Report VA4507.231212.NIA1.1

50-51 Russell Square, London

Noise Impact Assessment

12 December 2023

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Contents

Attachments

Report Version	Author	Approved	Changes	Date
NIA	Jamie Duncan	Steven Liddell	-	21/2/23
NIA1.1	Jamie Duncan	Ben Alexander	Updated plant selections and layouts	12/12/23

1. Introduction

It is proposed to install condenser units and air handling plant at 50-51 Russell Square, London.

Venta Acoustics has been commissioned by Taylor Project Services to undertake an assessment of the potential noise impact of these proposals in support of an application for planning permission.

An environmental noise survey has been undertaken to determine the background noise levels at the most affected noise sensitive receptors. These levels are used to undertake an assessment of the likely impact with reference to the planning requirements of Camden Council.

2. Design Criterion and Assessment Methodology

2.1 Camden Council Requirements

Camden Council's Local Plan (adopted June 2017), Appendix 3, provides the following guidance regarding noise from Industrial and Commercial Noise Sources

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).

Existing Noise sensitive receiver	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 $57dBL_{Amax}$	'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 $88dBL_{Amax}$

**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 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 $L_{eq,5mins}$ 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.

2.2 BS8233:2014

BS8233 *Guidance on sound insulation and noise reduction for buildings* provides guidance as to suitable internal noise levels for different areas within residential buildings.

The relevant section of the standard is shown below in Table 2.1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16 hour}$	-
Dining	Dining Room	40 dB $L_{Aeq, 16 hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 hour}$	30 dB $L_{Aeq, 8 hour}$

Table 2.1 - Excerpt from BS8233: 2014 **[dB ref. 20µPa]**

3. Site Description

As illustrated on attached site plan VA4507/SP1, the site building is located on the corner of Russell Square and Bedford Place.

The most affected noise sensitive receivers are expected to be the Bedford Place Apartments (20 Bedford Place) on the opposite side of Bedford Place, and the upper floor offices at 21 Bedford Place.

Existing building services plant was noted on several of the neighbouring rooftops.

4. Environmental Noise Survey

4.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Thursday 5th and Friday 6th January 2023 at the location shown in site plan VA4507/SP1. This location was chosen to be representative of the background noise level at the most affected noise sensitive receivers.

Continuous 5-minute samples of the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were undertaken at the measurement location.

The weather during the survey period was generally dry with light winds. The background noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-11586-E0	1502936-2	25/7/22
Larson Davis calibrator	CAL200	19816	44622-19816-CAL200	2/3/22

Table 4.1 – Equipment used for the tests

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

4.2 Results

The measured sound levels are shown as time-history plot on the attached chart VA4507/TH1.

The background noise level is determined by road traffic in the surrounding area.

The typical background noise levels measured were:

Monitoring Period	Minimum $L_{A90,5min}$
07:00 – 23:00 hours	48 dB
23:00 – 07:00 hours	44 dB
Office hours; 08:00 – 19:00	50 dB

Table 4.2 – Minimum background noise levels **[dB ref. 20 µPa]**

4.3 Plant Noise Emission Limits

On the basis of the measured noise levels and the planning requirements of the Local Authority, and considering that it is not expected that tonal noise will be generated by the proposed plant units, the following plant specific sound levels should not be exceeded at the most affected noise sensitive receivers:

Monitoring Period	Design Criterion (L_{Aeq})
07:00 – 23:00 hours	38 dB
23:00 – 07:00 hours	34 dB
Office hours; 08:00 – 19:00	40 dB

Table 4.3 – Specific sound pressure levels not to be exceeded at most affected noise sensitive receivers

5. Predicted Noise Impact

5.1 Proposed plant

The following plant is proposed for installation at main roof and first floor roof level at the locations indicated on the noise map VA4507/NM1.

Plant Item	Quantity	Proposed Model	Notes
Condenser	1	Daikin REYQ8U	Located on second floor roof
Condensers	3	Daikin REYQ12U	
Condensers	2	Daikin REYQ16U	
Condenser	1	Daikin REYQ20U	
Condenser	2	Daikin 3MXM52A	
MVHR	1	Daikin VAM 1000	Located on main roof
Toilet Extract	1	Nuaire AVS4	
Internal MVHRs	5	Daikin Modular Size 5	One per floor, located internally

Table 5.1 – Indicative plant selections assumed for this assessment.

Consulting the manufacturer's datasheets, the following noise emissions levels are attributed to the proposed plant items:

Plant Item	Octave Band Centre Frequency (Hz) Sound Pressure/Power Level, L_p@1m, L_w (dB)									dB(A)
	L_p/L_w	63	125	250	500	1k	2k	4k	8k	
Daikin REYQ8U	L_p@1m	62	63	59	55	50	45	44	31	
Daikin REYQ12U	L_p@1m	64	66	61	57	53	52	54	44	
Daikin REYQ16U	L_p@1m	67	69	64	62	55	52	52	43	
Daikin REYQ20U	L_p@1m	70	65	66	63	59	55	53	46	
Daikin 3MXM52A	L_p@1m	49	52	48	46	42	37	30	22	
Daikin VAM 1000	L_w	62	59	54	51	49	42	37	28	
Nuaire AVS4 – Outlet	L_w	75	77	77	83	84	81	75	68	87
Nuaire AVS4 – Breakout	L_w	73	66	60	55	46	43	45	34	57
Daikin Modular Size 5- Inlet	L_w	68	63	63	51	50	46	37	33	58
Daikin Modular Size 5 - Outlet	L_w	71	68	78	71	69	69	63	62	77

Table 5.2 – Advised plant noise data used for the assessment.

5.2 Recommended Mitigation Measures

The atmospheric side ductwork for the MVHR units and AHU will need to be fitted with attenuators providing the minimum insertion losses shown in Table 5.3. Alternative attenuation performance shape curves may be suitable and should be confirmed prior to installation.

Attenuation Component	Octave Band Centre Frequency (Hz) Minimum Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Toilet Extract Attenuator	3	6	11	19	24	24	15	11
On Floor MVHRs – Intake & Exhaust	4	6	12	26	30	31	22	16
Condenser Louvered Enclosure	6	6	8	10	14	18	16	15

Table 5.3 – Minimum attenuator insertion loss

Should the above insertion loss be achieved using multiple silencers, these should be separated from each other by a distance of minimum 3-4 x D, where D is the largest internal dimension of the duct work (e.g. D is 0.5m, so a minimum of 1.5-2m apart) or a bend of at least 90°. Attenuators should be fitted as close to the fan as possible, and attached to the ductwork using flexible connections.

It is recommended that a barrier be introduced between around the REYQ units and the noise sensitive receivers. This should be a minimum of 0.2m taller than the top of the units, and be formed of a continuous and imperforate material with a minimum mass per unit area of 14kg/m^2. A suggested location for such a screen is indicated on the attached noise map.

All plant and ductwork should be fitted with anti-vibration mounts in accordance with the manufacturer guidelines. This is expected to control structureborne noise to the building to acceptable levels.

Please note that the above recommendations relate to acoustic issues only. It is recommended that professional advice confirming the suitability of these measures be sought from others with regards to issues such as airflow, structural stability and visual impact.

5.3 Predicted noise levels

Due to the complexity of the building interaction in this locale and the likelihood of noise both reflecting off and being screened by the surrounding buildings, 3D noise mapping was implemented to ensure the most accurate prediction of plant noise levels at the nearest noise sensitive receivers.

This process uses several different calculation protocols to derive accurate noise analysis predictions. Noise propagation and barrier attenuation are calculated in accordance with ISO 9613-1:1993 *Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere* and ISO 9613-2:1996 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*.

The results are calculated in the attached noise maps VA4507/NM1-NM2.

Receiver	L_p 1m from receiver	Noise Criterion
Office; 07:00 – 19:00	L_{Aeq} 39 dB(A)	40 dB(A)
20 Bedford Place, 24 hour	L_{Aeq} 28 dB(A)	34 dB(A)

Table 5.4 – Predicted noise and level and design criteria at noise sensitive location

5.3.1 Comparison to NR35 Curve

As can been seen from the following comparison in Table 5.5, the predicted noise levels at 1m from the most affected receiver are comfortably below the NR35 curve.

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
NR35	63	52	45	39	35	35	30	28
20 Bedford Place	38	36	33	26	17	11	13	7

Table 5.5 – Comparison of predicted noise levels against the NR35 criterion

5.4 Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise level shown in Table 5.4 would result in internal noise levels that achieve the guidelines shown in Table 2.1.

6. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of 50-51 Russell Square, London in support of a planning application for the proposed introduction of new building services plant.

This has enabled noise emission limits to be set at the most affected noise sensitive receiver such that the proposed installation meets the requirements of Camden Council .

The cumulative noise emission levels from the proposed plant have been assessed to be compliant with the plant noise emission limits, with necessary mitigation measures specified.

The proposed scheme is not expected to have a significant adverse noise impact and the relevant plant noise requirements have been shown to be met.

Jamie Duncan MIOA


Noise monitoring location
Most Affected Receiver (24-hour)
Proposed New Plant Location
Most Affected Receiver (Office hours)
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google Earth

50-51 Russell Square, London

Environmental Noise Time History: 1

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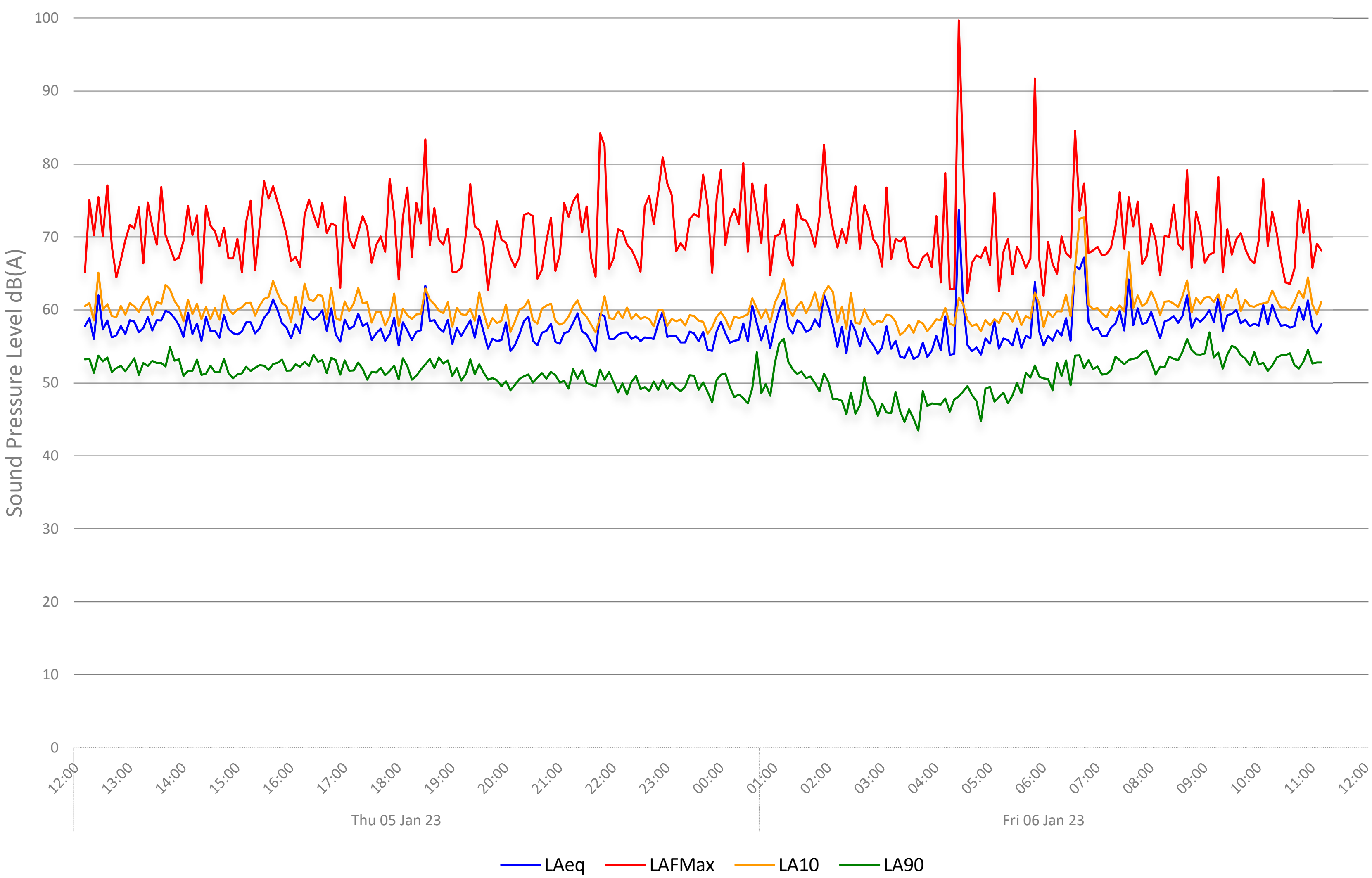
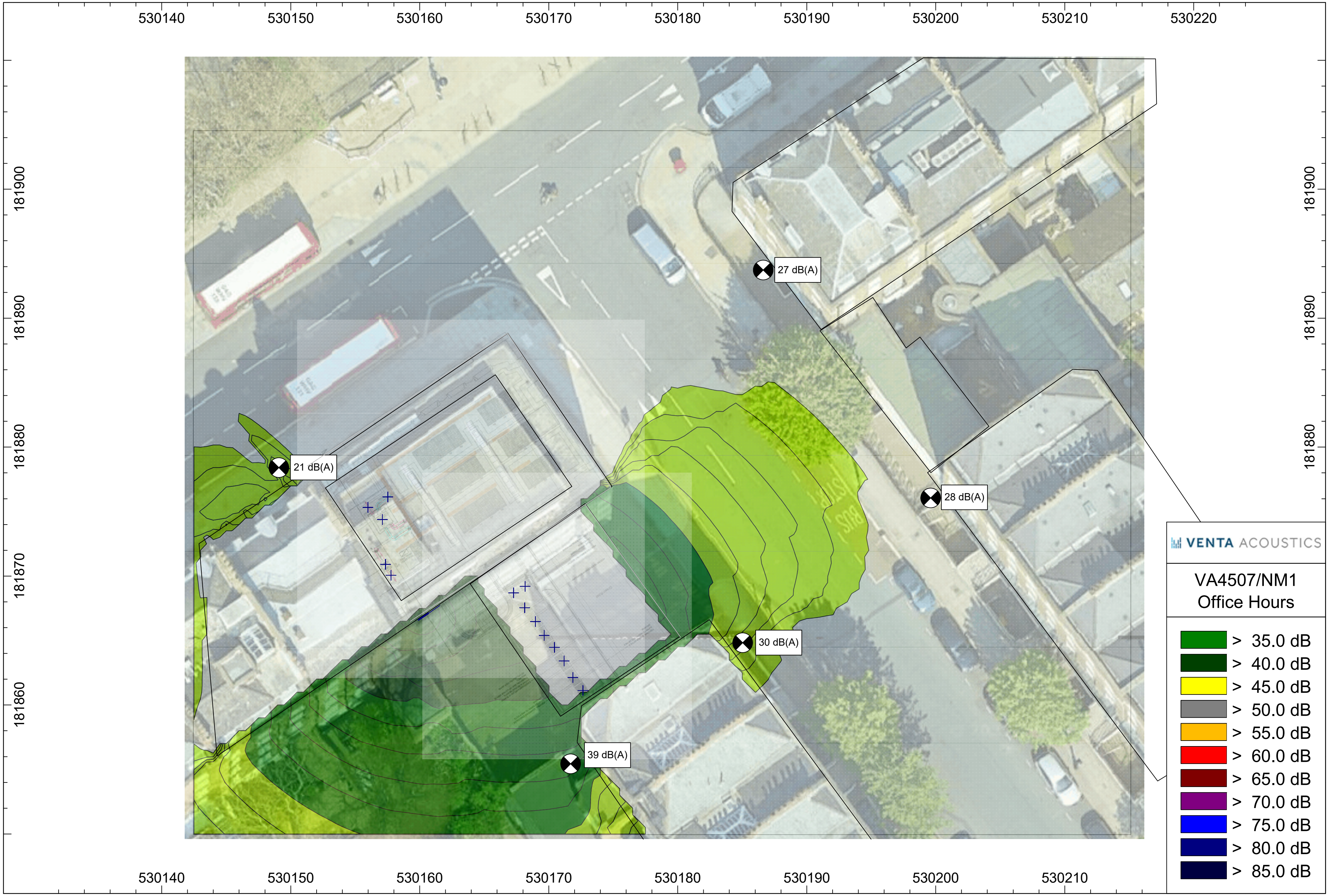
Figure VA4507/TH1

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VENTA ACOUSTICS
VA4507/NM1
Office Hours
> 35.0 dB
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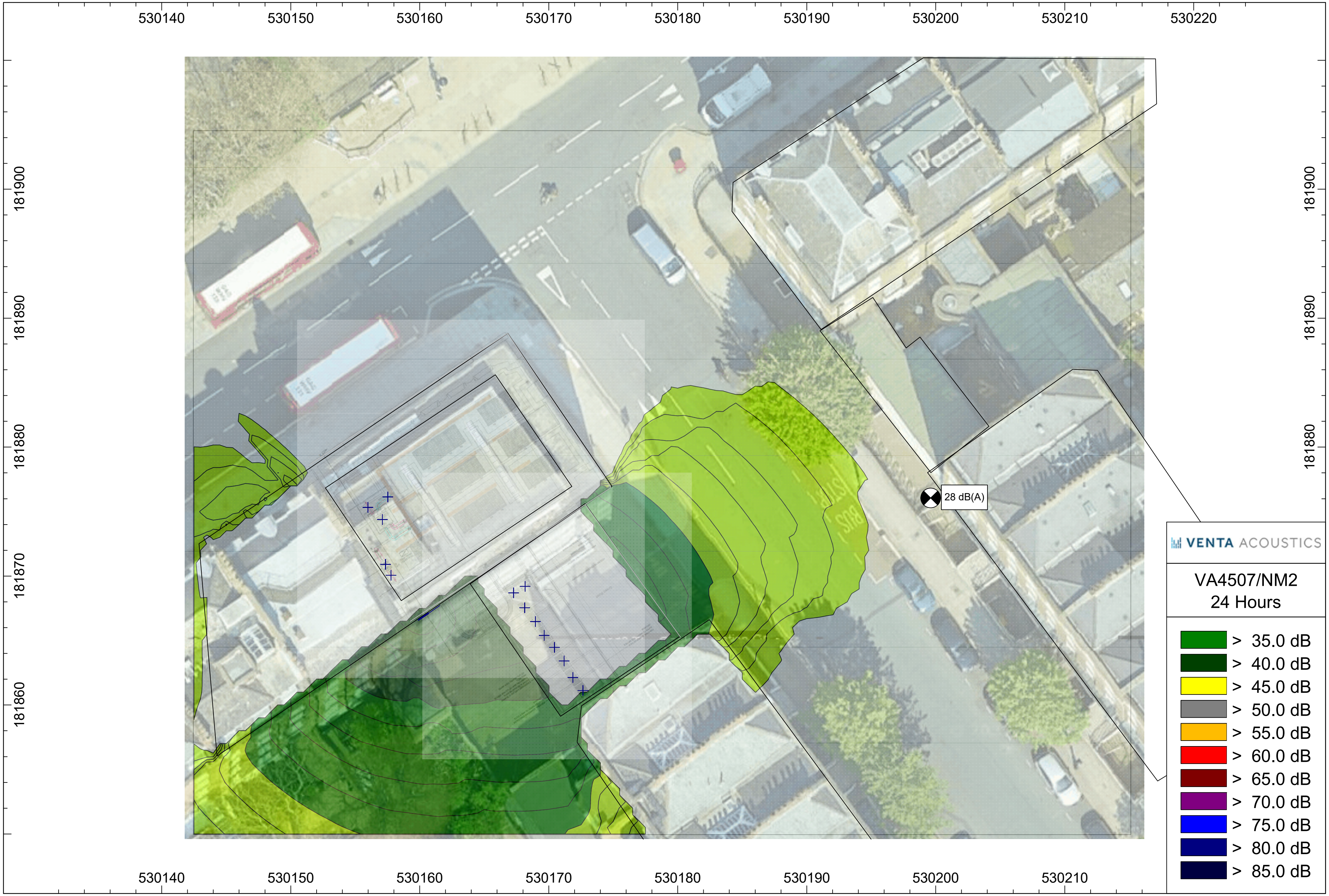

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24 Hours
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> 40.0 dB
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> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB

APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as ‘loudness’, its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of ‘pitch’, with low frequencies producing low ‘notes’ and higher frequencies producing high ‘notes’.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the ‘A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated ‘A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

APPENDIX A

1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial