4	62.9	62.3	61.7
24/10/2018	12:15:00	62.2	62.7	62	61.6
24/10/2018	12:30:00	62.1	62.6	61.9	61.5
24/10/2018	12:45:00	61.3	61.7	61.2	60.6
24/10/2018	13:00:00	60.9	61.3	60.7	60.4

24/10/2018	13:15:00	61.2	61.8	61	60.6
24/10/2018	13:30:00	62.5	63.1	62.6	61.4
24/10/2018	13:45:00	62.1	62.4	62	61.5
24/10/2018	14:00:00	60.9	61.4	60.8	60.4
24/10/2018	14:15:00	60.7	60.9	60.6	60.3
24/10/2018	14:30:00	60.6	61	60.5	60.2
24/10/2018	14:45:00	60.6	60.8	60.5	60.3
24/10/2018	15:00:00	61.4	61.9	61.3	60.6
24/10/2018	15:15:00	61.5	62	61.5	60.6
24/10/2018	15:30:00	61.5	62.3	61.3	60.6
24/10/2018	15:45:00	61	61.5	60.9	60.5
24/10/2018	16:00:00	61.4	62.2	61.3	60.3
24/10/2018	16:15:00	61.6	62.4	61.6	60.4
24/10/2018	16:30:00	60.7	61.1	60.6	60.2
24/10/2018	16:45:00	60.7	61	60.6	60.3
24/10/2018	17:00:00	62.3	63.2	62.1	61.2
24/10/2018	17:15:00	62.5	62.9	62.4	62
24/10/2018	17:30:00	62.5	62.9	62.4	61.9
24/10/2018	17:45:00	62.7	63.2	62.7	62
24/10/2018	18:00:00	62.1	62.5	62	61.5
24/10/2018	18:15:00	61.8	62.4	61.7	61
24/10/2018	18:30:00	61.7	61.9	61.6	61.2
24/10/2018	18:45:00	61.4	61.7	61.3	60.9
24/10/2018	19:00:00	61.2	61.5	61.1	60.6
24/10/2018	19:15:00	61.6	62	61.6	61.1
24/10/2018	19:30:00	61.3	61.8	61.3	60.6
24/10/2018	19:45:00	61.4	61.7	61.3	60.9
24/10/2018	20:00:00	61.7	61.9	61.6	61.2
24/10/2018	20:15:00	61.5	61.8	61.5	61.1
24/10/2018	20:30:00	61.6	61.9	61.5	61.1
24/10/2018	20:45:00	61.9	62.5	61.7	61.3
24/10/2018	21:00:00	61.5	62.5	61.2	60.5
24/10/2018	21:15:00	60.9	61.2	60.8	60.5
24/10/2018	21:30:00	61.6	62	61.4	60.7
24/10/2018	21:45:00	60.9	61.2	60.8	60.4
24/10/2018	22:00:00	61.2	61.5	61.2	60.7
24/10/2018	22:15:00	61.3	61.6	61.2	60.8
24/10/2018	22:25:00	58.6	61.8	50.7	45.7
24/10/2018	**22:25:00**	**41.9**	**42.3**	**42**	**41.9**
24/10/2018	**22:40:00**	**42.5**	**43.6**	**42.1**	**41**
24/10/2018	**22:55:00**	**45.4**	**44.9**	**42**	**41.3**
24/10/2018	**23:10:00**	**42.9**	**43.8**	**41.6**	**40.9**
24/10/2018	**23:25:00**	**42.1**	**43.1**	**41.8**	**41.3**

Appendix C – Environmental Noise Monitoring Graphs



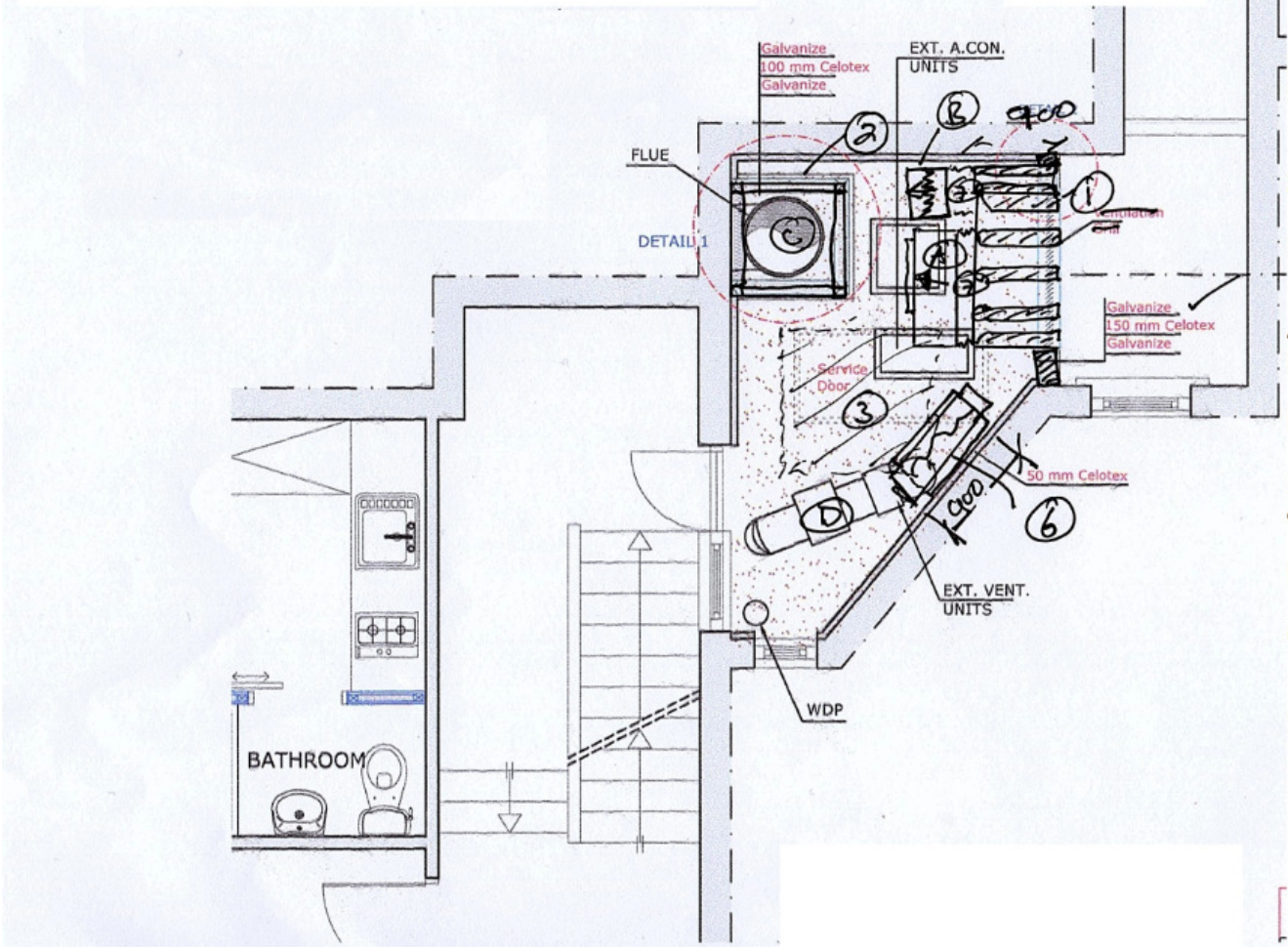
Appendix D – Location Plan – Site & Surrounding Area



Appendix E – Location Plan (1st Floor Roof) – Plant Position

A = Air Conditioning Unit - Daikin RZQS140D7V1
B = Coldroom Condenser CR18TN3MR
C = Extract Fan - Flakt WOods 56JM/20/4/6/28 ~ 2.0 m3/s
D = Supply Fan = Roof Units QP200B ~ 0.2 m3/s

QTI1570
12/11/18.



1 = Inlet Attenuator
1350mm W x 1350mm H x 900mm L
Serves AC Unit & Condenser

2 = Acoustic Fan Box, AV Mounts & Flex Connections.
840mm W x840mm D x 1100mm H.

3) = Outlet Attenuator
1350mm D x 1350mm W x 900mm H.
Serves AC Unit & Condenser

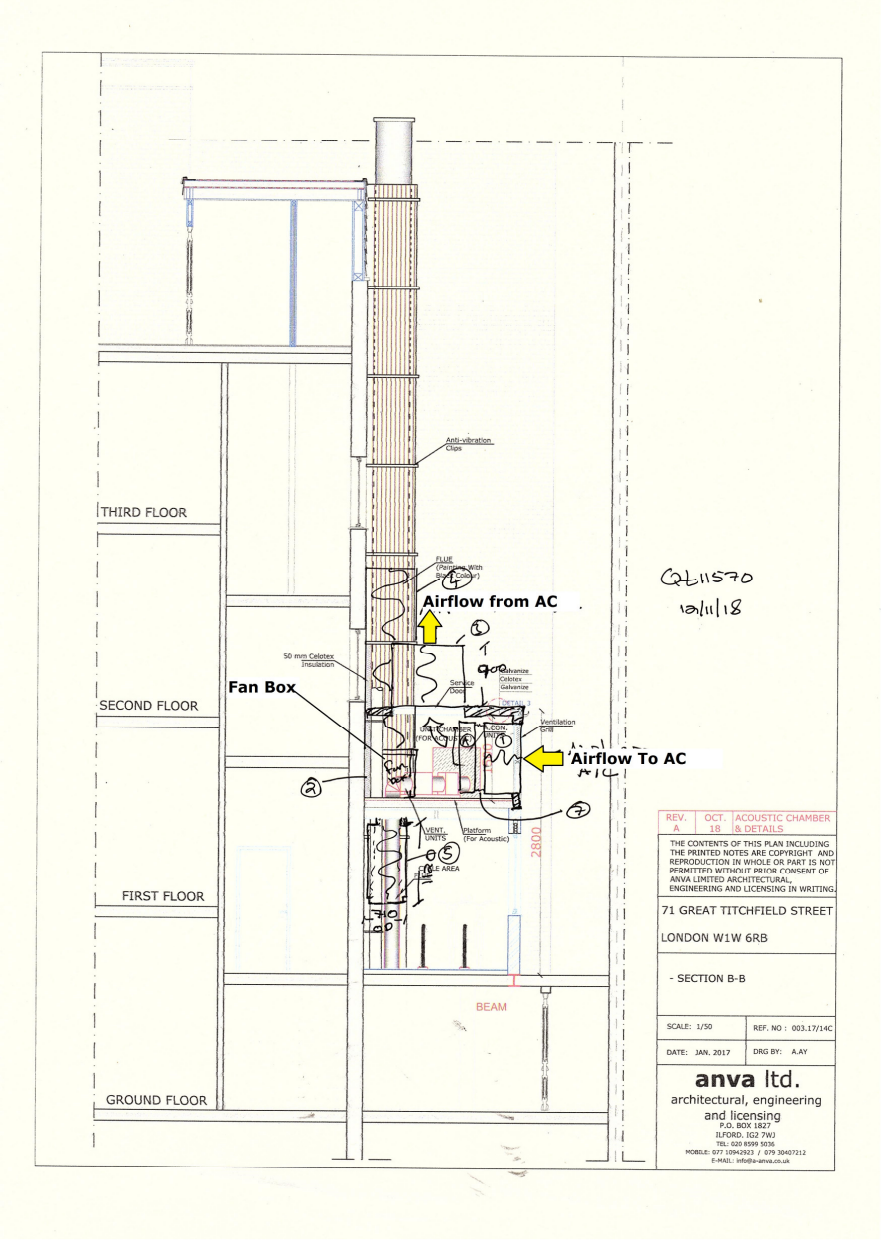
4) = Exhaust Attenuator (For Kitchen Extract Fan)
700mm W x 700mm D x 3000mm Long.

5) = Extract Attenuator (For kitchen extract fan)
560mm ID, 710mm OD x 1120mm Long.

6) = Fresh Air Attenuator
200mm ID, 300mm OD, 900mm L

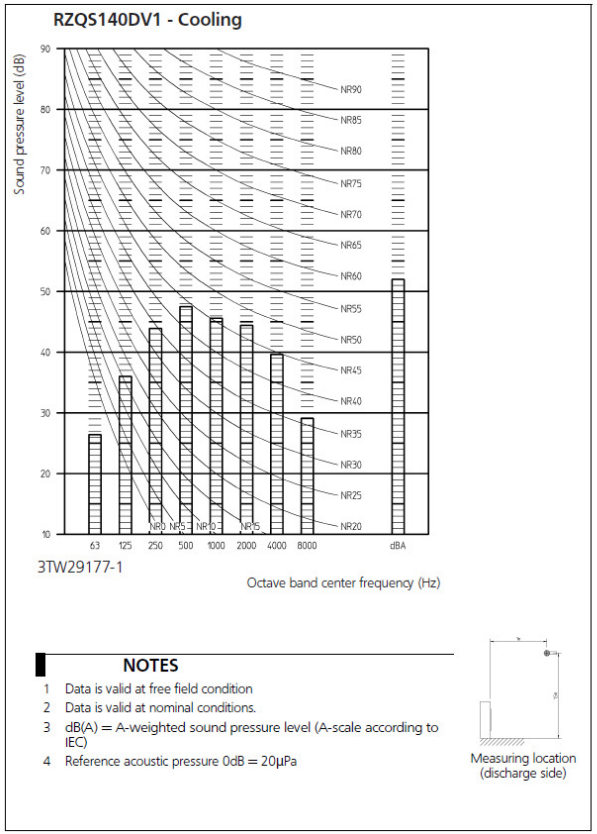
7) = Flexible Duct Connection

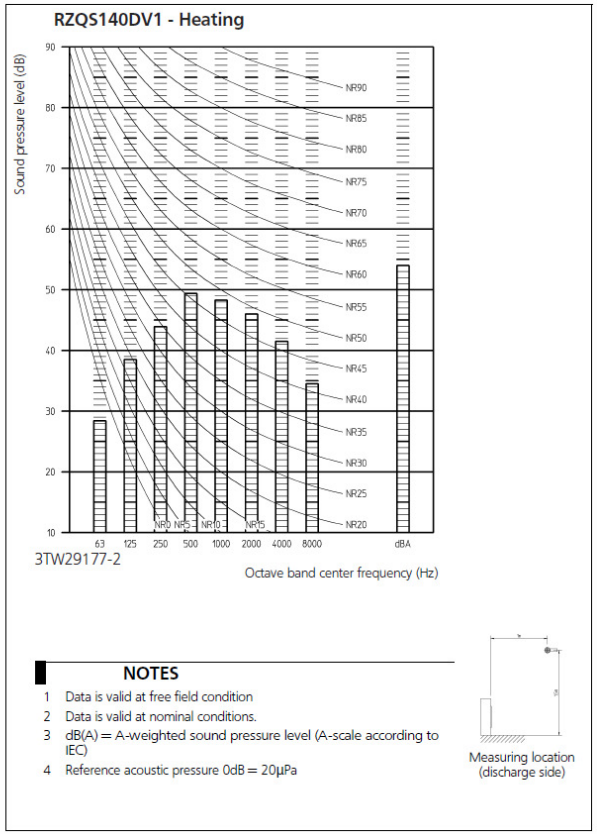
Appendix E – Location Plan (Section Through Plant Compound) – Plant Position



Appendix F – Plant Data Sheets

Item 1 – Daikin AC Unit





NOTE: - Noise Data is provided in dB(A) and incorrectly plotted on NR curve chart.

Appendix F – Plant Data Sheets

Item 2 – Kitchen Extract Fan

Project Name : jm single phase pdf
Quotation Number :
Customer : nfs

FanCode	56JM/20/4/6/28
FanDiameter/Size	560mm
Blades	6
FanSpeed	1420 rpm
Velocity	9.1 m/s
BladeAngle	28°
Form of Running	B
FanCasing	Long
RequestedDuty	2.24m³/s @ 221 Pa (static)
OutletDynamic Pressure	50 Pa
DutyShaft Power	0.873kW
MaxShaft Power	0.891kW
Total Efficiency	70 %
MotorFrame	CT9
Motor Rating	0.970kW
Full LoadCurrent	6.7A
StartingCurrent	13.5A
MotorMounting	Pad
ElectricalSupply	220-240 Volts 50 Hz 1 Phase
StartType	DOL
Motor Winding	Standard
Enclosure	StandardAll
AirDensity	1.2 kg/m³ /20 °C / 0 m / 50% RH
Smoke Venting	Non Smoke Venting
ProductNumber	DX571459

	Sound Spectrum (Hz)								Overall	
	63	125	250	500	1k	2k	4k	8k	Lw*	LpA@3m**
Inlet*	79	81	77	77	74	72	69	65	86	59
Outlet*	81	82	77	77	75	73	70	67	87	60
Breakout*	71	61	51	52	50	46	51	43	72	36

* Lw dB re 10^{-12} W ** dBA re $2x10^{-5}$ Pa

Appendix F – Plant Data Sheets

Quiet Pack (QP)

In-Line Centrifugal Duct Fans

ROOF UNITS
from Vent-Axia

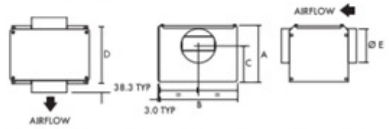
Features & Benefits

- 20mm 'O' Class rated acoustically treated casing, ensuring minimum duct and breakout noise levels
- Air volumes up to 1.08m³/s
- Suitable for external pressures up to 430Pa
- Designed to suit duct diameters from 100 to 500mm
- Operating Temperatures from 15°C up to +40°C
- Speed Controllable
- Quality Assurance to BS EN ISO 9001:1994
- Performance tested to BS848 Part 1 1980

Sound Power Level Spectra dB (ref 10^{12} Watts)

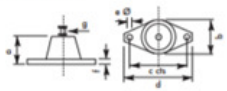
Fan Stock Ref		Mid Octave Bands 63	125	250	500	1k	2k	4k	8k	dB(A) @ 3m
QP100B	Inlet	55	63	47	45	45	43	42	31	31
	Outlet	49	63	53	55	50	47	45	40	36
	Breakout	50	58	45	39	34	20	20	20	24
QP125B	Inlet	51	58	49	42	39	37	33	20	27
	Outlet	50	55	54	53	55	47	45	41	37
	Breakout	47	51	45	35	31	20	20	20	20
QP150B	Inlet	62	66	50	54	49	49	49	45	37
	Outlet	56	66	62	61	62	64	62	62	49
	Breakout	57	58	54	46	42	38	37	30	29
QP160B	Inlet	62	66	50	54	49	49	49	45	37
	Outlet	56	66	62	61	62	64	62	62	49
	Breakout	57	58	54	46	42	38	37	30	29
QP200B	Inlet	61	66	53	55	51	46	48	45	36
	Outlet	57	67	63	63	66	64	63	62	50
	Breakout	57	61	53	47	43	37	36	33	30
QP250B	Inlet	68	63	59	56	50	46	45	41	37
	Outlet	64	67	61	63	61	58	59	59	46
	Breakout	64	65	59	53	48	43	40	34	35
QP315B	Inlet	73	72	66	61	59	59	56	47	45
	Outlet	72	74	71	69	70	69	67	61	55
	Breakout	70	72	68	61	57	58	55	48	45
QP400B	Inlet	74	74	68	62	61	61	58	51	47
	Outlet	72	76	71	71	73	70	70	66	57
	Breakout	77	75	69	64	59	59	56	47	47
QP500B	Inlet	70	73	67	62	61	63	60	54	48
	Outlet	60	70	69	70	71	70	67	61	55
	Breakout	77	75	69	64	59	59	56	47	47

Dimensions (mm)



Size	A	B	C	D	ØE	Kg
QP100	268	363	171	272	97	14
QP125	268	363	171	272	122	14
QP150	322	400	203	336	147	14
QP160	322	400	203	336	157	14
QP200	322	400	203	336	197	20
QP250	472	614	320	499	247	25
QP315	530	630	300	560	312	35
QP400	530	630	300	560	397	50
QP500	530	630	263	560	497	75

Anti Vibration Mountings



Stock ref	a	b	c	d	eØ	f	g
68MF033G	27	37	54	67	7	3	M8

Performance Guide

Fan Stock Ref	RPM	Ph.	Duty m³/s @ Pa 0	50	100	150	200	250	300	350	400	Motor Amps kW	FLC	SC
QP100	2500	1	0.06	0.06	0.05	0.03						0.08	0.64	2.6
QP125	2500	1	0.07	0.06	0.05	0.04						0.08	0.64	2.6
QP150	1400	1	0.18	0.18	0.16	0.15	0.13	0.11	0.08			0.145	0.7	3.2
QP160	1400	1	0.19	0.18	0.17	0.15	0.10	0.09	0.07	0.06		0.145	0.7	3.2
QP200	1500	1	0.25	0.23	0.21	0.19	0.15	0.13	0.11	0.09		0.28	0.81	4.0
QP250	930	1	0.53	0.49	0.44	0.20	0.17	0.14	0.11	0.08		0.60	3.1	12.0
QP315	1100	1	0.90	0.84	0.78	0.70	0.62	0.48	0.35	0.21		1.255	6.0	13.0
QP400	1100	1	0.99	0.94	0.87	0.81	0.72	0.60	0.46	0.29	0.11	1.25	6.0	13.0
QP500	1100	1	1.08	1.02	0.96	0.90	0.83	0.73	0.61	0.34	0.13	1.25	6.0	13.0

FLC = Full Load Current SC = Starting Current

220

T: 0844 856 0590

Appendix F – Plant Data Sheets

Item 4 – Cold Room Condenser

MODEL	FAN (mm)	VOLTAGE	SWLA
CGL90TB_1NR	200	220-240V / 50Hz	60.0
CGP12TB_1NR	230		64.0
CGP14TB_1NR	230		58.3
CGR18TB_1N	254		65.0
CGS34TB_3N	300		67.6
CMS34FB_3N	300		68.9
CL88TN_1MR	230		64.0
CP12TN_1MR	254		67.4
CR18TN_1MR	254		68.0
CS26TN_3M	300		70.0

SWLA.- Sound Power Level in dB(A) ref. 1pW (ISO-3745)

Appendix G – Acoustic Calculations – Noise Sensitive Receptor A

Plant Item 1 - Daikin RZQS140D7V1 AC Unit					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Option 1	R2	R1	63	125	250	500	1000	2000	4000	8000	Global (dB)
1	Manufacturer's Published Plant Octave Band SPL(A) @ 1m dB ref 20 µPa				28.5	38.5	44.0	49.5	48.0	46.0	41.5	34.5	**53.8**
2	1 off units				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	Maximum Plant Noise SPL @1m dB Ref ref 20 µPa	1+2			28.5	38.5	44.0	49.5	48.0	46.0	41.5	34.5	
4	Distance correction to 1m from Noise Senstive Receptor Façade	20 x LOG(R2/R1)	1	3	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5	
5	Directivity Correction (+3 dB)				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
6	SPL at Facade	3+4+5			22.0	32.0	37.5	43.0	41.5	39.5	35.0	28.0	**47.3**
7	Attenuation - 900mm L attenuator				6	11	19	33	43	41	36	28	
8	A-Weighted SPL at Facade	6+7			16.0	21.0	18.5	10.0	-1.5	-1.5	-1.0	0.0	**23.9**

Plant Item 2 - Kitchen Extract Fan Case Breakout - Flakt Woods 56JM/20/4/6/28					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Option 1	R2	R1	63	125	250	500	1000	2000	4000	8000	Global (dB)
9	Manufacturer's Published Plant Octave Band SWL dB ref 10^{-12} W				71.0	61.0	51.0	52.0	50.0	46.0	51.0	43.0	**71.6**
10	1 off units				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
11	Maximum Plant Noise SPL dB Ref 10^{-12} W	9+10			71.0	61.0	51.0	52.0	50.0	46.0	51.0	43.0	
12	Distance correction to 1 metre from Noise Sensitive Receptor	20 x LOG(R1)-11		4	-23.0	-23.0	-23.0	-23.0	-23.0	-23.0	-23.0	-23.0	
13	Directivity Correction (+3 dB)				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
14	SPL at Facade	11+12+13			51.0	41.0	31.0	32.0	30.0	26.0	31.0	23.0	**51.5**
15	dB(A) Correction				-26.0	-16.0	-9.0	-3.0	0.0	1.0	1.0	-1.0	
16	A-Weighted SPL at Facade	14+15			25.0	25.0	22.0	29.0	30.0	27.0	32.0	22.0	**36.8**
17	Attenuation - Acoustic Housing				11	17	22	28	33	40	41	37	
18	A-Weighted SPL at Facade	16+17			14.0	8.0	0.0	1.0	-3.0	-13.0	-9.0	-15.0	**15.3**

Plant Item 2 - Kitchen Extract Fan In-Duct Noise - Flakt Woods 56JM/20/4/6/28					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Equation Used	m3/s	pa	63	125	250	500	1000	2000	4000	8000	Global (dB)
19	Flakt Woods Manufacturer's Published in-duct Fan SWL		1.5	400	81.0	82.0	77.0	77.0	75.0	73.0	70.0	67.0	**86.5**
20	dB(A) Correction				-26.0	-16.0	-9.0	-3.0	0.0	1.0	1.0	-1.0	
21	SWL(A)	19+20			55.0	66.0	68.0	74.0	75.0	74.0	71.0	66.0	**80.4**
22	Duct Loss - 8 metres				0.7	0.7	0.7	1.0	1.7	1.7	1.7	1.7	
23	End reflection of outlet to Atmosphere	0.25			9	5	1	0	0				
			Area	Angle									
24	Directivity Correction (Area) Metres & Angle		0.25	90	1.0	2.0	2.0	0.0	-2.0	-7.0	-15.0	-15.0	
			Distance R1										
25	Distance loss to 1 metre from Noise Sensitive Receptor	$L_p = L_w$-20 x Log(r1)-11	9		-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	
26	SPL at Noise Sensitive Façade - dB(A)	21+22+23+24+25			16.2	32.2	38.2	42.9	41.2	35.2	24.2	19.2	**46.5**
27	Typical Attenuation - Rectangular Attenuator - 2400mm & Melinex				7.0	17.0	29.5	39.1	40.0	29.3	19.8	11.6	
28	SPL at Façade After Acoustic Mitigation - dB(A)	26+27			9.2	15.2	8.8	3.8	1.2	6.0	4.4	7.7	**18.2**

Plant Item 3 - Kitchen Make-Up Air Fan In-Duct Noise - Vent-Axia QP200B Make-Up Air Fan					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Equation Used	m3/s	pa	63	125	250	500	1000	2000	4000	8000	Global (dB)
29	Vent-Axia QP200B Manufacturer's Published in-duct Fan SWL (Inlet)		0.5	300	61.0	66.0	53.0	55.0	51.0	46.0	48.0	45.0	**67.8**
30	dB(A) Correction				-26.0	-16.0	-9.0	-3.0	0.0	1.0	1.0	-1.0	
31	SWL(A)	29+30			35.0	50.0	44.0	52.0	51.0	47.0	49.0	44.0	**57.5**
32	Duct Loss - 5m & 2 Bends				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
33	End reflection of outlet to Atmosphere = 0.05 m2	Look up table	0.03		15	11	6	2	1				
			Area	Angle									
34	Directivity Correction (Area) Metres & Angle	Look up table	0.03	45	0.0	2.0	3.0	4.0	4.0	5.0	5.0	6.0	
			Distance R1										
35	Distance loss to 1 metre from Noise Sensitive Receptor	$L_p = L_w$-20 x Log(r1)-11	3		-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	
36	SPL at Noise Sensitive Façade - dB(A)	31+32+33+34+35			-0.5	20.5	20.5	33.5	33.5	31.5	33.5	29.5	**39.6**
37	Typical Attenuation - Rectangular Attenuator - 200 dia 900mm L Circular				2.0	4.0	6.0	17.0	27.0	24.0	22.0	14.0	
38	A-Weighted SPL at Façade After Acoustic Mitigation	35-36			-2.5	16.5	14.5	16.5	6.5	7.5	11.5	15.5	**22.5**

Plant Item 4 - CR18TN3MR Coldroom Condenser					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Option 1	R2	R1	63	125	250	500	1000	2000	4000	8000	Global (dB)
39	Manufacturer's Published Plant SWL(A) dB ref 10^{-12} W (Estimated Frequency Data)				30.0	44.0	58.0	65.0	57.0	57.0	54.0	43.0	**68.0**
40	1 off units				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
41	Maximum Plant Noise SPL @1m dB Ref ref 20 µPa	39+40			30.0	44.0	58.0	65.0	57.0	57.0	54.0	43.0	
42	Distance correction to 1 metre from Noise Sensitive Receptor	20 x LOG(R1)-11		3	-23.0	-23.0	-23.0	-23.0	-23.0	-23.0	-23.0	-23.0	
43	Directivity Correction (+3 dB)				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
44	SPL at Facade	41+42+43			10.0	24.0	38.0	45.0	37.0	37.0	34.0	23.0	**47.0**
45	Attenuation - 900mm L attenuator				6	11	19	33	43	41	36	28	
46	A-Weighted SPL at Facade	44+45			4.0	13.0	19.0	12.0	-6.0	-4.0	-2.0	-5.0	**20.7**

47	Cumulative SPL at Noise Sensitive Façade - dB(A) WITHOUT ATTENUATION	6+16+26+36+44			**27.2**	**35.9**	**42.7**	**48.7**	**45.5**	**42.8**	**39.9**	**32.9**	**52.1**
48	**Cumulative SPL at Noise Sensitive Façade - dB(A) WITH ATTENUATION**	8+18+28+38+46			**18.8**	**23.6**	**22.7**	**18.7**	**8.6**	**10.3**	**12.6**	**16.3**	**28.1**
49	Lowest Pre-Existing Background Noise Level				**19.7**	**27.5**	**32.7**	**34.4**	**32.2**	**29.8**	**19.2**	**12.0**	**40.0**

Appendix G – Acoustic Calculations – Noise Sensitive Receptor B

Plant Item 1 - Daikin RZQS140D7V1 AC Unit					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Option 1	R2	R1	63	125	250	500	1000	2000	4000	8000	Global (dB)
1	Manufacturer's Published Plant Octave Band SPL(A) @ 1m dB ref 20 µPa				28.5	38.5	44.0	49.5	48.0	46.0	41.5	34.5	**53.8**
2	1 off units				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	Maximum Plant Noise SPL @1m dB Ref ref 20 µPa	1+2			28.5	38.5	44.0	49.5	48.0	46.0	41.5	34.5	
4	Distance correction to 1m from Noise Senstive Receptor Façade	20 x LOG(R2/R1)	1	9	-19.1	-19.1	-19.1	-19.1	-19.1	-19.1	-19.1	-19.1	
5	Directivity Correction (+3 dB)				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
6	SPL at Facade	3+4+5			12.4	22.4	27.9	33.4	31.9	29.9	25.4	18.4	**37.8**
7	Attenuation - 900mm L attenuator				6	11	19	33	43	41	36	28	
8	A-Weighted SPL at Facade	6+7			6.4	11.4	8.9	0.4	-11.1	-11.1	-10.6	-9.6	**14.4**

Plant Item 2 - Kitchen Extract Fan Case Breakout - Flakt Woods 56JM/20/4/6/28					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Option 1	R2	R1	63	125	250	500	1000	2000	4000	8000	Global (dB)
9	Manufacturer's Published Plant Octave Band SWL dB ref 10^{-12} W				71.0	61.0	51.0	52.0	50.0	46.0	51.0	43.0	**71.6**
10	1 off units				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
11	Maximum Plant Noise SPL dB Ref 10^{-12} W	9+10			71.0	61.0	51.0	52.0	50.0	46.0	51.0	43.0	
12	Distance correction to 1 metre from Noise Sensitive Receptor	20 x LOG(R1)-11		9	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	
13	Directivity Correction (+3 dB)				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
14	SPL at Facade	11+12+13			43.9	33.9	23.9	24.9	22.9	18.9	23.9	15.9	**44.5**
15	dB(A) Correction				-26.0	-16.0	-9.0	-3.0	0.0	1.0	1.0	-1.0	
16	A-Weighted SPL at Facade	14+15			17.9	17.9	14.9	21.9	22.9	19.9	24.9	14.9	**29.8**
17	Attenuation - Acoustic Housing				11	17	22	28	33	40	41	37	
18	A-Weighted SPL at Facade	16+17			6.9	0.9	-7.1	-6.1	-10.1	-20.1	-16.1	-22.1	**8.3**

Plant Item 2 - Kitchen Extract Fan In-Duct Noise - Flakt Woods 56JM/20/4/6/28					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Equation Used	m3/s	pa	63	125	250	500	1000	2000	4000	8000	Global (dB)
19	Flakt Woods Manufacturer's Published in-duct Fan SWL		1.5	400	81.0	82.0	77.0	77.0	75.0	73.0	70.0	67.0	**86.5**
20	dB(A) Correction				-26.0	-16.0	-9.0	-3.0	0.0	1.0	1.0	-1.0	
21	SWL(A)	19+20			55.0	66.0	68.0	74.0	75.0	74.0	71.0	66.0	**80.4**
22	Duct Loss - 8 metres				0.7	0.7	0.7	1.0	1.7	1.7	1.7	1.7	
23	End reflection of outlet to Atmosphere	0.25			9	5	1	0	0				
			Area	**Angle**									
24	Directivity Correction (Area) Metres & Angle		0.25	90	1.0	2.0	2.0	0.0	-2.0	-7.0	-15.0	-15.0	
			Distance R1										
25	Distance loss to 1 metre from Noise Sensitive Receptor	$L_p = L_w$-20 x Log(r1)-11	3		-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	
26	SPL at Noise Sensitive Façade - dB(A)	21+22+23+24+25			25.8	41.8	47.8	52.5	50.8	44.8	33.8	28.8	**56.1**
27	Typical Attenuation - Rectangular Attenuator - 2400mm & Melinex				7.0	17.0	29.5	39.1	40.0	29.3	19.8	11.6	
28	SPL at Façade After Acoustic Mitigation - dB(A)	26+27			18.8	24.8	18.3	13.4	10.8	15.5	14.0	17.2	**27.7**

Plant Item 3 - Kitchen Make-Up Air Fan In-Duct Noise - Vent-Axia QP200B Make-Up Air Fan					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Equation Used	m3/s	pa	63	125	250	500	1000	2000	4000	8000	Global (dB)
29	Vent-Axia QP200B Manufacturer's Published in-duct Fan SWL (Inlet)		0.5	300	61.0	66.0	53.0	55.0	51.0	46.0	48.0	45.0	**67.8**
30	dB(A) Correction				-26.0	-16.0	-9.0	-3.0	0.0	1.0	1.0	-1.0	
31	SWL(A)	29+30			35.0	50.0	44.0	52.0	51.0	47.0	49.0	44.0	**57.5**
32	Duct Loss - 5m & 2 Bends				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
33	End reflection of outlet to Atmosphere = 0.05 m2	Look up table	0.03		15	11	6	2	1				
			Area	**Angle**									
34	Directivity Correction (Area) Metres & Angle	Look up table	0.03	45	0.0	2.0	3.0	4.0	4.0	5.0	5.0	6.0	
			Distance R1										
35	Distance loss to 1 metre from Noise Sensitive Receptor	$L_p = L_w$-20 x Log(r1)-11	9		-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	
36	SPL at Noise Sensitive Façade - dB(A)	31+32+33+34+35			-10.1	10.9	10.9	23.9	23.9	21.9	23.9	19.9	**30.1**
37	Typical Attenuation - Rectangular Attenuator - 200 dia 900mm L Circular				2.0	4.0	6.0	17.0	27.0	24.0	22.0	14.0	
38	A-Weighted SPL at Façade After Acoustic Mitigation	35-36			-12.1	6.9	4.9	6.9	-3.1	-2.1	1.9	5.9	**12.9**

Plant Item 4 - CR18TN3MR Coldroom Condenser					Octave Band Centre Frequency (Hz)								
Row Ref No.	Description	Option 1	R2	R1	63	125	250	500	1000	2000	4000	8000	Global (dB)
39	Manufacturer's Published Plant SWL(A) dB ref 10^{-12} W (Estimated Frequency Data)				30.0	44.0	58.0	65.0	57.0	57.0	54.0	43.0	**68.0**
40	1 off units				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
41	Maximum Plant Noise SPL @1m dB Ref ref 20 µPa	39+40			30.0	44.0	58.0	65.0	57.0	57.0	54.0	43.0	
42	Distance correction to 1 metre from Noise Sensitive Receptor	20 x LOG(R1)-11		9	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	-30.1	
43	Directivity Correction (+3 dB)				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
44	SPL at Facade	41+42+43			2.9	16.9	30.9	37.9	29.9	29.9	26.9	15.9	**40.0**
45	Attenuation - 900mm L attenuator				6	11	19	33	43	41	36	28	
46	A-Weighted SPL at Facade	44+45			-3.1	5.9	11.9	4.9	-13.1	-11.1	-9.1	-12.1	**13.7**

47	Cumulative SPL at Noise Sensitive Façade - dB(A) WITHOUT ATTENUATION	6+16+26+36+44			**26.6**	**41.8**	**47.9**	**52.7**	**50.9**	**45.1**	**35.8**	**30.0**	**56.2**
48	**Cumulative SPL at Noise Sensitive Façade - dB(A) WITH ATTENUATION**	8+18+28+38+46			**19.3**	**25.1**	**19.7**	**14.9**	**11.0**	**15.6**	**14.3**	**17.5**	**28.2**
49	Lowest Pre-Existing Background Noise Level				**19.7**	**27.5**	**32.7**	**34.4**	**32.2**	**29.8**	**19.2**	**12.0**	**40.0**

Target Design = 35 dB(A) for plant operation 0800-2300 hours & 24-hour operation
Therefore Compliance with planning condition demonstrated

Appendix H – Sound Level Meter Calibration Certificates

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 24 November 2016 Certificate N° 1611615

AV Calibration
2 Warren Court
Chicksands, Shefford
Bedfordshire SG17 5QB
U.K.
Tel: +44 (0)1462 638600
Fax: +44 (0)1462 638601
Email: lab@avcalib.co.uk
www.avcalibration.co.uk

Page 1 of 3 Pages

Signed

G. Parry [ ]
B. Baker [ ] J. Harriman [ ]

Acoustics Noise and Vibration Ltd trading as AV Calibration

CLIENT Qt Acoustics Ltd

F.A.O. J P Williams

ORDER No - Job No TRAC16/11351/01

DATE OF RECEIPT 11 November 2016

PROCEDURE AV Calibration Engineer's Handbook, section 25

IDENTIFICATION Sound level meter NTi type XL2-TA serial No A2A-08390-E0 connected via an extension lead type ASD and preamplifier type MA220 serial No 1973 to a half-inch microphone type MC230 serial No 9158.

CALIBRATED ON 24 November 2016

PREVIOUS CALIBRATION None known

The measurements detailed herein are traceable to units of measurement realised at the National Physical Laboratory.
This certificate may not be reproduced other than in full, except with the prior written approval of AV Calibration.