31-32 & 33-34 Alfred Place London

Plant Noise Assessment Report

29661/PNA1 Rev4

18 May 2022

For:
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Hann Tucker Associates

Plant Noise Assessment Report
Report 29661/PNA1 Rev4

Document Control

Rev	Date	Comment	Prepared by	Authorised by
4	18/05/2022	Location updated		
			Rebeca Sanchez Assistant Consultant LArch, MSc	John Gibbs Director MIOA MSEE CEnv
3	12/05/2022	Correction in life-safety generator limiting noise levels	Rebeca Sanchez Assistant Consultant LArch, MSc	John Gibbs Director MIOA MSEE CEnv
2	10/05/2022	Generator marked as new plant	Rebeca Sanchez Assistant Consultant LArch, MSc	John Ridpath Director BSc(Hons) MIOA MIEnvSc
1	09/05/2022	Roof plan updated Alternative acoustic barriers proposed	Rebeca Sanchez Assistant Consultant LArch, MSc	John Ridpath Director BSc(Hons) MIOA MIEnvSc
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Contents

Attachments

1.0 Introduction

It is proposed to refurbish the properties on 31-32 & 33-34 Alfred Place. Works related to the refurbishment include renovations of the existing properties and the re-location of the existing plant.

Hann Tucker Associates have therefore been commissioned to undertake an assessment to determine the plant noise emissions at the nearest noise sensitive window and compare the predicted noise levels to the proposed criteria stated in our Environmental Noise Survey 29661/ENS1.

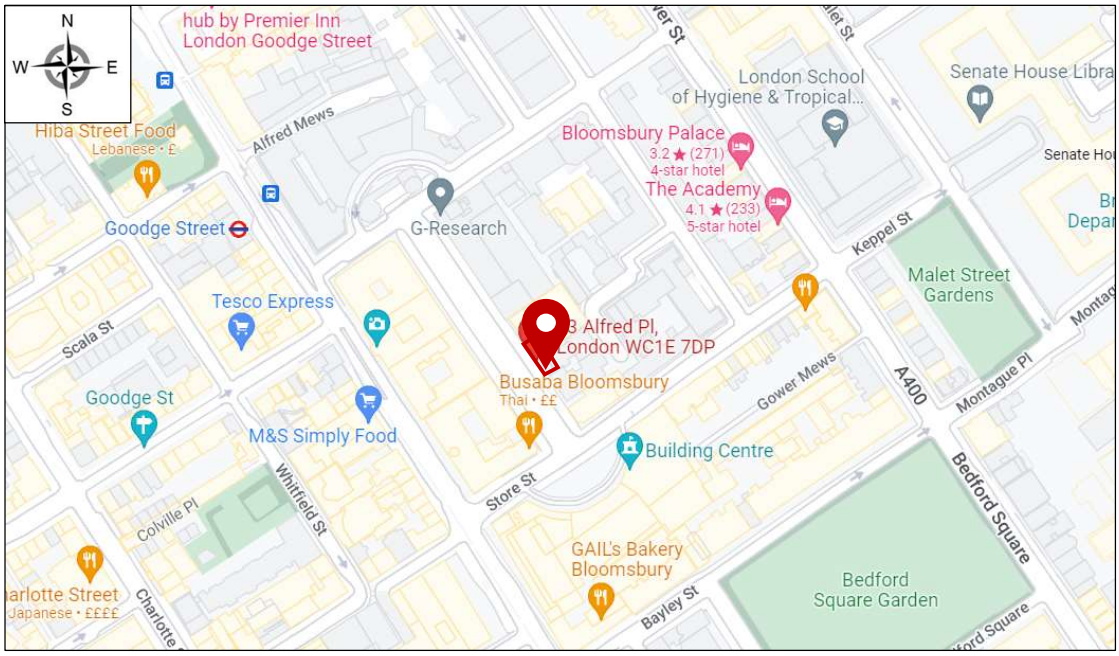
2.0 Objectives

To assess noise emissions from the proposed plant with reference to the proposed noise criteria presented in our Environmental Noise Survey 29661/ENS1 and comment on its acceptability.

3.0 Site Description

3.1 Location

The site is located at 31-32 & 33-34 Alfred Place, London, WC1E 7DP. The location is shown in the Location Map below.



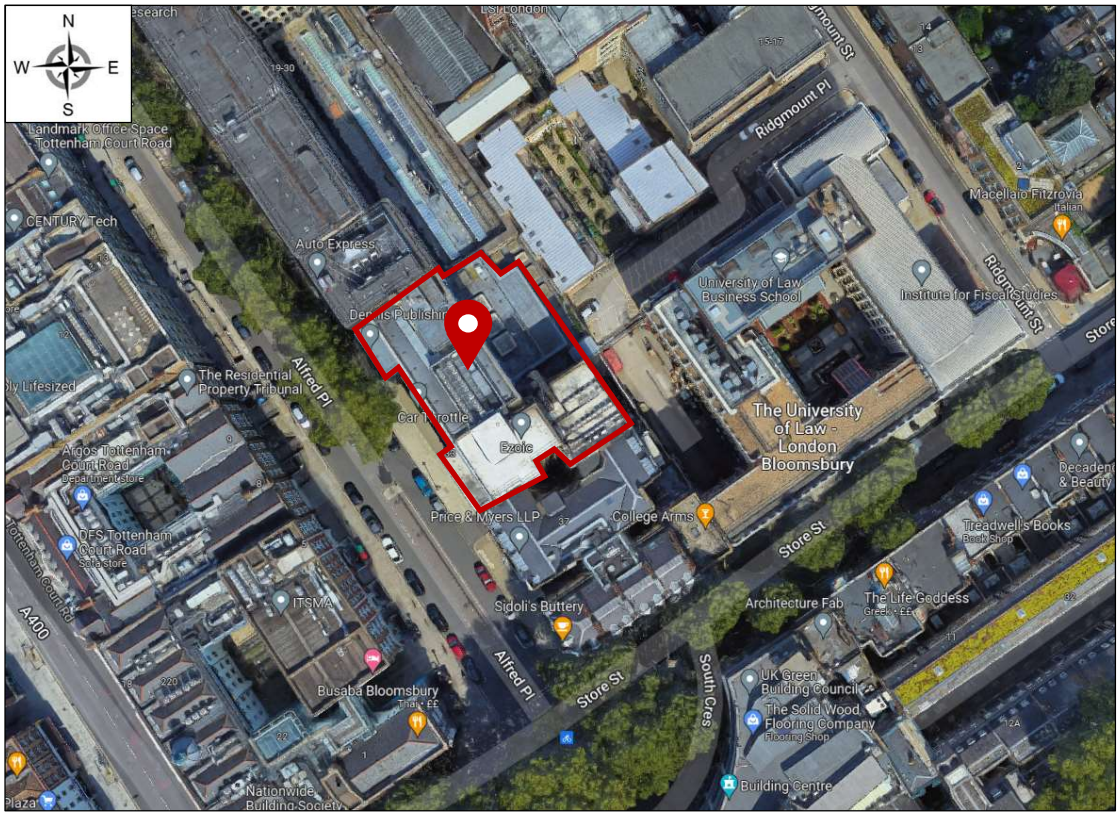
Location Map (Map data © 2022 Google)

The site falls within the jurisdiction of London Borough of Camden.

3.2 Description

The site is bounded to the north-west with office premises, to the southwest with Alfred Place (currently a plaza) and mixed-use buildings (commercial/office/residential), to the southeast with office premises and the University of Law-London Bloomsbury, and to the north-east with residential premises and Ridgmount Place. The offices at the north-west have a height of ground plus 7 storeys. The mixed-use buildings at the southwest and the offices at the southeast have a height that ranges from ground plus 3 to ground plus 4 storeys. The university has a height of ground plus 5 storeys. The residential dwellings have a height that ranges from ground plus 2 to ground plus 3 storeys.

The site is shown in the Site Plan below.



Site Plan (Imagery © 2022 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map Data © 2022 Google)

4.0 Acoustic Terminology

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

5.0 Acoustic Standards and Guidelines

5.1 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."

"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.

5.2 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) was first published in March 2012. This document replaced the existing Planning Policy Guidance Note 24 (PPG24) "Planning and Noise". A new edition of NPPF was published in July 2021 and comes into effect immediately.

The following paragraphs are from the NPPF (published July 2021):

185. 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.

187. 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 185 also references the Noise Policy Statement for England (NPSE). 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."

The NPPF document does not refer to any other documents or British Standards regarding nose other than the NPSE.

Paragraph 2 of the NPPF states that *"planning law required that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."*

Paragraph 12 of the NPPF states that *"The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed."*

5.3 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 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.	Significant Observed Adverse Effect	Avoid
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

5.4 Local Authority Requirements

The site lies within the jurisdiction of London Borough of Camden. Their advice regarding criteria for atmospheric noise emissions from building service plant is as follows:

"A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dB L_{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 given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area."

London Borough of Camden's advice regarding criteria for atmospheric noise emissions from generators is as follows:

"6.100 Emergency equipment such as generators which are only to be used for short periods of time will be required to meet the noise criteria of no more than 10dB above the background level (L90 15 minutes). During standby periods, emergency equipment will be required to meet the usual criteria for plant and machinery. Conditions to this effect may be imposed in instances where emergency equipment forms part of the application."

5.5 BS 4142:2014 + A1:2019

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+A1:2019. 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".

5.6 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.

5.7 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 $L_{Aeq,8hour}$*

5.8 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 residential 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.

6.0 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.

The requirements imposed by London Borough of Camden are stated on Section 5.4 of this report.

On the basis of the above and the results of the Environmental Noise Survey 29661/ENS 1, we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive residential windows.

Façade	**Plant Noise Emission Criteria (dB re $2x10^{-5}$ Pa)**		
	Daytime (07:00 – 23:00 hours)	**Night-time (23:00 – 07:00 hours)**	**24 hours**
North-east	42 dBA	39 dBA	39 dBA
South-west	43 dBA	37 dBA	37 dBA

The above criteria are to be achieved with all of the proposed plant operating simultaneously. It should be noted that the above are subject to the final approval of the Local Authority.

For life safety standby plant, only used in emergencies and occasional testing - e.g. smoke extract fans and life safety generators - relaxations of the internal and external criteria are normally acceptable but should comply with local authority and occupational requirements and must not interfere with internal audible emergency alarms. The liming noise level should be 70 dBA at 1m in any direction.

7.0 Plant Noise Impact Assessment

7.1 Existing Plant

We understand the existing plant that will be re-located comprises the following:

Plant item	Plant Description	Location	Qty	Plant Make	Model Number
1	VRF unit	Roof	1	Panasonic	U-16ME1E81
2	VRF unit	Roof	1	Mitsubishi Electric	PURY-P112YKM2
3	VRF unit	Roof	1	Mitsubishi Electric	PUHZ-ZRP100VKA3
4	VRF unit	Roof	4	Mitsubishi Electric	PURY-P300YLM-A1
5	VRF unit	Roof	2	Mitsubishi Electric	PURY-P250YLM-A1
6	VRF unit	Roof	6	Mitsubishi Electric	PURY-P200YLM-A1
7	AHU-RF-01	Roof	1	Easy Air Handling	CTA 100
8	Generator[1]	1st floor roof	1	Shenton Group	PHG55lv

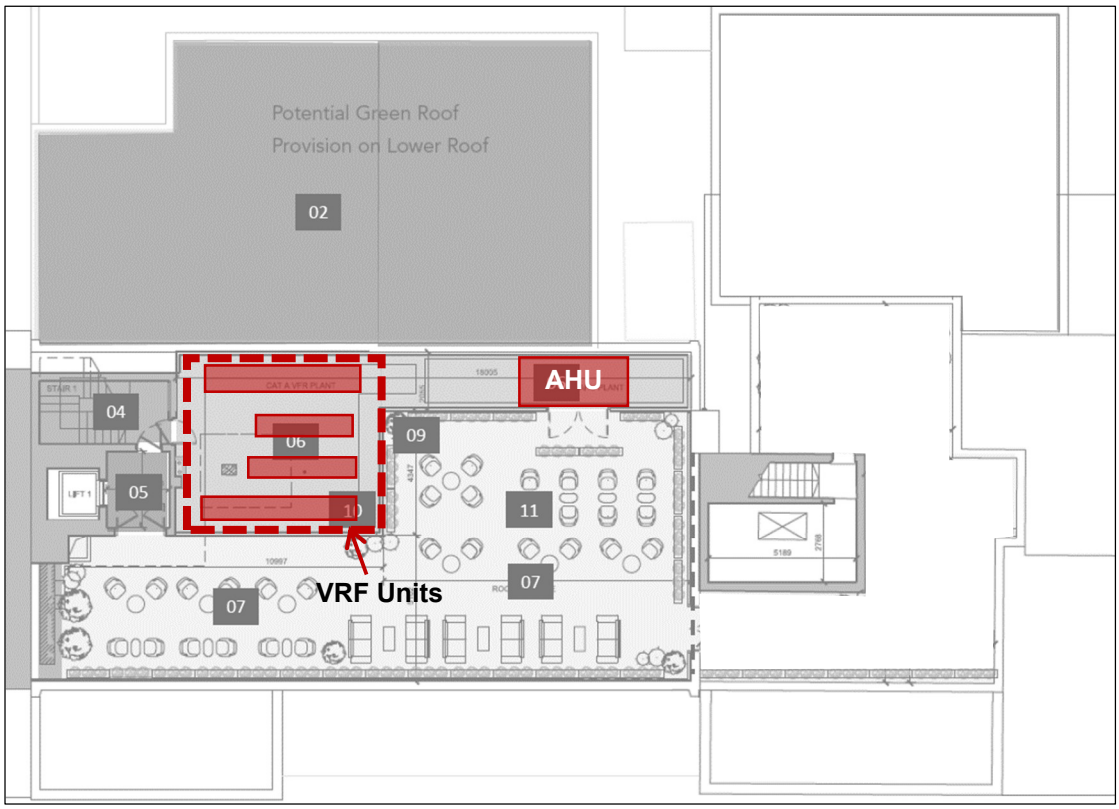
Note 1: Proposed plant item (new).

7.2 Drawings

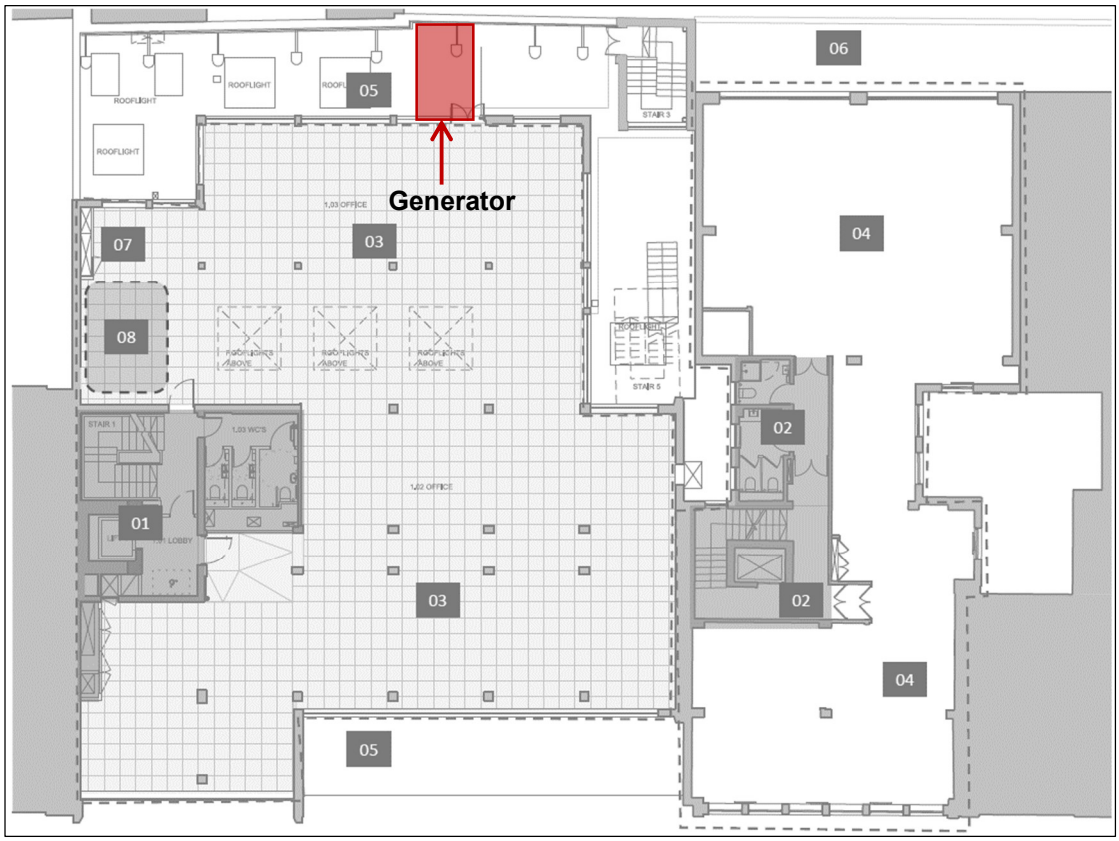
Our acoustic analyses are based on the following drawings provided by GDM.

Reference	Title
MEP Design Sketch Book	Proposed Roof 31-32 Alfred Place
MEP Design Sketch Book	1st Floor

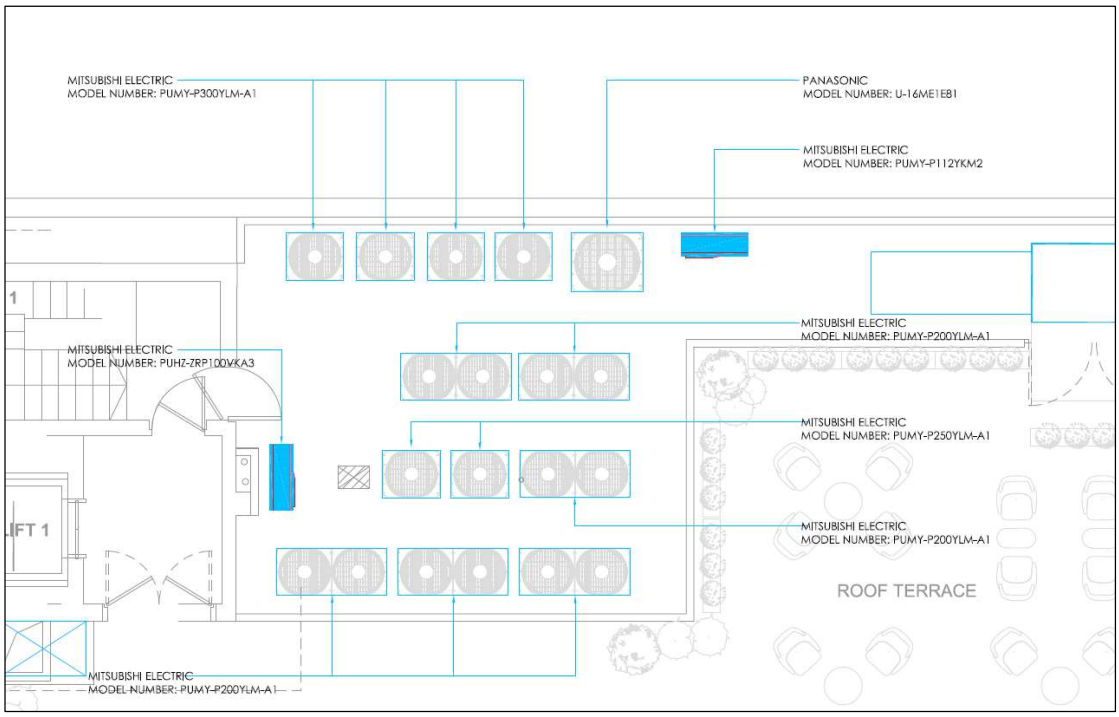
Proposed site plans are shown below.



Proposed Roof Plan (Plan provided by GDM)



Proposed 1st Floor Roof Plan (Plan provided by GDM)



Proposed Roof Plan (Plan provided by GDM)

7.3 Plant Noise Data

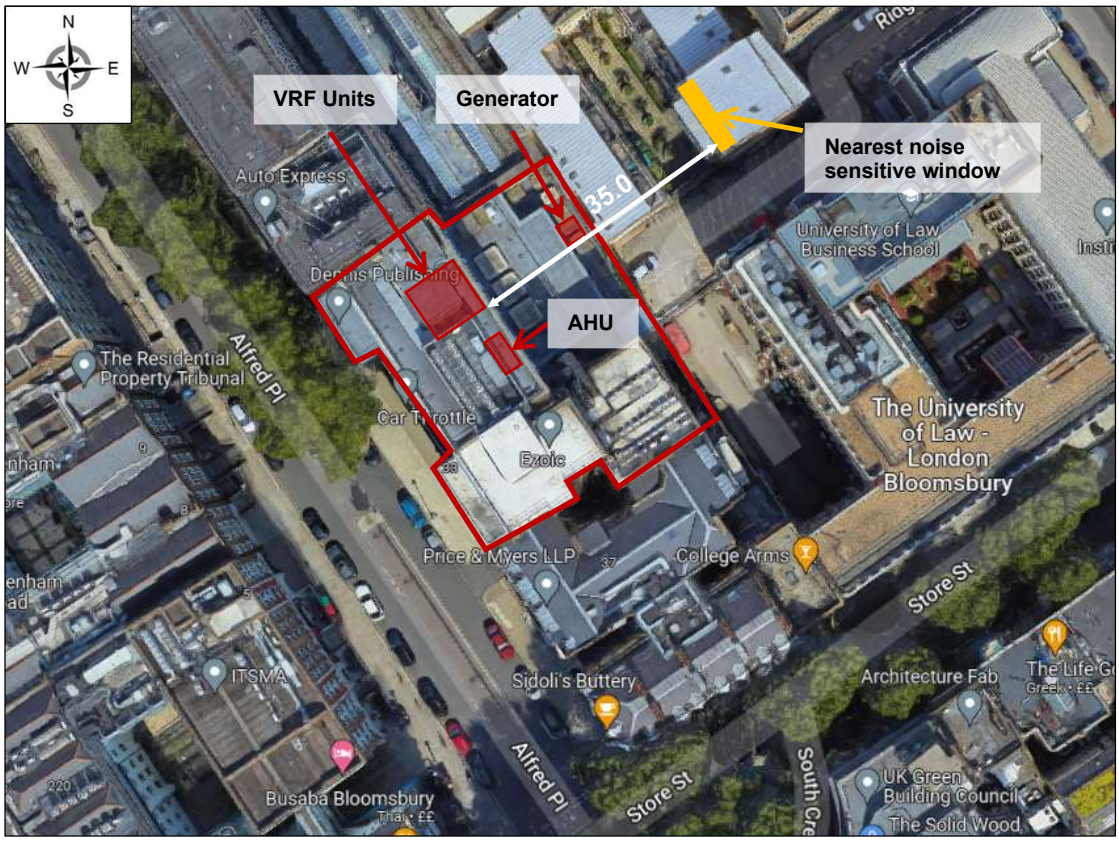
We understand the manufacturer's noise data for the equipment to be as follows:

Plant item	Model Number	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	
1	U-16ME1E81	76.5 dB (Sound Power Level)								
2	PUMY-P112YKM1	56.9	52.4	49	46.9	44	39.2	33.7	32.1	49
3	PUHZ-ZRP100VKA3	53	51	49	48	44	40	34	27	49
4	PURY-P300YLM-A1	73.5	68.5	65	61.5	55.5	48	41	37	62.5
5	PURY-P250YLM-A1	76	66	62.5	58.5	52	46	41.5	34	60
6	PURY-P200YLM-A1	75	65	61.5	57.5	51	45	38.5	32.5	59
7	CTA 100 (AHU)	61 dBA (Sound Pressure Level @ 1 m)								
8	PHG55lv (Generator)	70 dB(A) (Sound Pressure Level @ 7 m)								

7.4 Location of Plant

We understand the existing plant will be re-located on the roof of 31-32 Alfred Place, which will be at a height of ground plus 6 storeys approximately. The distance from the nearest plant to the nearest noise sensitive residential window is approximately 35 metres.

The location of the plant and the nearest noise sensitive window are shown on the plan below.



Proposed Plant Relocation - Site Plan (Imagery © 2022 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map Data © 2022 Google)

7.5 Mitigation Measures

In order to control plant noise emissions in line with the proposed criterion, we recommend to install the units 1, 2 and 4 in an acoustic enclosure capable of achieving no less than 12 dB reduction. As an alternative, a solid acoustic screen capable of providing no less than 12 dB reduction could be installed. Please find the specification and a suitable suppliers list at the end of the report. If the acoustic screen is located near to the AHU, an acoustic louvre screen with the following performance could be installed instead, which would allow airflow to the AHU. If this is the case, the airflow requirements should be checked by a services consultant.

Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
6	6	9	13	21	20	16	16

The AHU should be fitted with attenuators at inlet and discharge (supply sides). These shall provide the following minimum octave band insertion losses when tested in accordance with BS EN ISO 7235 : 2009 “Acoustics - laboratory measurement procedures for ducted silencers and air terminal units–insertion loss, flow noise and total pressure loss”.

Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
4	7	13	19	23	23	16	13

Silencers can be 900mm long. However, the dimensions can vary if the minimum insertion loss is met.

7.6 Plant Noise Impact Assessment

The AHU will be attenuated such that the planning conditions imposed by London Borough of Camden are satisfied. It is likely that noise control techniques such as attenuation of air intake/discharge louvres with duct-mounted attenuators and/or acoustic louvres, will be implemented. With these measures atmospheric noise emissions from the proposed AHU will comply with the planning conditions imposed by London Borough of Camden and statutory noise nuisance legislation.

We understand that the re-located units will be operational during daytime/night-time hours.

The following table summarise our predictions of atmospheric noise emissions from the plantroom louvres to the nearest noise sensitive residential window.

Plant Item	Description	Sound Pressure Level (dB re $2x10^{-5}$ Pa)
1	Sound Power Level	77
	Conformal Area Distance Loss (1.0 m to 35 m)	- 42
	Façade Reflection	+ 3
	Proposed enclosure	-12
	Calculated Noise Level at Receptor	26
2	Sound Pressure Level at 1m	49
	Conformal Area Distance Loss (1.0 m to 35 m)	- 26
	Façade Reflection	+ 3
	Proposed enclosure	-12
	Calculated Noise Level at Receptor	14
3	Sound Pressure Level at 1m	49
	Conformal Area Distance Loss (1.0 m to 37 m)	- 26
	Façade Reflection	+ 3
	Barrier loss	-12
	Calculated Noise Level at Receptor	14

Plant Item	Description	Sound Pressure Level (dB re $2x10^{-5}$ Pa)
4	Sound Pressure Level at 1m	63
	Correction for 4No. Units	6
	Conformal Area Distance Loss (1.0 m to 35 m)	- 26
	Façade Reflection	+ 3
	Proposed enclosure	-12
	Calculated Noise Level at Receptor	34
5	Sound Pressure Level at 1m	60
	Correction for 2No. Units	3
	Conformal Area Distance Loss (1.0 m to 37 m)	- 26
	Façade Reflection	+ 3
	Barrier loss	-12
	Calculated Noise Level at Receptor	28
6	Sound Pressure Level at 1m	59
	Correction for 6No. Units	8
	Conformal Area Distance Loss (1.0 m to 37 m)	- 26
	Façade Reflection	+ 3
	Barrier loss	-12
	Calculated Noise Level at Receptor	32
7	Cumulative Sound Pressure Level with attenuators	53
	Conformal Area Distance Loss (1.0 m to 37 m)	- 24
	Façade Reflection	+ 3
	Calculated Noise Level at Receptor	32
Cumulative noise level at receptor		**38 dBA**

Our calculations indicate that the proposed plant, in conjunction with the proposed mitigation measures, should be capable of achieving the requirements of the Local Authority outlined in Section 6.0.

7.7 Life Safety Generator

The roof mounted life safety packaged generator shall be supplied with a full acoustic package in order to control noise emissions to adjacent properties and the office space below. The package shall include:

- Full acoustic enclosure completely encasing the generator set on all sides (i.e., comprise four walls, a roof and a floor).

- Inlet and discharge attenuators for ventilation air.
- Exhaust flue attenuators. Primary and secondary attenuators to be inside enclosure. Tertiary attenuators (if required) can be outside of the enclosures if height constraints permit.
- Anti-vibration mounts as per schedule.

The complete package shall be designed, constructed and installed so as to ensure that the total radiated noise does not exceed a sound pressure level (dB re 2 x 10^{-5} Pa) of 90 dBA at 1m in any direction, under any load conditions, under free field conditions over a plane reflecting surface.

This will meet London Borough of Camden's criterion for noise emissions from a life safety generator the nearest noise sensitive window.

8.0 Conclusions

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).

31-32 & 33-34 ALFRED PLACE

SPECIFICATION FOR

SMALL ACOUSTIC ENCLOSURES

The condenser units shall be supplied complete with acoustic treatment which shall achieve adequate levels of attenuation to ensure that the following limiting sound pressure levels are not exceeded when measured at a distance of 1m (free field over a reflecting plane) or [in any horizontal direction] or [in any horizontal or vertical direction] under any load conditions.

Plant item	A-weighted Limiting Sound Pressure Level @ 1m (dB re 2 x 10-5 Pa)
1	49 dB
2	37 dB
4	51 dB

Furthermore they shall not exhibit any significant tonal content.

Exceedances in excess of the measurement tolerance for a Type 1 sound level meter shall constitute a failure.

The enclosed outer panels shall be constructed from galvanized sheet steel having a minimum thickness of 1.6mm and fixed at 300mm (max) centres. The enclosure inner panels shall be constructed from punch-perforated (round-hole) galvanised sheet steel facing, having a minimum thickness of 0.7mm fixed at 300mm (max) centres. Flattened-expanded ("Expamet") sheet shall not be used, unless all edges of the sheet are mechanically fixed to the panel casing and galvanised steel cover strips are used to prevent rivet heads pulling through the perforated sheet (trapping the Expamet between two solid steel layers).

The inert, rot and vermin proof, non-hygroscopic and non-combustible mineral wool or glass fibre acoustic medium shall be packed to a density of not less than 48kg/$m^{3.}$ This shall be faced with a glass fibre cloth, or other approved infill protection membrane. Panels shall be constructed and assembled so that no egress of the acoustic medium will occur under the operating conditions.

Doors, access panels, windows and ventilation ducts or electrical cable penetrations hall be treated so as to maintain the specified acoustic insulation of the assembled enclosure.

Demountable sections shall be designed to allow easy disassembly and reassembly by unskilled personnel without affecting the acoustic performance.

The supplier shall ensure that the assembled enclosure is designed and constructed to withstand site operating conditions such as wind and snow loads, roof mounted plant, etc., as appropriate, and if outside, to be suitably weatherproofed.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

Any deviations from the above specification must be agreed by, and confirmed in writing to, Hann Tucker Associates.

31-32 & 33-34 ALFRED PLACE

ACOUSTIC SPECIFICATION FOR

ACOUSTIC SCREEN (SOLID)

Acoustic screening shall extend:

- continuously along/around the west side of the plant area.
- from the roof up to a minimum height of 1800 mm above roof level, or equal to the highest part of the plant, whichever is the higher.

The screen shall be imperforate (solid) and have a minimum mass per unit area of at least 10kg/m^2. This could be achieved using two or more layers of a wide range of materials including, for example, 25mm treated timber, 18mm WBP plywood, 8mm dense cement bonded particle board, 1.5mm galvanized steel or equivalent sheet material to a suitable thickness required to achieve the mass per unit area. All junctions should be staggered.

Doors, access panels and service penetrations shall be treated so as to maintain the acoustic performance of the assembled screen.

All junctions between the screen and adjacent structures shall be made good and sealed with a heavy grout and/or dense non-hardening mastic.

The complete structure shall be wind and weather resistant to standards agreed with the Client.

The exact design of the screen will be agreed with and approved by Hann Tucker Associates.

SUITABLE SUPPLIERS

of

ACOUSTIC ENCLOSURES FOR SMALL AIR CONDITIONING UNITS

Name & Address	Telephone Number	Contact
Environ Technologies Ltd Regus House 1010 Cambourne Business Park Cambourne CB23 6DP	0870 383 3344	Simon Parker - 07974428395 simonparker@environ.co.uk Paul Gunter- 07712579106 paulgunter@environ.co.uk
Acoustic Engineering Services (UK) Ltd The Redwood Suite Guardian House Borough Road Godalming Surrey GU7 2AE	01483 495963	Barry Austin Mark Stagg

SUITABLE SUPPLIERS

of

ATTENUATORS (H & V)

Name & Address	Telephone Number	Contact
IAC Acoustics IAC House Moorside Road Winchester SO23 7US	01962 87300	Kevin Shipway Gill Budd
Allaway Acoustics Ltd 1 Queens Road Hertford SG14 1EN	01992 550825	Jim Grieves Andy Smith
Caice Riverside House 3 Winnersh Fields Gazelle Close Winnersh Wokingham RG41 5QS	0118 918 6470	Mike Jackson