43 Eagle Street
London
WC1R 4AT

Environmental Noise Survey and Plant Noise Assessment Report

27392/PNA1

10 December 2019

For:
LGIM LGAS Property Fund
c/o JLL
P O Box 527
London
EN11 1RN

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

Head Office: Duke House, 1-2 Duke Street, Woking, Surrey, GU21 5BA (t) +44 (0) 1483 770 595
Manchester Office: First Floor, 346 Deansgate, Manchester, M3 4LY (t) +44 (0) 161 832 7041
(w) hanntucker.co.uk (e) enquiries@hanntucker.co.uk

Hann Tucker Associates

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Document Control

Rev	Date	Comment	Prepared by	Authorised by
2	10/12/2019	-	[redacted]	[redacted]
			Bo Ding Assistant Consultant PhD, MSc, BSc, AMIOA	Simon Hancock Director BEng(Hons), CEng, MIMechE MCIBSE, FIOA
1	09/12/2019	Two AHUs added	Bo Ding Assistant Consultant PhD, MSc, BSc, AMIOA	Simon Hancock Director BEng(Hons), CEng, MIMechE MCIBSE, FIOA
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1.0 Introduction

It is proposed to install multiple external condenser units at 43 Eagle Street, London, WC1R 4AT.

Hann Tucker Associates has therefore been appointed to conduct an environmental noise survey and plant noise assessment report to support the planning application.

This report presents the methodology and findings.

2.0 Objectives

To inspect the site to familiarise ourselves with its layout and surroundings in order to identify suitable accessible locations for environmental noise measurements.

To establish by means of an unmanned 24 hour survey the existing L_{Amax}, L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels at a single secure and accessible on-site position, using fully computerised noise monitoring equipment.

Measurement procedures shall be in general accordance with those described in BS 4142: 2014, Method for rating industrial noise affecting mixed residential areas, published by the British Standards Institution.

The survey will enable noise emission limits from the development to be identified with reference to the requirements of the Local Authority and the application of BS 4142: 2014 and to minimise the possibility of noise nuisance by neighbours.

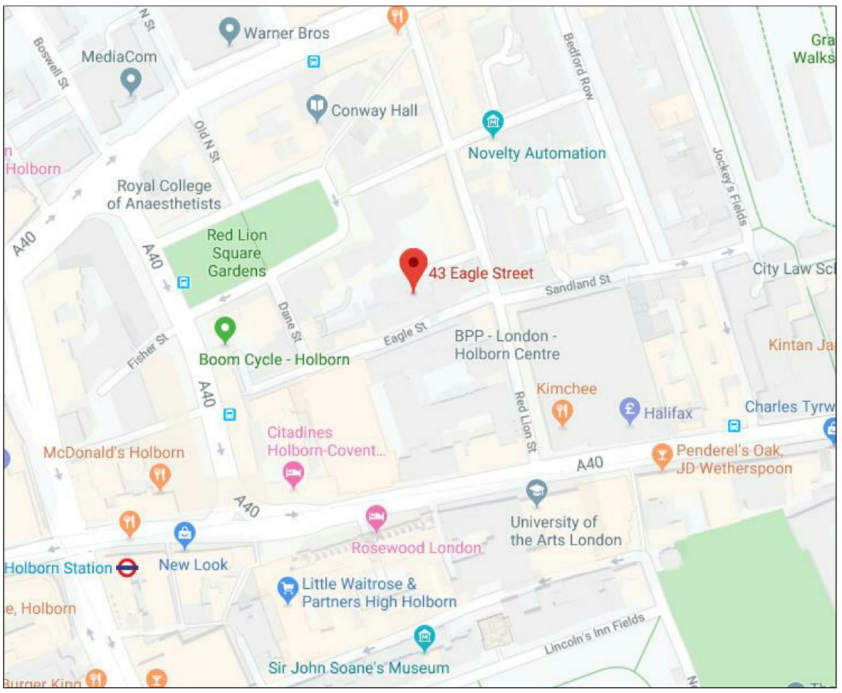
To assess the noise emissions from the proposed plant based upon data with which we are provided and comment upon the acceptability.

To advise on noise control measures if required with reference to the requirements of the Local Authority.

3.0 Site Description

3.1 Location

The site is located at 43 Eagle Street, London, WC1R 4AT. The location is shown in the Location Map below.



Location Map (Map Data © 2019 Google)

The site falls within the jurisdiction of Camden City Council.

3.2 Description

The site consists of a four storey building and is located at the north side of Eagle Street. The surrounding area is mostly residential and commercial properties. The dominant source of noise at the site is considered to be traffic on the surrounding area, particularly from Eagle Street.

The site is shown in the Site Plan below.

Site Plan (Map Data © 2019 Google)

4.0 Acoustic Terminology

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

5.0 Project Proposals

5.1 Proposed Plant

We understand the proposed plant comprises installation of the plant detailed in Section 11 of this report.

5.2 Operating Hours

We understand that the operating hours of the proposed plant are daytime only.

6.0 Acoustic Standards and Guidelines

6.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is to:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

That vision is supported by the following NPSE noise policy aims which are reflected in three of the four aims of planning policies and decisions in paragraph 123 of the NPPF (see paragraph 8.2 (b) below):

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an

SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

6.2 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (revised February 2019):

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

6.3 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at http://planningguidance.planningportal.gov.uk/blog/guidance/. This includes specific guidance on Noise although, like the NPPF and NPSE the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Perception	Examples of Outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for	Significant Observed Adverse Effect	Avoid

	sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.		
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable hard, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

6.4 Local Authority Requirements

The site comes under the jurisdiction of Camden, which outlines its requirements as below in *Camden Local Plan 2017: Appendix 3*

Note: NOAL – No Observed Effect Level, LOAEL- Lowest Observed Averse Effect Level, SOAEL – Significant Observed Adverse Effect Level.

"…a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion.

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 window (façade)*	*Day*	*'Rating level' 10dB below background*	*'Rating level' 9dB below and 5dB above background*	*'Rating level' greater than 5dB above background*
*Dwellings **		*Night*	*'Rating level' 10dB below background and no events exceeding 57dBL_{Amax}*	*'Rating level' 9dB below and 5dB above background or noise events between 57dB and 88dBL_{Amax}*	*'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}*

**10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise*

Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

***Levels are given for dwellings, however, levels are use specific and different levels will apply dependant on the use of premises.*"

6.5 BS 4142:2014

When setting plant noise emission criteria reference is commonly made to BS 4142: 2014 "*Methods for rating and assessing industrial and commercial sound*".

The procedure contained in BS 4142:2014 provides an assessment of the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise levels. Where the noise contains "a tone, impulse or other characteristic" then various corrections can be added to the specific (source) noise level to obtain the "rating level".

BS 4142 states that: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:*

- *"Typically, the greater this difference, the greater the magnitude of the impact."*

- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*

- *"A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."*

- *"The lower the rating level is relative 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."*

The determination of the "rating level" and the "background level" are both open to interpretation, depending on the context.

In summary it is not possible to set plant noise emission criteria purely on the basis of BS 4142:2014. It is reasonable to infer from the above, however, that a difference of around -5dB corresponds to "No Observed Effect Level" as defined in the Noise Policy Statement for England. It is also reasonable to infer from the above that if the plant noise rating level does not exceed the existing background noise level outside any noise sensitive residential window then the plant noise is of "low impact".

6.6 World Health Organisation Guidelines on Community Noise

BS8233:2014 is based upon the current World Health Organisation (WHO) guidance "*Guidelines on Community Noise*". A summary of the noise guidelines relevant to the proposed scheme is presented in the table below.

Residential Environment	Critical Health Effect(s)	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

These WHO guidelines are based, in almost all cases, on the lower threshold below which the occurrence rates of any particular effect can be assumed to be negligible.

6.7 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	*Location*	*Desirable Internal Ambient Criteria*	
		07:00 - 23:00	*23:00 - 07:00*
Resting	*Living Rooms*	*35 dB $L_{Aeq,16hour}$*	-
Dining	*Dining Room/Area*	*40 dB $L_{Aeq,16hour}$*	-
Sleeping (Daytime Resting)	*Bedroom*	*35 dB $L_{Aeq,16hour}$*	*30 dB $L_{Aeq,8hour}$*

6.8 Statutory Noise Nuisance

There is no quantitative definition of statutory noise nuisance. It is generally accepted however, that if the plant noise level is at least 5dB (or 10dB if tonal) below the minimum background $L_{90(15minutes)}$ at 1m from the nearest noise sensitive window, then the risk of a statutory noise nuisance is avoided. By adopting this as a design criterion the guidance contained in BS 4142:2014 should also be complied with.

7.0 Survey Methodology

The survey was undertaken by Bo Ding, Assistant Consultant, AMIOA.

7.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 10:45 hours on Thursday 24th October 2019 to 10:45 hours on Friday 25th October 2019.

During the periods we were on site the wind conditions were calm. The sky was patchy cloud. We understand that generally throughout the survey period the weather conditions were similar. These conditions are considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

7.2 Measurement Position

The microphone was located on the roof level of the site and attached to a pole approximately 1.5 metres above roof level.

Measurement Position (Map Data © 2019 Google)

7.3 Instrumentation

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

Type 1 ½" Condenser Microphone	**ACO Pacific**	**7052E**	**71786**	**Calibration on 13/09/2019**
Type 1 ½" Condenser Microphone	ACO Pacific	7052E	71786	Calibration on 13/09/2019
Preamp	Svantek	SV18	75754	Calibration on 13/09/2019
Type 1 Data Logging Sound Level Meter	Svantek	971	74415	Calibration on 13/09/2019
Type 1 ½" Condenser Microphone	ACO Pacific	7052E	71786	Calibration on 13/09/2019

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

The sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable.

The microphone was fitted with a windshield.

8.0 Results

The results have been plotted on Time History Graphs 27392/TH1 enclosed, presenting the 15 minute A-weighted (dBA) L_{90} and L_{eq} noise levels at each measurement position throughout the duration of the survey.

The lowest $L_{A90\ (15\ min)}$ measurements recorded during the survey are presented in the table below:

Lowest Measured $L_{A90(15min)}$ Background Noise Level (dB re 2 x 10^{-5} Pa)	
Daytime (07:00 – 23:00) Hours	**Night-Time (23:00 – 07:00) Hours**
46 dBA	42 dBA

9.0 Discussion Of Noise Climate

During the periods we were on site the dominant noise source was noted to be traffic noise.

10.0 Plant Noise Emission Criteria

On the basis of the above and the results of the environmental noise survey, we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive residential window.

Plant Noise Emission Criteria (dB re 2x10^{-5} Pa)	
Daytime (07:00 – 23:00 hours)	**Night-time (23:00 – 07:00 hours)**
36 dBA	32 dBA

The above criteria are to be achieved with all of the proposed plant operating simultaneously.

If plant contains tonal or impulsive characteristics the external design criteria should be reduced by 5dBA.

It should be noted that the above are subject to the final approval of the Local Authority.

11.0 Plant Noise Impact Assessment

We understand the proposed plant comprises the following:

Plant Description	Location	Qty	Plant Make	Model Number
Type A	Main Roof	3	Mitsubishi	PURY-P200-YNW-A
Type B	Main Roof	2	Mitsubishi	PURY-P300-YNW-A
Type C	Main Roof	1	Mitsubishi	PURY-P350-YNW-A
AHU-Main Roof	Main Roof	1	Mitsubishi	LGH-100RVX-E
AHU-2nd Floor Roof	Second floor roof	1	Mitsubishi	LGH-150RVX-E

11.1 Plant Noise Data

We understand the manufacturer's noise data for the condensers to be as follows:

Plant Description	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at 1 metre at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Type A	69	61	61	58	52	48	48	43	59
Type B	75	70	69	66	61	57	52	48	67
Type C	72	71	64	62	57	54	52	48	64

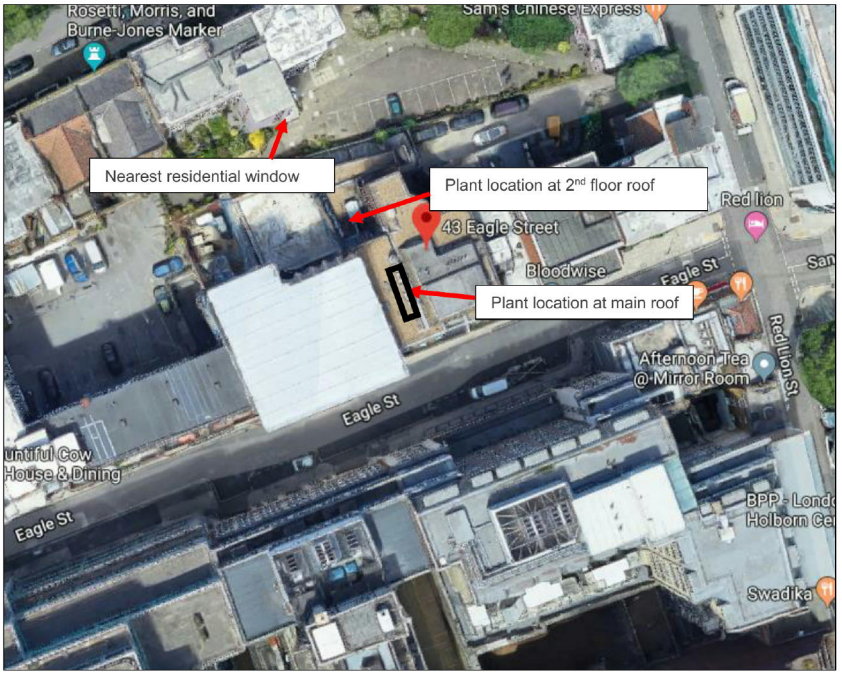
We understand the manufacturer's noise data for the AHUs to be as follows:

Plant Description	In Duct Sound Power Level for Supply Air (dB re $2x10^{-12}$ Watts) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
LGH-100RVX-E	69	73	71	66	67	67	62	50	73
LGH-150RVX-E	71	76	74	69	70	67	62	53	74

Please note that the manufacturer only provide the data for supply air. It is assumed in the following sections that the noise data for intake and exhaust would be the same with the supply air.

11.2 Location of Plant

The proposed plant will be located at the roof. The nearest residential window lies to the north of the plant location and is approximately 30 m away from the main roof plant location. The location of the plant is shown below. We have also been provided drawings of the location of the plant (see Attachments).



Proposed plant location (Map Data © 2019 Google)

11.3 Mitigation measures

In order to control plant noise emissions from the plant in line with the proposed criterion, we recommend the following mitigation measures:

- we would suggest acoustic enclosure to be installed to ensure the limiting cumulative sound pressure level for each condenser unit to be as follows:

Plant Description	Limiting Sound Pressure Level (dB re $2x10^{-5}$ Pa)
Condenser	54dBA @1m (equates to approx. 38dBA @10m)

- We would suggest atmospheric side attenuators be installed for the exhaust and intake of the AHUs. The attenuators shall achieve the following minimum insertion loss:

	Minimum Insertion Loss (dB) @ Octave Band Centre Frequency (Hz)							
Description	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8K**
Intake of LGH-100RVX-E	1	2	7	10	11	9	8	7
Exhaust of LGH-100RVX-E	1	2	7	10	11	9	8	7
Intake of LGH-150RVX-E	2	4	8	12	13	13	9	8
Exhaust of LGH-150RVX-E	2	4	8	12	13	13	9	8

11.4 Plant Noise Impact Assessment with Mitigation Measures

We understand that the proposed plant units will be operational during the daytime only.

The following table summarises our predictions of atmospheric noise emissions from the plant to the nearest noise sensitive residential window with the mitigation measures mentioned above.

	Sound Pressure Level (dBA)
	Daytime (07:00 – 23:00 hours)
Sound Pressure Level at Receptor from Condensers (acoustic enclosures are installed)	32
Sound Pressure Level at Receptor from AHU at main roof (attenuators are installed)	20
Sound Pressure Level at Receptor from AHU at second floor roof (attenuators are installed)	23
Cumulative Noise Level	32
Façade Reflection	+3
Calculated Noise Level at Receptor	35

Please note that the calculations of the sound pressure level from AHUs are based on that the exhaust and intake duct will be facing away from the residential window (see Attachments).

Our calculations indicate that the proposed plant, in conjunction with the mitigation measures described in Section 11.3, should be capable of achieving the requirements of the Local Authority outlined in Section 10.0.

12.0 Conclusions

An environmental noise survey has been undertaken in order to establish the currently prevailing noise levels.

Plant noise emission criteria have been recommended based on the results of the noise survey and with reference to the Local Authority's requirements.

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

The assessment indicates that the proposed plant, in conjunction with the proposed attenuation, should be capable of achieving the proposed environmental noise criteria at the nearest noise sensitive residential window.

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.

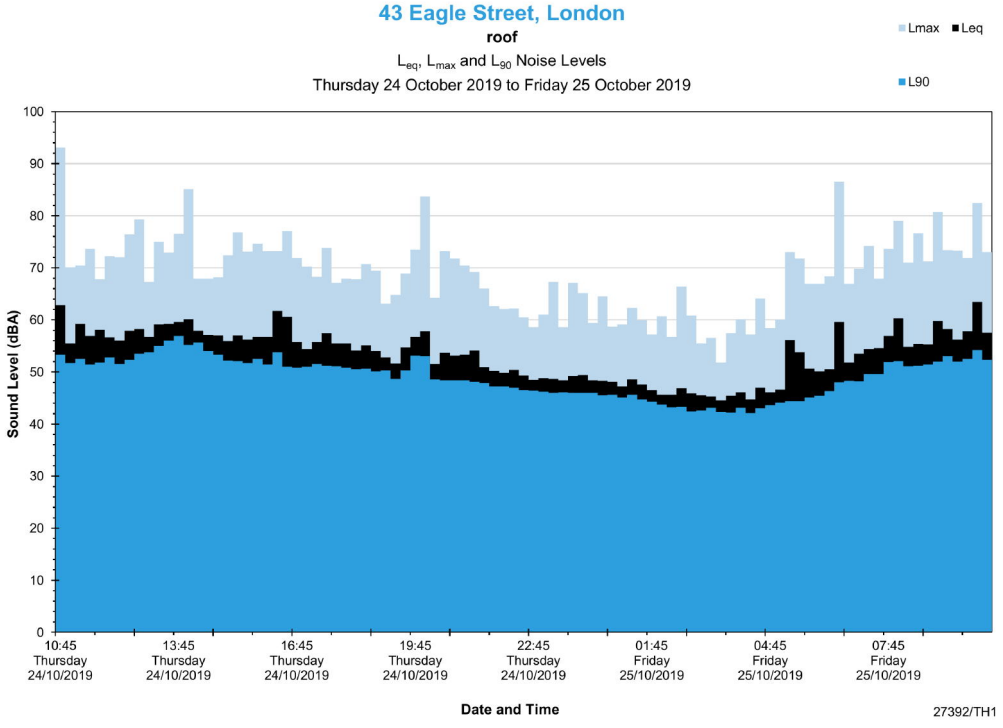
$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ 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.

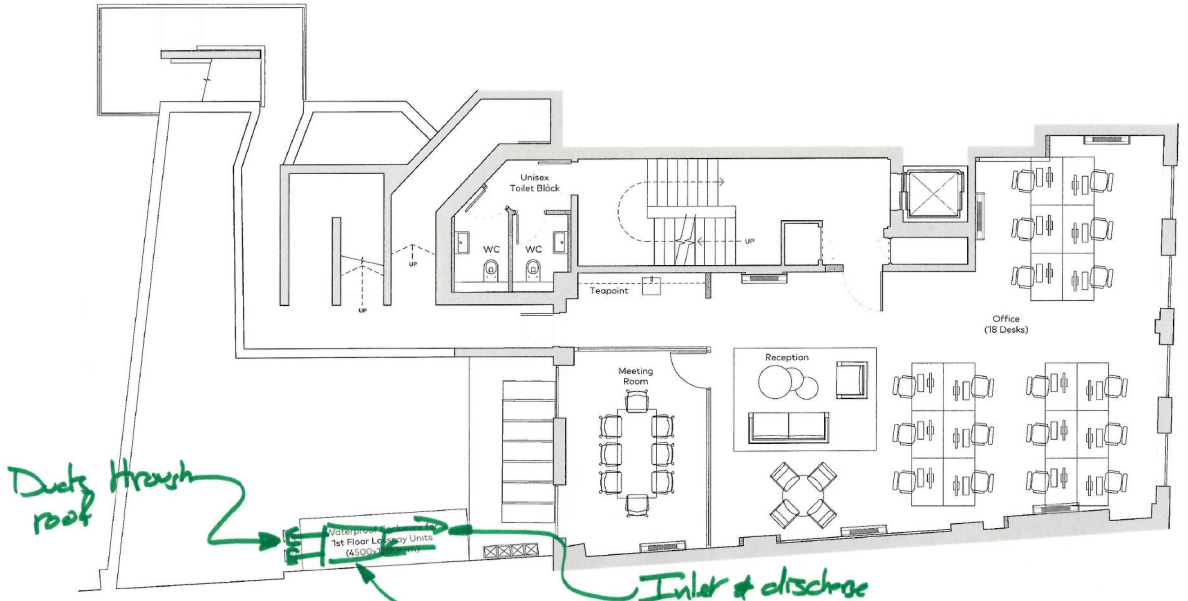
Sound Pressure Level (L_p) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

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).


43 Eagle Street, London
roof
L_{eq}, L_{max} and L_{90} Noise Levels
Thursday 24 October 2019 to Friday 25 October 2019
Lmax
Leq
L90
Sound Level (dBA)
100
90
80
70
60
50
40
30
20
10
0
10:45 Thursday 24/10/2019
13:45 Thursday 24/10/2019
16:45 Thursday 24/10/2019
19:45 Thursday 24/10/2019
22:45 Thursday 24/10/2019
01:45 Friday 25/10/2019
04:45 Friday 25/10/2019
07:45 Friday 25/10/2019
Date and Time
27392/TH1

KEY

- Existing Walls
- Proposed Walls
- Mechanical Ductwork
- Lighting



Ducts through roof

Inlet & discharge from unit

LGH-150 RVX-E ventilation unit on roof terrace in weather proof enclosure

Indicative roof terrace ventilation plant locations	
Hollis	26/11/19

01 Second Floor Plan
1:50@A1 As Proposed

Scale in Metres @ 1:50

Rev	Issue Date	Revision Notes	Drwn
A	15.11.2019	Preliminary issue	MB

General Notes

Do not scale. All written dimensions must be checked on site before work commences on site or in shop. Figured dimensions take preference over those scaled. Discrepancies, where identified, must be reported to the Architect immediately. Any areas indicated in this drawing are for guidance purposes only. No responsibility is taken for the accuracy. All work must be carried out in accordance with the Building Regulations and to the satisfaction of the Local Authority.

Drawing Status:

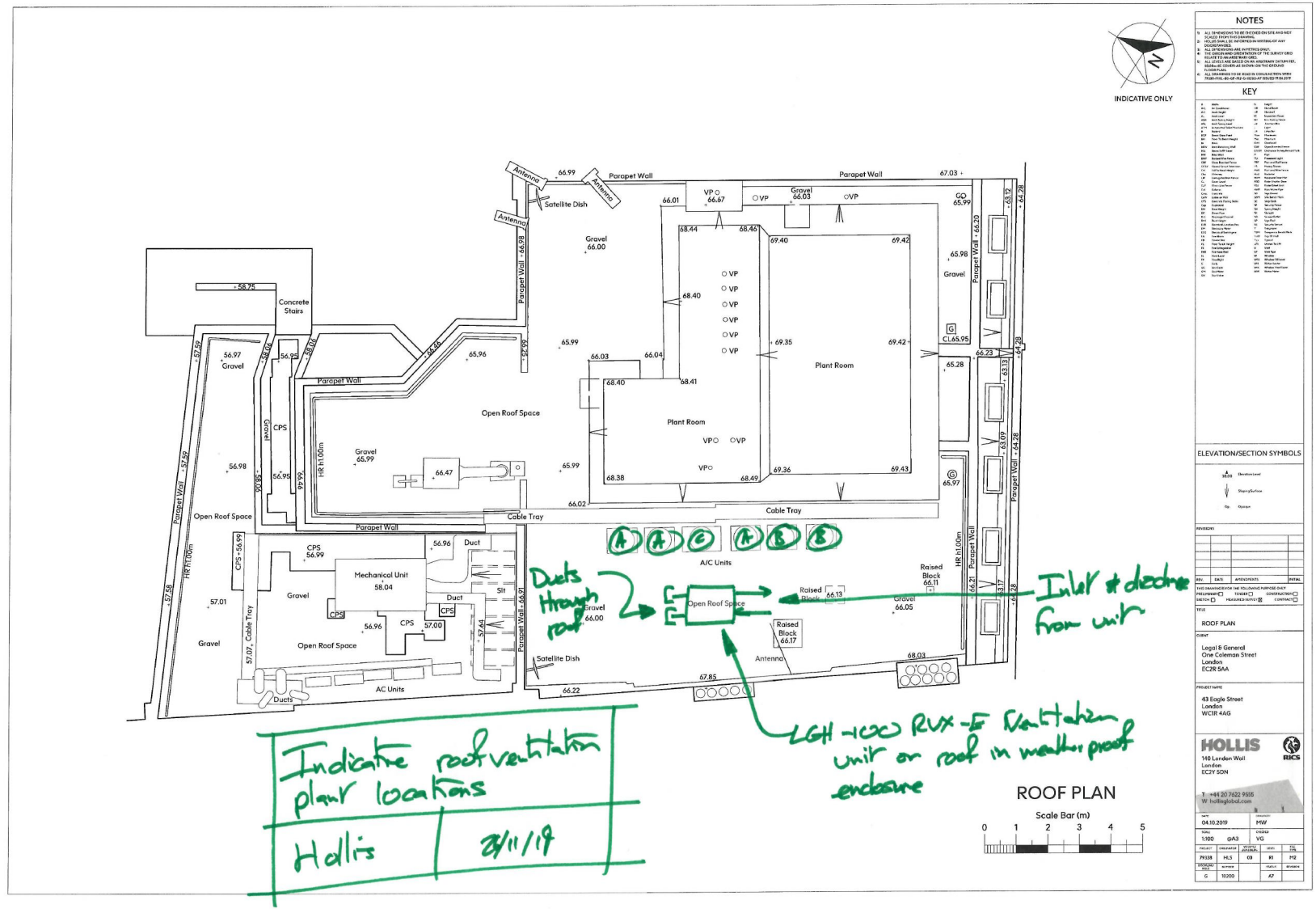
PRELIMINARY

Job Number	Drawing Number	Rev	Scale
873	(SK)013	A	1:50@A1 1:100@A3

Drawing Title	Second Floor Plan As Proposed Option 2 - Lossnay
Project	43 Eagle Street Holborn, London, WC1
Client	Legal & General
Date	15.11.2019 drawn MB checked

Garnett & Partners
Architects

Garnett & Partners LLP
Studio 303, The Printroom
164-180 Union Street
London
SE1 0LH
+44 20 7404 7677


INDICATIVE ONLY
NOTES
KEY
ELEVATION/SECTION SYMBOLS
Antenna
Satellite Dish
Parapet Wall
Gravel
Concrete Stairs
Open Roof Space
Plant Room
Cable Tray
A/C Units
Mechanical Unit
Duct
CPS
Raised Block
Ducts Through roof
Inlet & discharge from unit
LGH-1000 RUX-E Ventilation unit on roof in weather proof enclosure
Indicate roof ventilation plant locations
Hollis
29/11/19
ROOF PLAN
Scale Bar (m)
0 1 2 3 4 5
Legal & General
One Coleman Street
London
EC2R 5AA
43 Eagle Street
London
WC1R 4AG
HOLLIS
140 London Wall
London
EC2Y 5DN
T +44 20 7622 9555
W hollisglobal.com
04.10.2019
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1:100
@A3
VG
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R1
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G
1:200
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