Elm House
10-16 Elm Street
London

Environmental Noise Survey and Plant Noise Assessment Report

22827/PNA1

1 April 2016

For:
Como
155 Moorgate
London
EC2M 6XB

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

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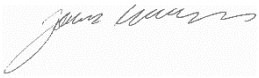
Hann Tucker Associates

Environmental Noise Survey and Plant Noise Assessment Report 22827/PNA1

Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	01/04/2016	-		
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Hann Tucker Associates

Environmental Noise Survey and Plant Noise Assessment Report 22827/PNA1

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1.0 Introduction

The current site at Elm House is undergoing redevelopment. New items of building services plant are proposed to be installed.

Hann Tucker Associates have therefore been commissioned to undertake a detailed environmental noise survey of the site, propose suitable plant noise emission criteria based on the results of the survey and the requirements of the Local Authority. The data has been used to assess the proposed plant and subsequently make recommendations to ensure the criteria of the Local Authority are met.

This report presents the survey methodology and findings.

2.0 Objectives

To establish by means of detailed short period manned environmental noise measurements, the existing A-weighted (dBA) L_{90}, L_{eq} and L_{max} environmental noise levels at selected accessible street and roof level positions around the site, thought to be representative of the nearest affected properties.

To measure L_{eq}, L_{90} and L_{max} octave band spectra noise levels at each measurement position in order to obtain a more detailed description of the noise climate.

To use the results of the manned survey to review and validate the more extensive noise survey data previously undertaken by Waterman.

To recommend suitable plant noise emission criteria based on the results of the noise survey data, and in conjunction with the Local Authority

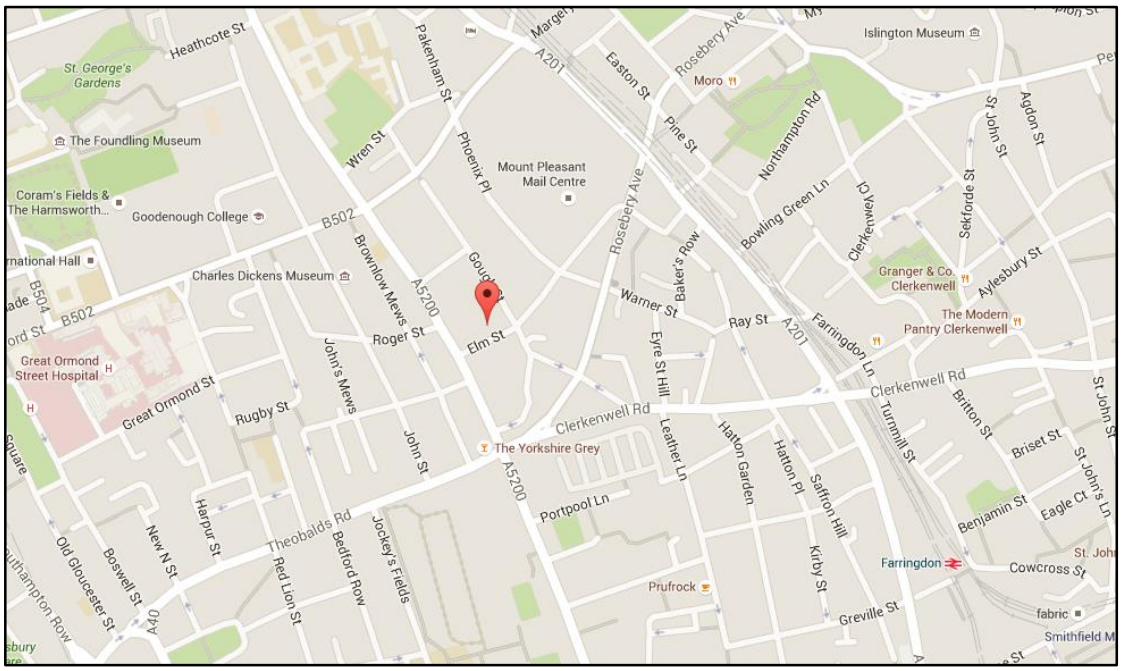
To assess the proposed plant based on manufacturer's noise data and comment on its acceptability.

These objectives are as set out our Outline Brief dated 15 January 2016 and Como's written instructions received on 23 February 2016.

3.0 Site Description

3.1 Location

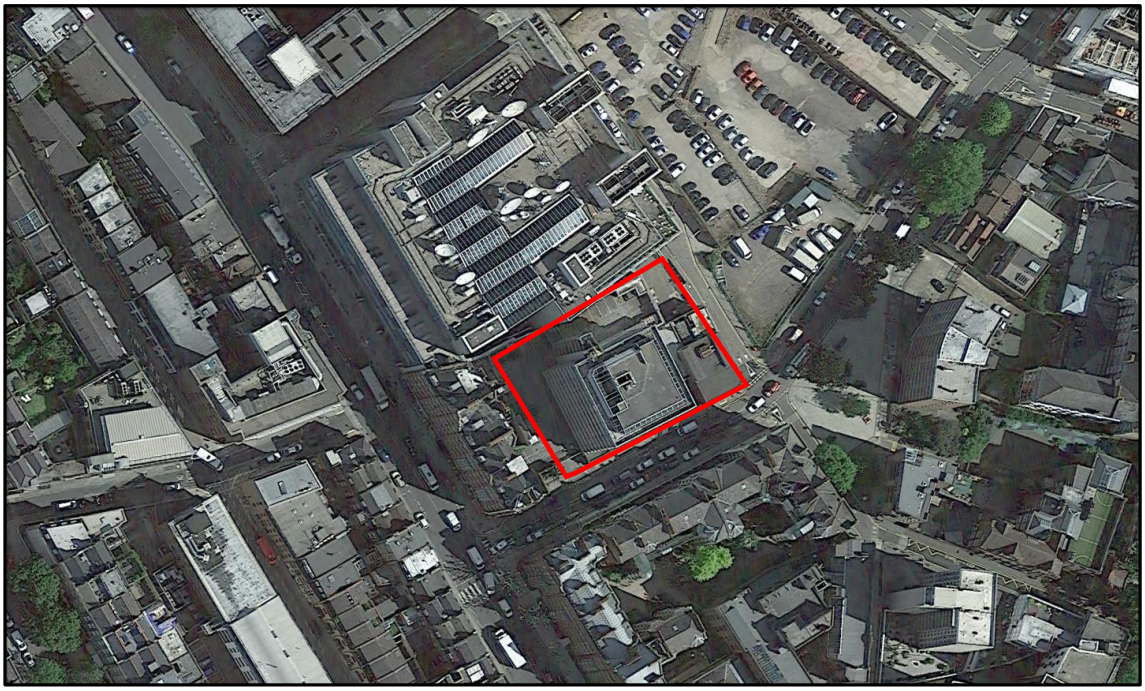
The site is located at Elm Street, London, WC1X 0BJ and falls within Camden Borough Council's jurisdiction. See location map below.



Location Map (Imagery © 2016 Google Inc.)

3.2 Description

The current site is a twelve storey building including ground and basement levels. The building is bounded by Elm Street to the south and Gough Street to the north-east. To the north of the site is 200 Grays Inn Road which is a commercial property of similar height to Elm House. To the east of the site is an open air ground level car park. To the west of the site is Churston Mansions and to the south of the site is Holsworthy Square, both of which are residential properties. See site plan below.



Site Plan (Imagery © 2016 Google Inc.)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Methodology

An baseline noise survey was previously undertaken by Waterman from 24 November to 25 November 2015, and the results are presented in the report Ref: WIE10742-100-TN-001. In order to validate the noise survey data for use in our acoustic assessment, a short manned daytime survey undertaken at selected positions representative of those used in the Waterman's.

The manned survey was undertaken by James Mackenzie BSc(Hons) MA AMIOA.

5.1 Procedure

Manned environmental noise monitoring was undertaken from approximately 16:30 to 18:00 hours on 2 March 2016.

During the survey period the wind conditions were moderate, the sky was generally patchy cloud and there was no rain. Road surfaces were dry throughout the survey period. These

conditions are considered suitable for obtaining representative measurement results.

Measurements were taken of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over periods of not less than 5 minutes. Atypical noises were excluded as far as reasonably possible. The noise levels measured are therefore assumed to be representative of the noise climate during the period in which the measurements were taken.

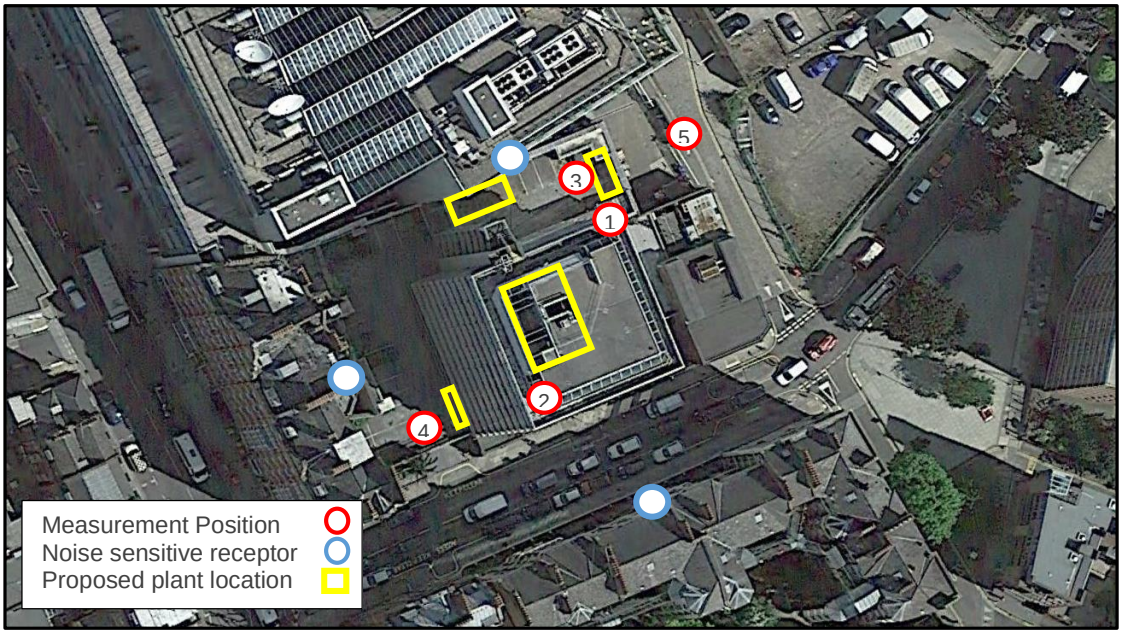
In addition, at each position typical L_{90}, L_{eq} and L_{max} octave band spectra (from 63Hz to 8kHz) were taken in order to gain a more detailed description of the prevailing noise climate.

5.2 Measurement Positions

The noise level measurements were undertaken at 5 positions as described in the table below.

Position No	Description
1	North east corner of Elm House at roof level. The microphone was held approximately 1.5m above the floor and around 1.5m from the closest reflective surface.
2	South west corner of Elm House at roof level The microphone was held approximately 1.5m above the floor and around 1.5m from the closest reflective surface.
3	North east corner of Elm house at ground level. The microphone was held approximately 1.5m above the ground and at least 4m from the closest reflective surface.
4	South west corner of Elm house at ground level. North east corner of Elm house at ground level The microphone was held approximately 1.5m above the ground and around 2m from the closest reflective surface.
5	North east corner of Elm House on Gough Street. North east corner of Elm house at ground level The microphone was held approximately 1.5m above the ground around 1m from the closest reflective surface.

The positions were selected in order to assess typical noise levels incident at the building façade for subsequent use for validating noise survey data from the Waterman survey. This data is used to obtain the lowest L_{90} noise levels at the development site for subsequent use in setting plant noise emission criteria and are shown on the plan below.



Plan Showing Manned Measurement Positions (Imagery © 2016 Google Inc.)

5.3 Instrumentation

The instrumentation used during the survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 Precision Sound Level Meter	Brüel and Kjær	2260	2001716	B & K calibration on 17/03/2015
Type 1 Calibrator	Brüel and Kjær	4231	2545668	B & K calibration on 09/03/2015

The sound level meter was fitted with a Brüel and Kjær microphone windshield.

The sound level meter was calibrated prior to and on completion of the survey. No significant change was found to have occurred (no more than 0.1 dB).

6.0 Results

6.1 Results of Noise Survey

The results of the noise survey previously conducted by Waterman, as presented in their report Ref: WEI10742-100-TN-001, are presented below.

Position	Period	Sound Levels dBA		
		L_{90}	L_{eq}	L_{max}
1 (Long term)	Daytime (07:00 -23:00)	59	64	79
	Night-time (23:00 – 07:00)	58	60	73
2 (Long term)	Daytime (07:00 -23:00)	55	61	78
	Night-time (23:00 – 07:00)	49	53	70
3 (Short term)	Daytime (16:00 - 16:20)	52	56	66
4 (Short term)	Daytime (15:15 – 15:35)	57	63	76
5 (Short term)	Daytime (15:40 – 15:55)	52	65	85

6.2 Results of the Manned Survey

The A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound levels recorded during the Fully Manned survey are presented below.

Position	Time	Sound Levels dBA		
		L_{90}	L_{eq}	L_{max}
1	16:30 – 16:35	58	60	70
2	16:40 – 16:45	53	56	67
3	16:50 – 17:05	54	57	73
4	17:10 – 17:25	55	59	76
5	17:45 – 18:00	53	60	86

The L_{90}, L_{eq} and L_{max} values measured during the manned survey are comparable to those undertaken by Waterman. We believe that the results of the manned survey validate the more extensive data previously collected in 2015, and therefore both surveys have been used as a basis for our acoustic assessment.

7.0 Discussion Of Noise Climate

Over the course of the survey period the dominant noise sources were noted to be plant noise from neighbouring 200 Grays Inn Road along with road traffic noise from Elm Street and Grays Inn Road.

8.0 Plant Noise Emission Criteria

Building services plant external noise emission levels will need to comply with Local Planning/Environmental Authority requirements and statutory noise nuisance legislation.

We understand that the requirements/planning condition imposed by the London Borough of Camden states as follows:

"Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (LA90), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless the plant/equipment hereby permitted will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, click, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the LA90, expressed in dB(A)".

Based on the above criteria, and having reviewed existing noise survey data (Ref: WIE10742-100-TN-001), we therefore propose the following plant noise emission criteria measured 1m from the nearest noise sensitive receptor:

Noise Emission Limit (dBA)	
Daytime (07 :00 – 23:00 hours)	**Night Time (23 :00 – 07 :00 hours)**
47	44

We understand Camden consider emergency plant on a case by case basis. We would therefore suggest the criteria presented above may be increased by 10dBA for emergency plant such as life safety generators. Noise from emergency smoke extract fans to external areas is not normally a concern. If plant contains tonal or impulsive characteristics the external design criteria should be reduced by 5dBA.

The above is subject to approval by the local Authority.

9.0 Plant Noise Assessment

It is understood that the plant operating times will be during the daytime (07:00 to 20:00 hours). It is imperative that we are advised if this is not the case for any item of plant. As such the daytime criteria from Section 8.0 above is deemed to comply.

9.1 Plant Data

The attached Plant Noise Schedule 22827/PNS (enclosed) details the manufacturer's sound level data used in our acoustic analysis for each item of building services plant.

This data presents "maximum" sound levels which should not be exceeded. The sound levels shown have been based upon manufacturer's data, and should thus be typical for these units with their respective duties.

It is essential that we are appraised of any alterations or additions to this list. Should the selection of any item of plant differ from that shown on the schedule, provided their sound levels are comparable to (or less than) those shown then it should not be necessary to make significant changes to our current attenuation recommendations.

9.2 Roof Level Plant

We understand that the following items of plant are to be installed at roof level.

Plant Ref.	Plant Description	Location	Qty	Plant Make	Model Number
AHU:10:01	Air Handling Unit	Raised Roof	1	IV Produkt	Size: 740-1V 6.20/5.30m^3/s
TE:RF:01	Toilet Extract Fan	Raised Roof	1	Nuaire	AVT7-R
Type 1: PURY-P400 YLM-A1	Condenser	West side roof level in acoustic enclosure	9	Mitsubishi	PURY-P400 YLM-A1
Type 2: PURY-P550 YLM-A1	Condenser	West side roof level in acoustic enclosure	1	Mitsubishi	PURY-P550 YLM-A1
Type 3: PURY-P300 YLM-A1	Condenser	West side roof level in acoustic enclosure	1	Mitsubishi	PURY-P300 YLM-A1

9.2.1 Location of Plant

It is proposed that 11 No. condensers are proposed to be situated on west side of the roof housed in an existing acoustic enclosure, with the louvres directed towards the west. The nearest noise sensitive window appears to be located at Churston Mansions, a residential property approximately 20m towards the west.

An air handling unit and toilet extraction fan will be located on a raised section of roof. The nearest noise sensitive window appears to be located at 200 Grays Inn Road a commercial property approximately 14m towards the north.

9.2.2 Plant Noise Impact Assessment

The following tables present our calculations relating to the proposed plant installation.

11 No. condensers on Roof	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Plant Ref: Type 1: PURY-P400 YLM-A1, Type 2: PURY-P550 YLM-A1, Type 3: PURY-P300 YLM-A1.	85	88	75	72	66	59	53	48	75
Distance Loss (20m)	-23	-23	-23	-23	-23	-23	-23	-23	
Barrier Correction	-2	-2	-2	-2	-2	-2	-3	-3	
Acoustic Louvre	-4	-5	-8	-9	-12	-10	-8	-6	
Façade effect	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Window	58	61	45	41	32	26	22	19	46

Roof level AHU and Toilet Extract	Sound Level at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Plant Ref: AHU:10:01, TE:RF:01. Sound Power Level (SWL) *	73	78	73	67	62	55	52	44	70
Distance Loss (SWL to SPL 14m)	-28	-28	-28	-28	-28	-28	-28	-28	
Barrier Correction	-5	-5	-5	-6	-6	-8	-11	-14	
Façade effect	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Window	43	48	43	37	30	22	16	5	39

*It should be noted that the plant noise data in the table above includes the attenuators specified in 22827/AS (enclosed).

We understand that the proposed units will be operational during daytime hours (07:00 - 20:00). Our calculations indicate that the proposed plant should be capable of achieving the requirements of the Local Authority outlined in Section 8.0.

9.3 Ground Level Plant

We understand that the following item of plant is to be installed at ground level.

Plant Ref.	Plant Description	Location	Qty	Plant Make	Model Number
AHU:00:03	Air Handling Unit	North site boundary	1	IV Produkt	Size: 100-1V 0.66/0.66 m^3/s
AHU:00:04	Air Handling Unit	North east site boundary	1	IV Produkt	Size: 100-1V 0.66/0.66 m^3/s
HP:00:01	Condenser	North site boundary	1	Mitsubishi	PUMY-P112YKM1
HP:00:02	Condenser	North site boundary	1	Mitsubishi	PURY-P200YSLM-A1
HP:00:03	Condenser	North east site boundary	1	Mitsubishi	PURY-P200YSLM-A1
AHU:B1:05	Air Handling Unit	Basement	1	M&Y Ventilation	-
Life Safety Generator	Generator	North site boundary - Ground level	1	Bells	-

9.3.1 Location of Plant

It is proposed that a single Air Handling Unit and 2No. Condensers are located towards the north boundary of the site. The nearest noise sensitive window is located approximately 6m away at 200 Grays Inn Road.

A single Air Handling Unit and 1No. condenser is to be located towards the north east site boundary. The nearest noise sensitive window is located 10m at 200 Grays Inn Road.

The supply and extract grilles for the basement level Air Handling Unit are to be located at the west of the property at ground level. The nearest effected noise sensitive window will be located at Churston Mansions approximately 14m away.

9.3.2 Plant Noise Impact Assessment

The following tables present our calculations relating to the proposed plant installation.

AHU and 2No. Condensers at north boundary	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Plant Ref: AHU:00:03, HP:00:01, HP:00:02. *	75	65	62	58	52	47	40	34	60
Distance Loss (6m)	-9	-9	-9	-9	-9	-9	-9	-9	
Barrier Correction	-7	-9	-11	-13	-16	-19	-20	-20	
Façade effect	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Window	63	51	46	40	31	22	14	8	43

AHU and condenser at north east site boundary	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Plant Ref: AHU:00:04, HP:00:03. *	75	65	62	58	51	45	39	33	59
Distance Loss (12m)	-16	-16	-16	-16	-16	-16	-16	-16	
Barrier Correction	-4	-2	0	0	0	0	0	0	
Façade effect	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Window	59	51	49	45	38	32	26	20	46

Basement AHU supply and extract grilles	Sound Power Level (SWL) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Plant Ref: AHU:B1:05	85	78	83	75	75	75	72	66	82
Distance Loss (SWL to SPL)	-28	-28	-28	-28	-28	-28	-28	-28	
Barrier Correction	0	0	0	0	0	0	0	0	
Duct Attenuator	-2	-4	-9	-15	-17	-14	-10	-8	
Façade effect	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Window	58	49	49	35	33	36	37	33	45

*It should be noted that the plant noise data in the table above includes the attenuators specified in 22827/AS (enclosed).

We understand that the proposed units will be operational during daytime hours (07:00 - 20:00). Our calculations indicate that the proposed plant should be capable of achieving the requirements of the Local Authority outlined in Section 8.0.

9.4 Generator

A Life Safety Generator is to be installed at ground level. It is our understanding that it will only operate for a short weekly test and in case of an emergency. We have contacted the Local Authority with regards to their policy on noise criteria for Life Safety Plant. They state:

"*the relaxation of limits on generators such as these would be applied on a case by case basis and needs to be reviewed in context*".

We would recommend that a limit of 10dB above the normal criteria is employed for Life Safety Plant, however this is to be approved by the Local Authority.

At present the proposed Life Safety Generator should be capable of achieve this.

9.5 Mitigation Measures

In order to bring the proposed installations into compliance with the proposed criterion, our calculations have included attenuation on the Air Handling Units. The attenuator schedule 22827/AS (enclosed) details roomside and atmospheric attenuation requirements such that the cumulative level from all plant assessed in this report meets the Local Authority requirements.

It should be noted that:

- All attenuator selection dimensions are suggestions and could be altered in most instances.

- In the majority of cases it would be possible to reduce attenuator length by increasing cross-sectional area, and vice-versa.

- In all cases it would be possible to alter attenuator width and height providing the cross-sectional area is maintained and the width to height aspect ratio does not exceed 3:1.

- All alterations must be confirmed by ourselves.

It is our understanding that 11No. condensers are to be installed towards the west side of the property at roof level. It is proposed that these will be housed in an existing acoustic enclosure. We were not able to obtain manufacturers data for the performance of the current enclosure, however Hann Tucker Associates conducted a visual inspection of it to assess its possible specification. On the basis that it appears to be a 300mm acoustic louvre installation the following performance could be considered likely.

Attenuation at Octave Band Centre Frequencies (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8K**
4	5	8	9	12	10	8	6

The nearest noise sensitive receptor that could be affected by the proposed plant is believed to be Churston Mansions which lies towards the west of the site. As we do not have manufacturers data for the acoustic louvres, it may be necessary to consider the installation of an additional louvre or replace the existing with one with a known performance.

10.0 Conclusions

A detailed manned environmental noise survey has been undertaken in order to validate noise survey data previously collected by Waterman. The data from both surveys has been used in order to establish the currently prevailing roof and street level environmental noise climate around the site.

Plant noise emission criteria have been recommended based on the results of the noise surveys and in conjunction with the Local Authority.

An assessment has been carried out to determine the plant noise emissions at the nearest noise sensitive windows.

The assessment indicates that with the suitably recommended mitigation measures, the proposed plant should be capable of achieving the requirements of the Local Authority at the nearest noise sensitive receptors.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

Sound Pressure Level (L_p) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

Sound Power Level (SWL or L_w) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

Plant Noise Schedule
22827/PNS

Hann Tucker Associates
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Manchester: 0161 832 7041

Elm House

Revision:	Date: 24/03/2016	Prepared by: James Mackenzie			Comments:									
			Duty		Data		Sound Level (dB) at Octave Band Centre Frequency (Hz)							
Plant Ref.	Location	Plant Type	m^3/s	Pa	mfr/empir	Lw/Lp	63	125	250	500	1k	2k	4k	8k
AHU:10:01 Supply Atmospheric	Roof	Air Handling Unit	6.2	760	mfr	Lw	73	78	73	67	62	55	52	44
AHU:10:01 Supply Roomside	Roof	Air Handling Unit	6.2	760	mfr	Lw	82	87	84	82	82	79	77	74
AHU:10:01 Extract Atmospheric	Roof	Air Handling Unit	5.3	684	mfr	Lw	79	85	82	80	80	77	75	72
AHU:10:01 Extract Roomside	Roof	Air Handling Unit	5.3	684	mfr	Lw	71	75	70	64	63	60	54	44
AHU:10:01 Total	Roof	Air Handling Unit	6.2	760	mfr	Lw	79	79	66	56	54	53	50	41
AHU:00:03 Supply Atmospheric	Ground Level External	Air Handling Unit	0.66	557	mfr	Lw	65	59	65	62	54	48	46	36
AHU:00:03 Supply Roomside	Ground Level External	Air Handling Unit	0.66	557	mfr	Lw	73	68	74	75	77	75	71	66
AHU:00:03 Extract Atmospheric	Ground Level External	Air Handling Unit	0.66	453	mfr	Lw	72	68	75	76	78	76	71	66
AHU:00:03 Extract Roomside	Ground Level External	Air Handling Unit	0.66	453	mfr	Lw	65	59	63	62	57	53	52	39
AHU:00:03 Total	Ground Level External	Air Handling Unit	0.66	557	mfr	Lw	71	61	57	50	50	50	45	34
AHU:00:04 Supply Atmospheric	Ground Level External	Air Handling Unit	0.66	554	mfr	Lw	65	59	64	62	54	48	46	36
AHU:00:04 Supply Roomside	Ground Level External	Air Handling Unit	0.66	554	mfr	Lw	73	68	74	75	77	75	71	66
AHU:00:04 Extract Atmospheric	Ground Level External	Air Handling Unit	0.66	463	mfr	Lw	72	68	75	76	78	76	71	66
AHU:00:04 Extract Roomside	Ground Level External	Air Handling Unit	0.66	463	mfr	Lw	66	59	64	62	57	53	52	39
AHU:00:04 Total	Ground Level External	Air Handling Unit	0.66	554	mfr	Lw	71	61	57	50	50	50	45	34

'he above data represent 'maximum' noise levels which should therefore not be exceeded. It is essential that Hann Tucker Associates are appraised of any alterations or additions to this lis

Plant Noise Schedule
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			Duty		Data		Sound Level (dB) at Octave Band Centre Frequency (Hz)							
Plant Ref.	Location	Plant Type	m^3/s	Pa	mfr/empir	Lw/Lp	63	125	250	500	1k	2k	4k	8k
AHU:B1:05	Basement	Air Handling Unit	0.388	400	mfr	Lw	85	78	83	75	75	75	72	66
TE:RF:01 Atmospheric	Roof	Toilet Extract Fan	0.826	225	mfr	Lw	88	77	74	75	74	71	67	61
TE:RF:01 Roomside	Roof	Toilet Extract Fan	0.826	225	mfr	Lw	78	76	73	73	67	65	62	57
TE:RF:01 Total	Roof	Toilet Extract Fan	0.826	225	mfr	Lw	67	59	54	46	36	33	37	27
Type 1: PURY-P400 YLM-A1	Roof	Condenser	-	-	mfr	Lp @1m	73.5	78.5	64.5	61.5	55.5	48	43	37.5
Type 2: PURY-P550 YLM-A1	Roof	Condenser	-	-	mfr	Lp @1m	78	71	67	63	57	50.5	44.5	39
Type 3: PURY-P300 YLM-A1	Roof	Condenser	-	-	mfr	Lp @1m	73.5	68.5	65	61.5	55.5	48	41	37
Life Safety Generator	Ground Level External	Generator	-	-	mfr	Lp @1m	68							
HP:00:01	Ground Level External	Condenser	-	-	mfr	Lp @1m	64	52	52	50	46	41	35	29
HP:00:02	Ground Level External	Condenser	-	-	mfr	Lp @1m	75	65	61.5	57.5	51	45	38.5	32.5
HP:00:03	Ground Level External	Condenser	-	-	mfr	Lp @1m	75	65	61.5	57.5	51	45	38.5	32.5

The above data represent 'maximum' noise levels which should therefore not be exceeded. It is essential that Hann Tucker Associates are appraised of any alterations or additions to this list

Attenuator Schedule
22827/AS

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration
Woking: 01483 770 595
Manchester: 0161 832 7041

Elm House

Revision: 0	Date: 23/03/2016	Prepared by: James Mackenzie			Comments:									
			Dimensions (mm)		Vol	Max PD	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
Attenuator Ref.	Description	.	Max Face Velocity	L	m^3/s	Pa	63	125	250	500	1k	2k	4k	8k
AHU:RF:ATT:01	AHU:10:01 Extract Atmospheric Side	1	5.5	1200	5.3	50	4	9	17	26	31	30	23	16
AHU:RF:ATT:03	AHU:10:01 Extract Roomside	1	5.5	1200	5.3	50	4	9	17	26	31	30	23	16
AHU:RF:ATT:02	AHU:10:01 Supply Atmospheric Side	1	7.2	900	6.2	50	2	4	9	15	17	14	10	8
AHU:RF:ATT:04	AHU:10:01 Supply Roomside	1	4.5	1200	6.2	50	9	18	31	48	50	49	44	24
AHU:03:ATT:01	AHU:00:03 Supply Atmospheric Side	1	7.2	900	0.66	50	2	4	9	15	17	14	10	8
AHU:03:ATT:02	AHU:00:03 Extract Atmospheric Side	1	4.5	1200	0.66	50	5	11	19	29	36	37	29	18
AHU:04:ATT:01	AHU:04 Supply Atmospheric Side	1	6.2	900	0.66	50	2	5	11	17	20	19	12	10
AHU:04:ATT:02	AHU:04 Extract Atmospheric Side	1	5.5	1200	0.66	50	4	9	17	26	31	30	23	16
AHU:05:ATT:01	AHU:B1:05 Extract Atmospheric Side	1	7.2	900	0.388	50	2	4	9	15	17	14	10	8
AHU:05:ATT:02	AHU:B1:05 Supply Atmospheric Side	1	7.2	900	0.388	50	2	4	9	15	17	14	10	8
AHU:05:ATT:03	AHU:B1:05 Supply Roomside	1	5.5	900	0.388	50	4	7	13	19	23	23	16	13
AHU:05:ATT:04	AHU:B1:05 Extract Roomside	1	6.2	900	0.388	50	2	5	11	17	20	19	12	10
TE:RF:ATT:01	TE:RF:01 Atmosphere Side	1	5.5	1200	0.826	50	2	5	11	17	20	19	12	10
TE:RF:ATT:02	TE:RF:01 Roomside	1	7.2	900	0.826	50	2	4	9	15	17	14	10	8

All attenuators must comply with Hann Tucker Associates General Specification for Acoustic and Vibration Isolation Materials and Products (copy available upon request if not supplied)