



PREPARED: July 2020

## QUEENSWAY PARADE; PLANNING COMPLIANCE REPORT

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## LIST OF ATTACHMENTS

ASI1149/SP1	Indicative Site Plan
ASI1149/TH1-TH10	Environmental Noise Time Histories
APPENDIX A	Acoustic Terminology
APPENDIX B	Acoustic Calculations

<b>Project Ref:</b>	ASI1149	<b>Title:</b>	114-150 Queensway Parade & 97-113 Inverness Terrace
<b>Report Ref:</b>	ASI1149.190812.PCR1.3	<b>Title:</b>	Planning Compliance Report
<b>Client Name:</b>	MB (QW) Guernsey Limited		
<b>Project Manager:</b>	Daniel Saunders		
<b>Report Author:</b>	Daniel Saunders		
Clarke Saunders Acoustics Winchester SO22 5BE		This report has been prepared in response to the instructions of our client. It is not intended for and should not be relied upon by any other party or for any other purpose.	

## 1.0 EXECUTIVE SUMMARY

- 1.1 Planning approval is being sought for the installation of new plant associated with the development at 114-150 Queensway Parade & 97-113 Inverness Terrace.
- 1.2 Data obtained from an environmental noise survey carried out between Wednesday 19<sup>th</sup> June and Monday 24<sup>th</sup> June 2019 has been used to establish the existing background noise climate at the site. This has enabled assessment criteria to be identified in accordance with WCC's requirements.
- 1.3 Data for the proposed plant items has been used to predicted the noise impact of the new plant on neighbouring residential properties. Compliance with the noise emissions design criteria has been demonstrated. No further mitigation measures are, therefore, required.
- 1.4 Preliminary external building fabric performance has been specified; further detailed specification will be provided at Developed and Technical Design stages.

## 2.0 INTRODUCTION

- 2.1 Planning approval is being sought for the installation of new plant associated with the development at 114-150 Queensway Parade & 97-113 Inverness Terrace.
- 2.2 The proposed development is the demolition and mixed use redevelopment of the existing buildings on site to provide two adjacent buildings of the highest quality sustainable design and architecture by Foster + Partners. The proposals seek to deliver a range of uses in line with planning policy, which are appropriate for the town centre setting of the site, and which will make a significant contribution to the regeneration of Queensway and its vitality and viability. Specifically, the northern end of the site on Queensway will deliver a contemporary residential mansion block, evoking a typology that is commonly found along and around Queensway, with enhanced retail units at ground floor level and 32 units above. To the south of the residential building will be a commercial building on Queensway which wraps around to Porchester Gardens, comprising enhanced retail uses at ground floor level, with office use above in a distinctive yet complementary building for the locality.
- 2.3 Specifically, the proposed development is for:
- 2.4 Demolition of 114-150 Queensway and 97-113 Inverness Terrace, and redevelopment to provide two buildings comprising basement, ground and up to six upper floor levels, providing retail use (class A1 and flexible A1/A3) at ground floor, up to 32 residential units (class C3) and Office (class B1) floorspace at upper floors, with associated amenity space, basement level secure cycle parking, ancillary facilities and plant, with servicing provision to Cervantes Court.
- 2.5 Clarke Saunders Associates (CSA) has been appointed by MB (QW) Guernsey Limited to undertake an environmental noise survey in order to measure the prevailing background noise climate at the site. The background noise levels measured will be used to determine daytime and night-time noise emission limits for new building services plant in accordance with the planning requirements of City of Westminster (WCC).

### 3.0 SURVEY PROCEDURE AND EQUIPMENT

- 3.1 A survey of the existing background noise levels was undertaken to the east of the development overlooking Cervantes Court/Inverness Terrace and to the west of the development overlooking Queensway, as shown in the attached site plan ASI1149/SP1. Measurements of consecutive 5-minute  $L_{Aeq}$ ,  $L_{Amax}$ ,  $L_{A10}$  and  $L_{A90}$  sound pressure levels were taken between 12:00 hours on Wednesday 19<sup>th</sup> June and 10:40 hours on Monday 24<sup>th</sup> June 2019.
- 3.2 Results of these measurements will allow suitable noise criteria to be set for the new building services plant, depending on hours of operation.
- 3.3 The following equipment was used during the course of the survey:
- 1 no. Rion data logging sound level meter type NL32;
  - 1 no. Rion data logging sound level meter type NL52;
  - 1 no. Rion sound level calibrator type NC-74.
- 3.4 The calibration of the sound level meters was verified before and after use. No significant calibration drift was detected.
- 3.5 The weather during the survey was generally dry with light winds, which made the conditions suitable for the measurement of environmental noise.
- 3.6 Measurements were made following procedures in BS7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise part 2 – Acquisition of data pertinent to land use*.
- 3.7 Please refer to Appendix A for details of the acoustic terminology used throughout this report.
- 3.8 Measured minimum background and average noise levels are shown in the table below:

Monitoring Period	Minimum $L_{A90,5min}$	Average $L_{Aeq,T}$
07:00 - 19:00 hours (daytime)	Queensway: 39 dB Inverness Terrace: 39 dB	Queensway: 67 dB Inverness Terrace: 58 dB
19:00 - 23:00 hours (evening)	Queensway: 47 dB Inverness Terrace: 44 dB	Queensway: 63 dB Inverness Terrace: 54 dB
23:00 - 07:00 hours (night-time)	Queensway: 35 dB Inverness Terrace: 33 dB	Queensway: 57 dB Inverness Terrace: 49 dB

Table 1. Measured minimum background and average noise levels [dB ref. 20µPa]

### 4.0 DESIGN CRITERIA

#### 4.1 LOCAL AUTHORITY REQUIREMENTS (STANDARD OPERATIONAL PLANT)

- 4.1.1 Westminster's Unitary Development Plan [UDP] was approved by Full Council on the 24<sup>th</sup> January 2007. Policy Env 7 of the UDP states:



*Where development is proposed, the City Council will require the applicant to demonstrate that this will be designed and operated so that any noise emitted by plant and machinery and from internal activities, including noise from amplified or unamplified music and human voices, will achieve the following standards in relation to the existing external noise level at the nearest noise sensitive properties, at the quietest time during which the plant operates or when there is internal activity at the development.*

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

*either*

*(a) and where noise from the proposed development will not contain tones or be intermittent sufficient to attract attention, the maximum emission level ( $L_{Aeq,15min}$ ) should not exceed 10dB below the minimum external background noise at the nearest noise sensitive properties. The background noise level should be expressed in terms of  $L_{A90,15min}$ .*

*or*

*(b) and where noise emitted from the proposed development will contain tones, or will be intermittent sufficient to attract attention, the maximum emission level ( $L_{Aeq,15min}$ ) should not exceed 15dB below the minimum external background noise at the nearest noise sensitive properties. The background noise level should be expressed in terms of  $L_{A90,15min}$ .*

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

*either*

*(a) where noise emitted from the proposed development will not contain tones or be intermittent sufficient to attract attention, the maximum emission level ( $L_{Aeq,15min}$ ) should not exceed 5dB below the minimum external background noise level at the nearest noise sensitive properties. The background noise levels should be expressed in terms of  $L_{A90,15min}$ .*

*or*

*(b) where noise emitted from the proposed development will contain tones or will be intermittent sufficient to attract attention, the maximum emission level ( $L_{Aeq,15min}$ ) should not exceed 10dB below the minimum external background noise level at the nearest noise sensitive properties. The background noise levels should be expressed in terms of  $L_{A90,15min}$ .*

- 4.1.2 The noise emission standards in relation to the existing external noise levels are summarised in the table below:

Plant Criteria	Day (07:00 - 19:00)		Evening (19:00 - 23:00)		Night (23:00 - 07:00)	
Existing (dB)	$L_{Aeq} \leq 55$	$L_{Aeq} > 55$	$L_{Aeq} \leq 50$	$L_{Aeq} > 50$	$L_{Aeq} \leq 45$	$L_{Aeq} > 45$
Non-tonal plant	Min $L_{A90}$ -5dB	Min $L_{A90}$ -10dB	Min $L_{A90}$ -5dB	Min $L_{A90}$ -10dB	Min $L_{A90}$ -5dB	Min $L_{A90}$ -10dB
Tonal plant	Min $L_{A90}$ -10dB	Min $L_{A90}$ -15dB	Min $L_{A90}$ -10dB	Min $L_{A90}$ -15dB	Min $L_{A90}$ -10dB	Min $L_{A90}$ -15 dB

Table 2. Summary of plant noise emission criteria [dB ref. 20 $\mu$ Pa]

- 4.1.3 It is not expected that tonal noise will be generated by the selected plant units. Plant noise emissions criteria applicable at the nearest noise sensitive receiver are detailed below:

Day (07:00 - 19:00)	Evening (19:00 - 23:00)	Night (23:00 - 07:00)
Inverness Terrace: $L_{Aeq}$ 29 dB	Inverness Terrace: $L_{Aeq}$ 34 dB	Inverness Terrace: $L_{Aeq}$ 23 dB

Table 3. Proposed design noise criteria (standard operational plant) [dB ref. 20 $\mu$ Pa]

## 4.2 LOCAL AUTHORITY REQUIREMENTS (EMERGENCY PLANT)

- 4.2.1 City of Westminster sets different requirements for emergency/standby plant which should not increase the existing background level by more than 10 dB(A) during brief testing periods and emergency use only. Testing will be limited by condition to between 09:00-17:00 hours (Monday to Friday). Emergency plant noise emissions criteria applicable at the nearest noise sensitive receiver are detailed below:

Day (07:00 - 19:00)	
Queensway: $L_{Aeq}$ 49 dB	Inverness Terrace: $L_{Aeq}$ 49 dB

Table 4. Proposed design noise criteria (emergency plant) [dB ref. 20 $\mu$ Pa]

## 4.3 BS8233:2014 GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS

- 4.3.1 The guidance in this document indicates suitable noise levels for various activities within residential and commercial buildings.

4.3.2 The relevant sections of this standard are shown in the following table:

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

Table 5. Excerpt from BS8233:2014 [dB ref. 20 $\mu$ Pa]

## 5.0 PREDICITED NOISE IMPACT

### 5.1 PROPOSED PLANT

5.1.1 The preliminary Landlord plant selection has been confirmed as:

- 2 No. Daikin EWYD8004ZXRA2 air source heat pumps with AA303S acoustic package;
- 1 no. DN3-AJ375S-5S1 emergency generator.

5.1.2 The air source heat pumps will be located within a plant room at 5<sup>th</sup> floor level and the generator within a plant room at 6<sup>th</sup> floor level.

5.1.3 Noise levels generated by the EWYD8004ZXRA2 air source heat pumps with AA303S acoustic package have been confirmed by the manufacturer as follows:

Frequency (Hz)	63	125	250	500	1K	2K	4K	8K	dB(A)
EWYD8004ZXRA2 ( $L_p$ @ 1m)	65	58	53	46	39	38	33	29	49

Table 6. ASHP noise levels [dB ref. 20 $\mu$ Pa]

5.1.4 In the absence of spectral noise data for the proposed generator, a typical spectrum for a packaged generator set has been used for the purpose of the calculations.

Frequency (Hz)	63	125	250	500	1K	2K	4K	8K
DN3-AJ375S-5S1 ( $L_w$ )	72	75	76	73	66	62	57	50

Table 7. Emergency Generator noise levels [dB ref. 20 $\mu$ Pa]

5.1.5 Tenants will provide their own plant. For the purposes of this feasibility assessment, example plant selections have been advised by the mechanical engineers as follows:

- 1 no. Mitsubishi PUMY-P140YKM4;
- 5 no. Mitsubishi PUMY-P200YKM2;
- 2 no. Mitsubishi PUHY-P250YSNW-A;
- 2 no. Mitsubishi PUHY-P550YSNW-A;
- 1 no. Mitsubishi PUHY-P650YSNW-A;

- 5.1.6 The tenants' plant will be located within individual plantrooms at the rear of each ground floor retail unit, as shown in site plan ASI1149/SP1. Tenancy agreements will include appropriate clauses limiting noise emissions from each plantroom.
- 5.1.7 It has been assumed that the plant items will be operating on "low noise mode" during the night-time period, and that each tenant will fit its plantroom louvre with a silencer to provide the insertion losses indicated in the table below. Furthermore, plantrooms will be internally-lined to minimise the build-up of reverberant sound pressure.

Frequency (Hz)	63	125	250	500	1K	2K	4K	8K
Silencer Insertion Loss	3	5	9	13	15	16	11	9

Table 8. Silencer insertion loss [dB ref. 20µPa]

- 5.1.8 For the purpose of noise limitation, it is suggested that the night-time period is extended by half an hour on weekdays, i.e. to 07:30h.
- 5.1.9 The adjusted plant noise emissions criteria applicable at the nearest noise sensitive receiver during the daytime periods are detailed below. The evening and extended night-time criteria remain as detailed in Table 3 above.

Day (Weekday: 07:30 - 19:00)	Day (Weekend: 19:00 - 23:00)
Average $L_{Aeq}$ : 60 dB Min $L_{A90}$ : 43 dB Criterion: 33 dB	Average $L_{Aeq}$ : 55 dB Min $L_{A90}$ : 39 dB Criterion: 34 dB

Table 9. Propose daytime design noise criteria [dB ref. 20µPa]

## 5.2 PREDICTED NOISE LEVELS

- 5.2.1 Following an inspection of site, the most affected noise sensitive receivers are understood to be on the Inverness Terrace side of site at the southern end of Cervantes Court at 1<sup>st</sup> and 2<sup>nd</sup> floor level, as shown on the indicative site plan ASI1149/SP1 attached. The receivers will benefit from roof edge screening from the Landlord's proposed air source heat pumps and emergency generator. The 1<sup>st</sup> floor dwelling's balcony will screen its windows from the retail plant units, and the 2<sup>nd</sup> floor windows will also benefit from line of site screening. Suitable propagation losses for screening have been allowed in the enclosed acoustic calculations.
- 5.2.2 The cumulative plant noise levels at the nearest noise sensitive receiver, based on the plant being installed as per the mechanical engineers' drawings, have been calculated using the noise data above. These are summarised in Table 10.

Day (Weekday)	Day (Weekend)	Evening	Night
$L_{Aeq}$ 33 dB	$L_{Aeq}$ 33 dB	$L_{Aeq}$ 33 dB	$L_{Aeq}$ 23 dB

Table 10. Predicted noise levels (standard operational plant)

- 5.2.3 The cumulative noise level at the nearest noise sensitive receiver associated with the emergency plant is  $L_{Aeq}$  **45 dB**, compliant with the design criterion of  $L_{Aeq}$  **49 dB**.



5.2.4 Noise impact from standard operational and emergency plant to other residential receptors in the vicinity of the development site, indicated in ASI1149/SP1, has been verified and the assessment above demonstrates a worst-case.

5.2.5 These calculations are based on an example plant selection in order to demonstrate feasibility. Limiting sound pressure levels will be specified for each tenant's plant area in the management plan to ensure the criteria are met.

5.2.6 All other air handling and extract plant, the emergency generator exhaust, will be fitted with in-duct silencers as appropriate.

### 5.3 COMPARISON TO BS8233:2014 CRITERIA

5.3.1 BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise levels predicted in Section 5.2 above would result in internal noise levels that would meet the BS8233:2014 noise level criteria within the dwelling by a considerable margin.

## 6.0 EXTERNAL BUILDING FABRIC (RESIDENTIAL AREAS)

6.1 The following design review is based on the architectural drawings for the proposed construction and site layout available at the time of writing, targeting the internal noise levels set out in Table 5 and utilising the measured environmental noise survey data.

### 6.2 NON-GLAZED FAÇADE ELEMENT

6.2.1 It has been assumed that all non-glazed elements, i.e. masonry walls/facings and the roof systems, will provide the following minimum sound insulation performances, when tested in accordance with ISO 10140-2:2010:

ELEMENT	SINGLE FIGURE WEIGHTED SOUND REDUCTION FIGURE
Masonry	51 dB

Table 11. Sound insulation performance [dB ref. 20µPa]

6.2.2 The minimum sound insulation specifications for the glazed elements of the building façades are provided in the table below.

TYPE	SINGLE FIGURE WEIGHTED SOUND REDUCTION FIGURE	CORRESPONDING VENTILATOR PERFORMANCE
Type A	$R_w$ 32 dB	$D_{n,e,w}$ 30 dB
Type B	Standard thermal double glazing (typically = $R_w$ 31 dB)	Natural ventilation via partially opened window

Table 12. Sound insulation specifications for glazed elements

6.2.3 External noise levels at the Queensway side of the proposed development are such that windows cannot remain open for background ventilation purposes, as this would result in an exceedance of the guidance levels for internal noise. Provision for an alternative means of adequate background ventilation should therefore be allowed to ensure that these windows can remain closed to preserve appropriate internal noise levels.

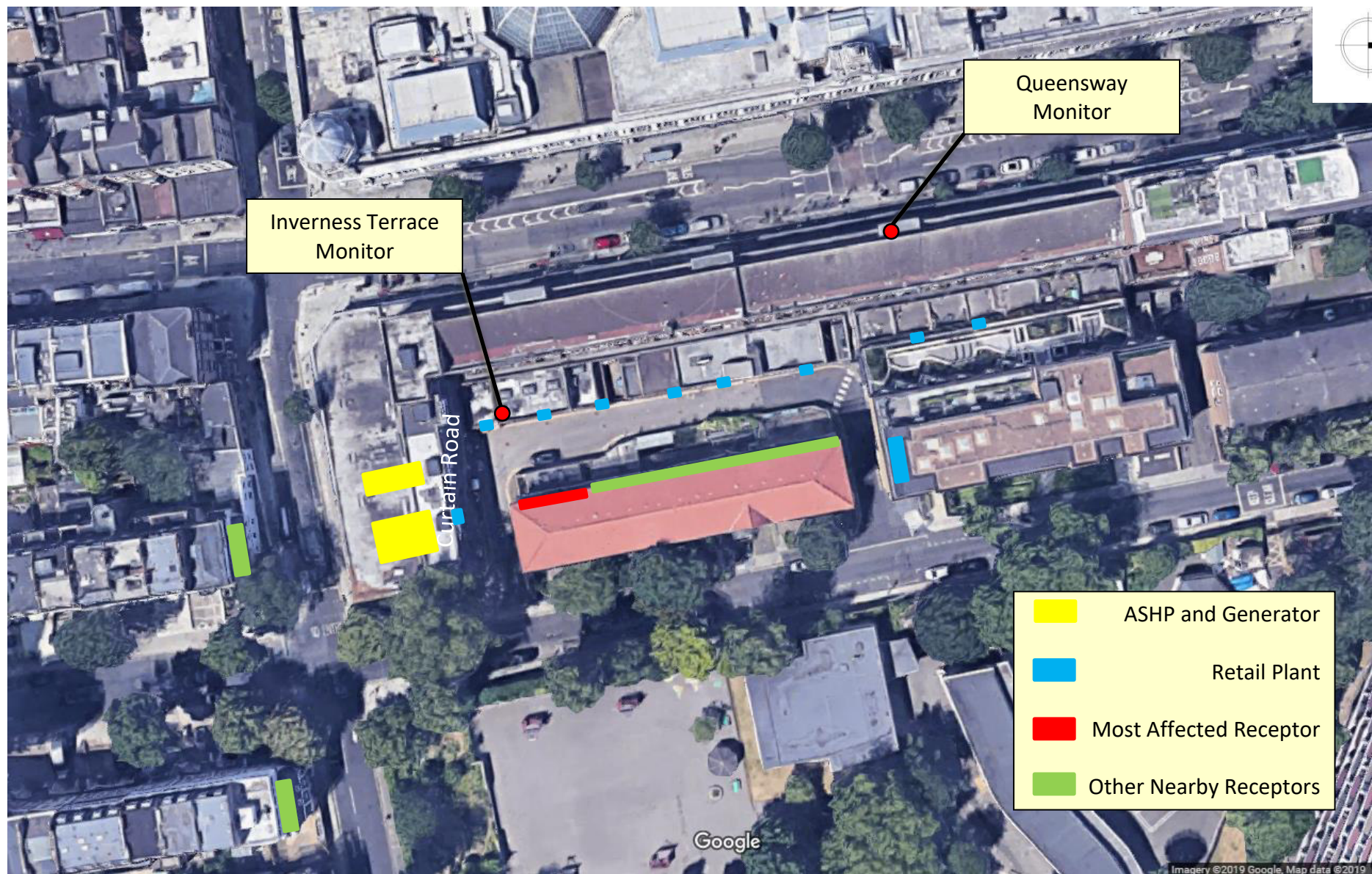
- 6.2.4 If passive ventilation means such as wall or trickle vents are used, this could be achieved with ventilator units that achieve the performance for 'Type A', shown in the table above. The stated guidance performance figure is for a single vent per room. If multiple vents are required, then the performance requirement shown in this table will increase by a value equal to  $+10\log(N)$ , with N being the total number of vents serving the room.
- 6.2.5 Glazing units at the Queensway side of the development will still be openable and there is no reason why these windows could not be opened as a matter of personal preference or for purge ventilation. No internal noise criteria are specified for the purge scenario, during which the expulsion of odours and/or fumes such as burned toast or drying paint is the priority.
- 6.2.6 Glazing units at the Inverness Terrace side of the development will benefit from self-screening by the immediate building mass and increased distance from Queensway. As such, these windows could remain partially open to allow sufficient background ventilation, without resulting in an exceedance of the internal noise level guidance values.
- 6.2.7 Further detailed specification regarding the external building fabric performance will be provided at Developed and Technical design stages.

## 7.0 CONCLUSION

- 7.1 An assessment of environmental noise emissions from proposed plant to be installed at 114-150 Queensway Parade & 97-113 Inverness Terrace, London has been undertaken by Clarke Saunders Associates.
- 7.2 Data obtained from an environmental noise survey carried out between Wednesday 19<sup>th</sup> June and Monday 24<sup>th</sup> June 2019 has been used to establish the current background noise climate at the site. This has enabled suitable assessment criteria to be identified in accordance with WCC's requirements.
- 7.3 Data for the proposed plant items has been used to predict the noise impact of the new plant on neighbouring residential properties. Compliance with the noise emissions design criterion has been demonstrated. No further mitigation measures are, therefore, required.
- 7.4 Preliminary external building fabric performance has been specified, further detailed specification will be provided at Developed and Technical Design stages.



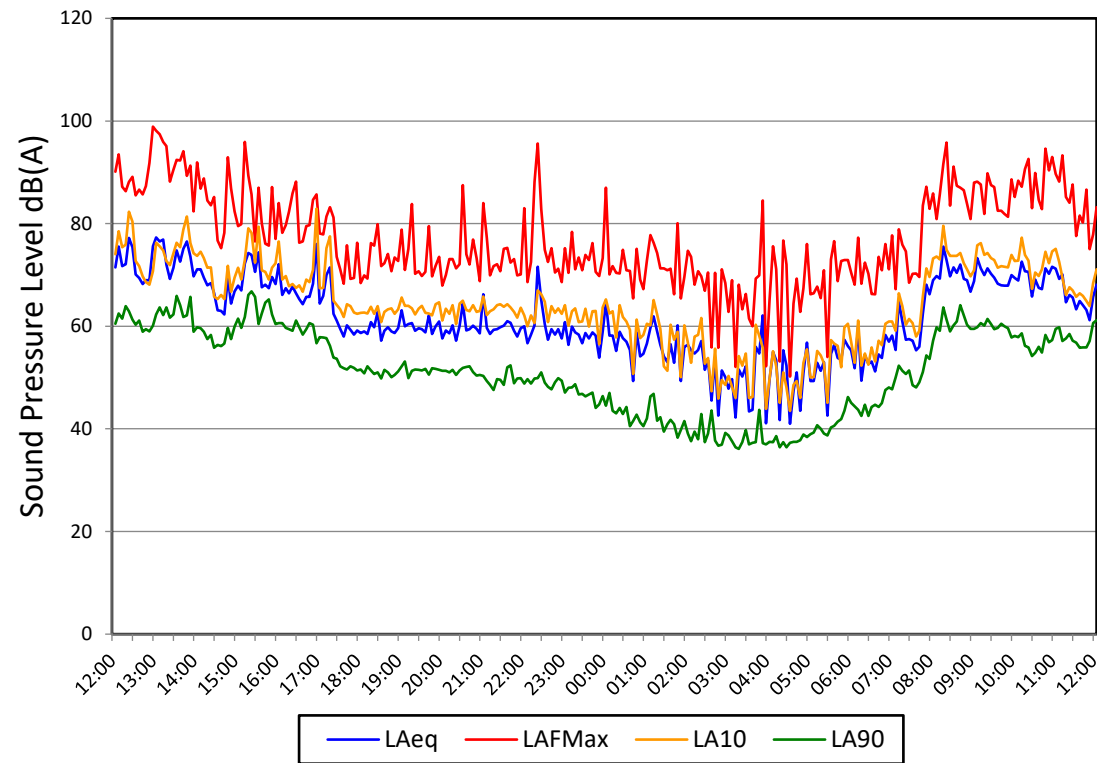
**Daniel Saunders MIOA**  
**CLARKE SAUNDERS ACOUSTICS**





# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Queensway

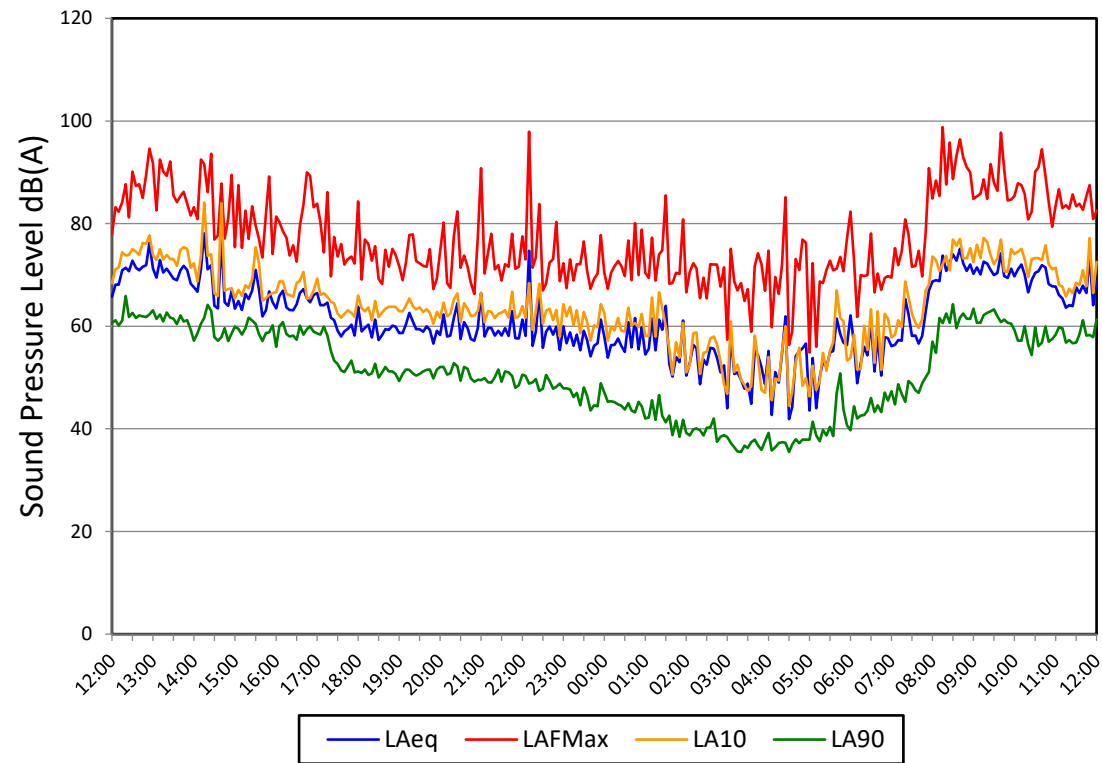


Wednesday 19 June to Thursday 20 June 2019

Figure AS11149/TH1

# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Queensway



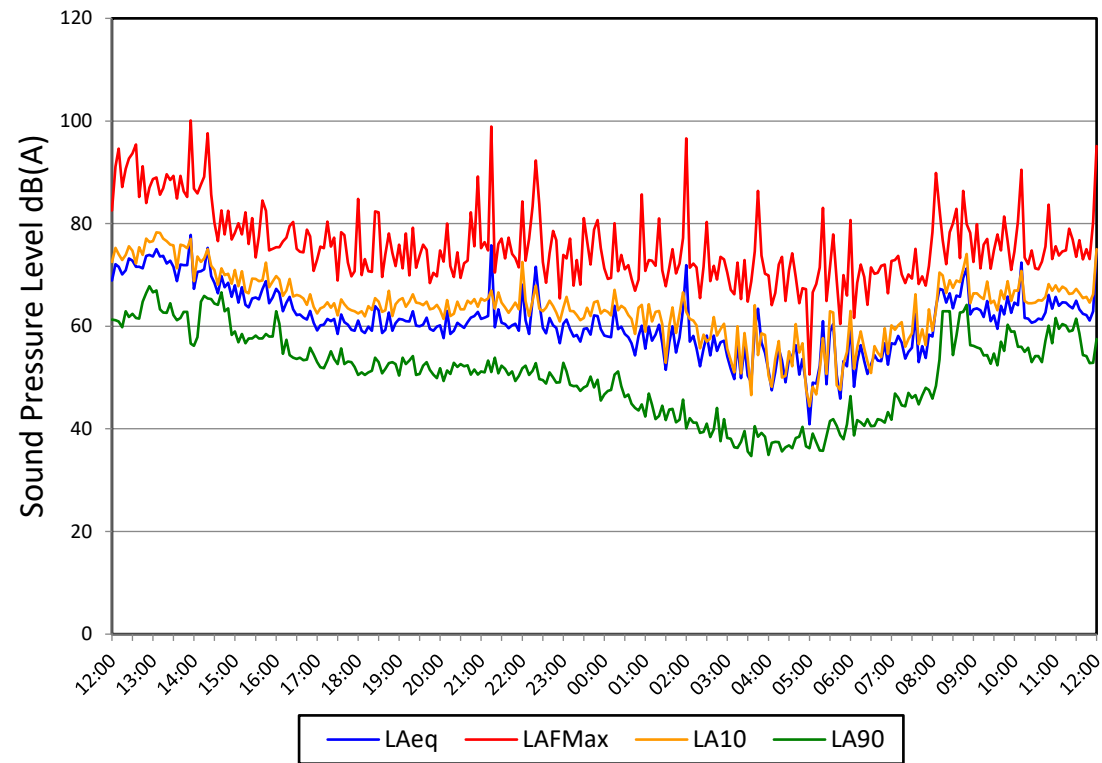
Thursday 20 June to Friday 21 June 2019

Figure AS11149/TH2



# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Queensway

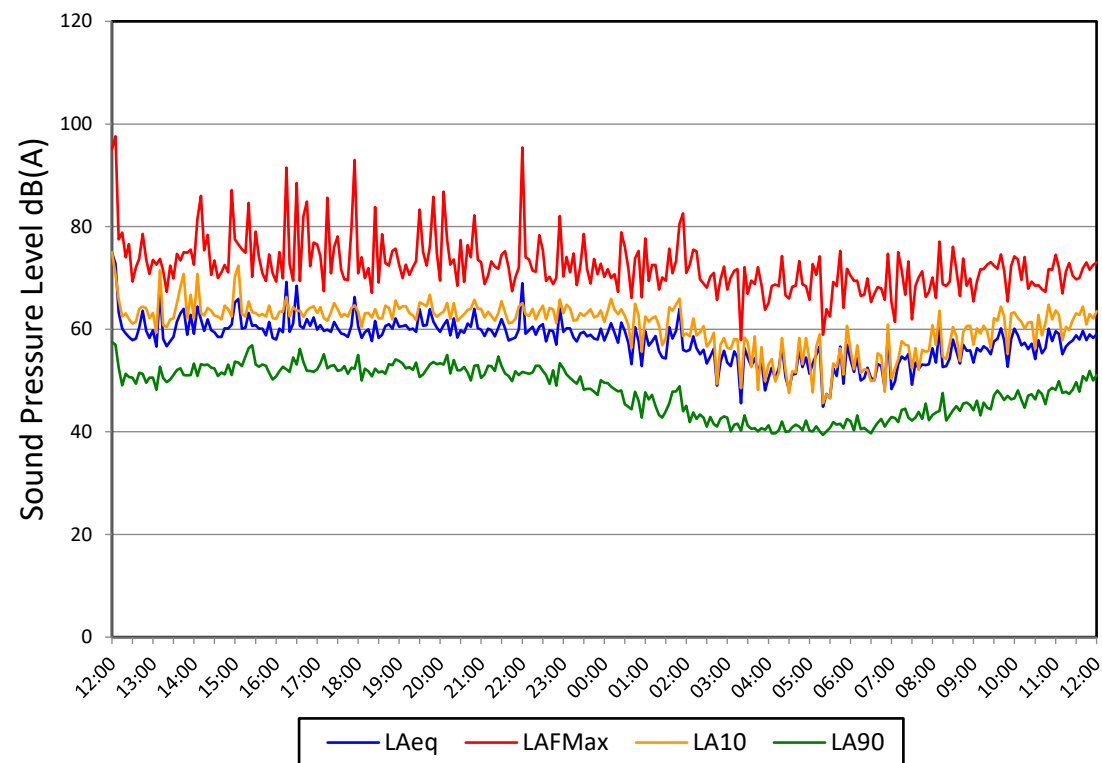


Friday 21 June to Saturday 22 June 2019

Figure AS11149/TH3

# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Queensway

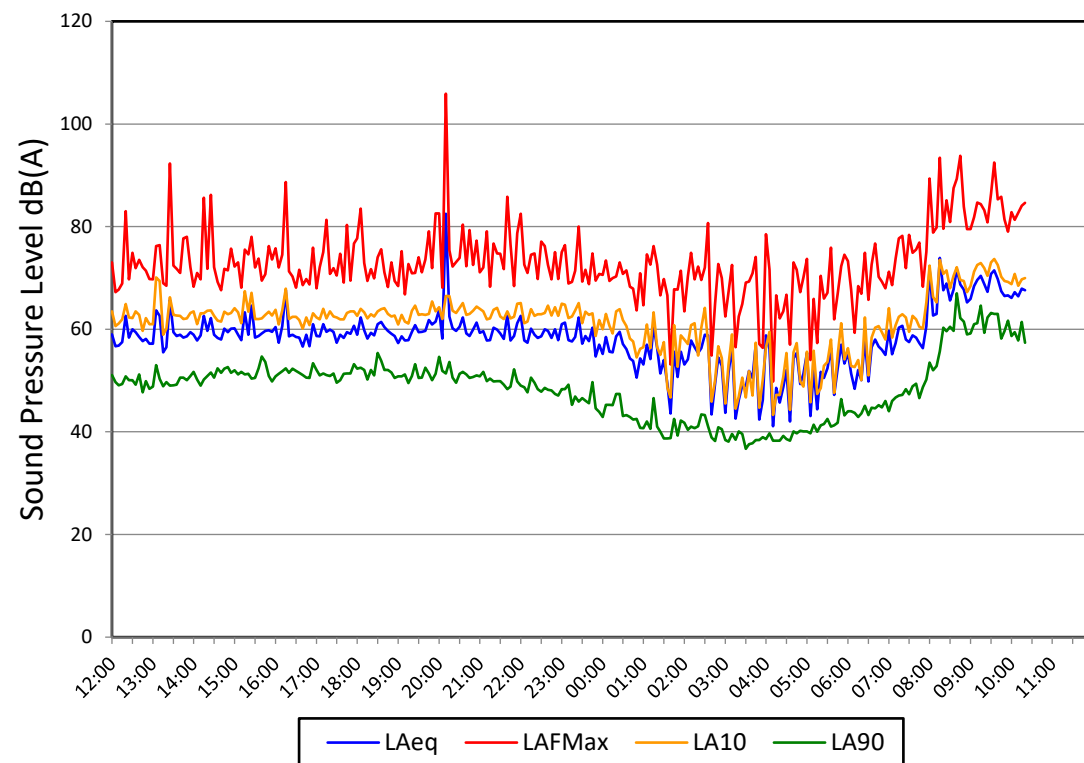


Saturday 22 June to Sunday 23 June 2019

Figure AS11149/TH4

# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Queensway

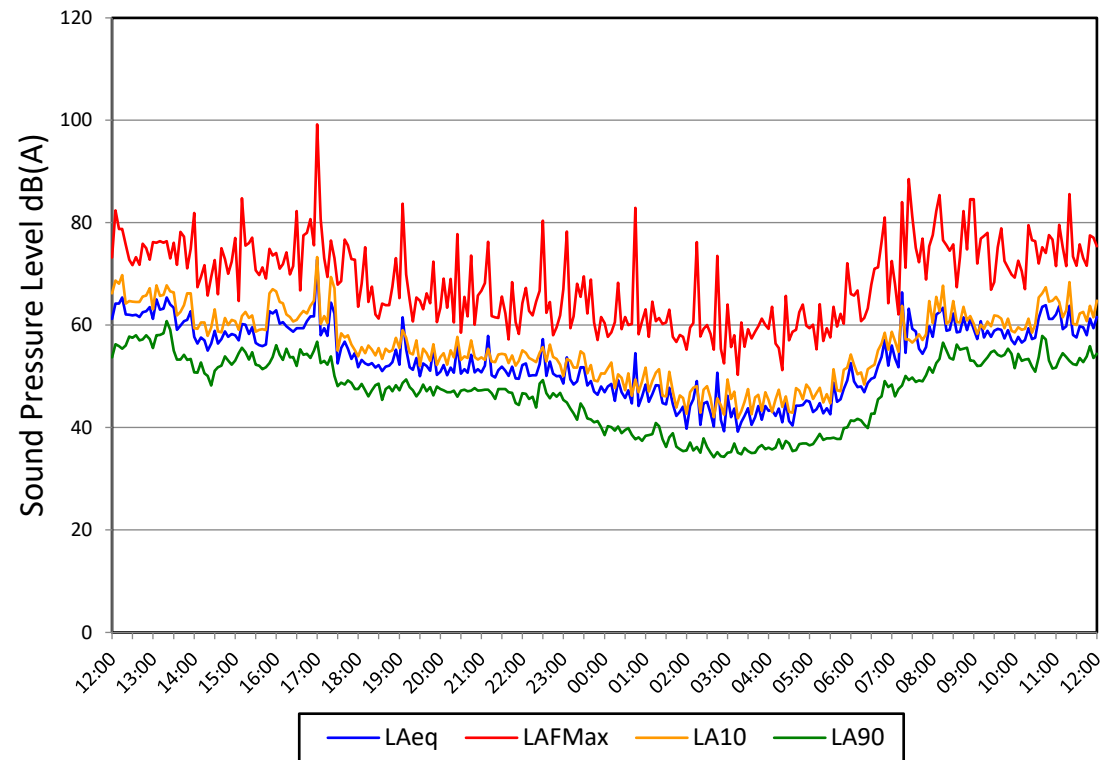


Sunday 23 June to Monday 24 June 2019

Figure AS11149/TH5

# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Inverness Terrace

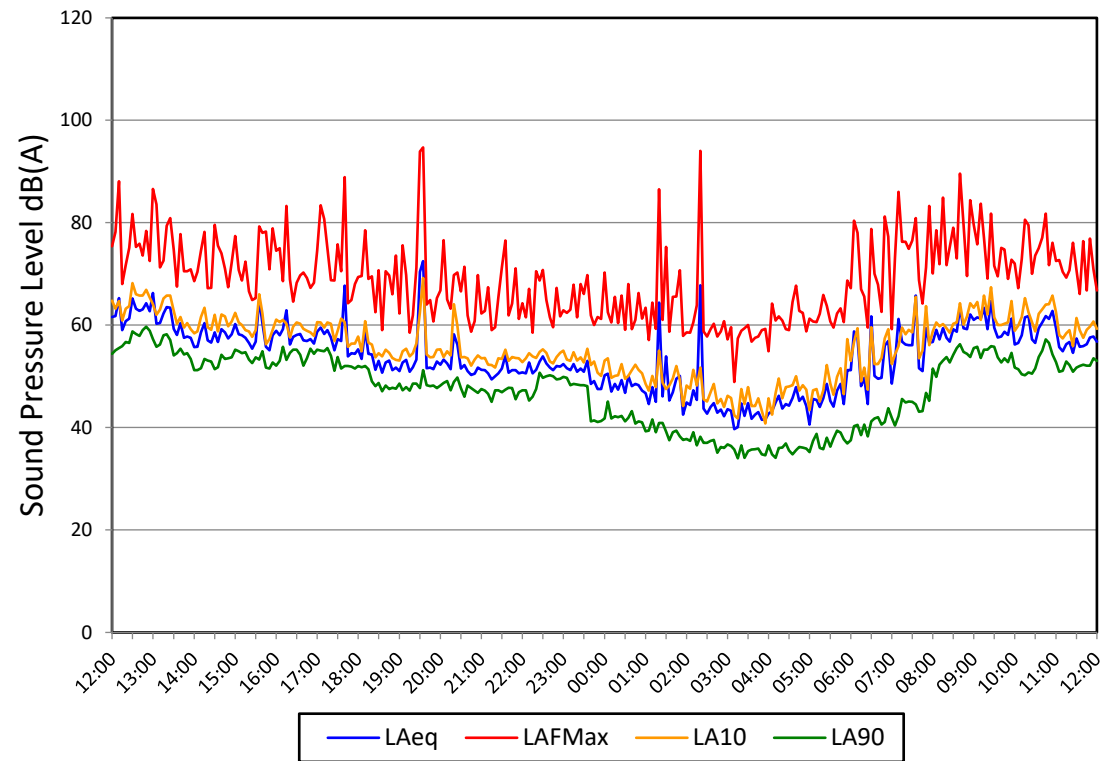


Wednesday 19 June to Thursday 20 June 2019

Figure AS11149/TH6

# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Inverness Terrace



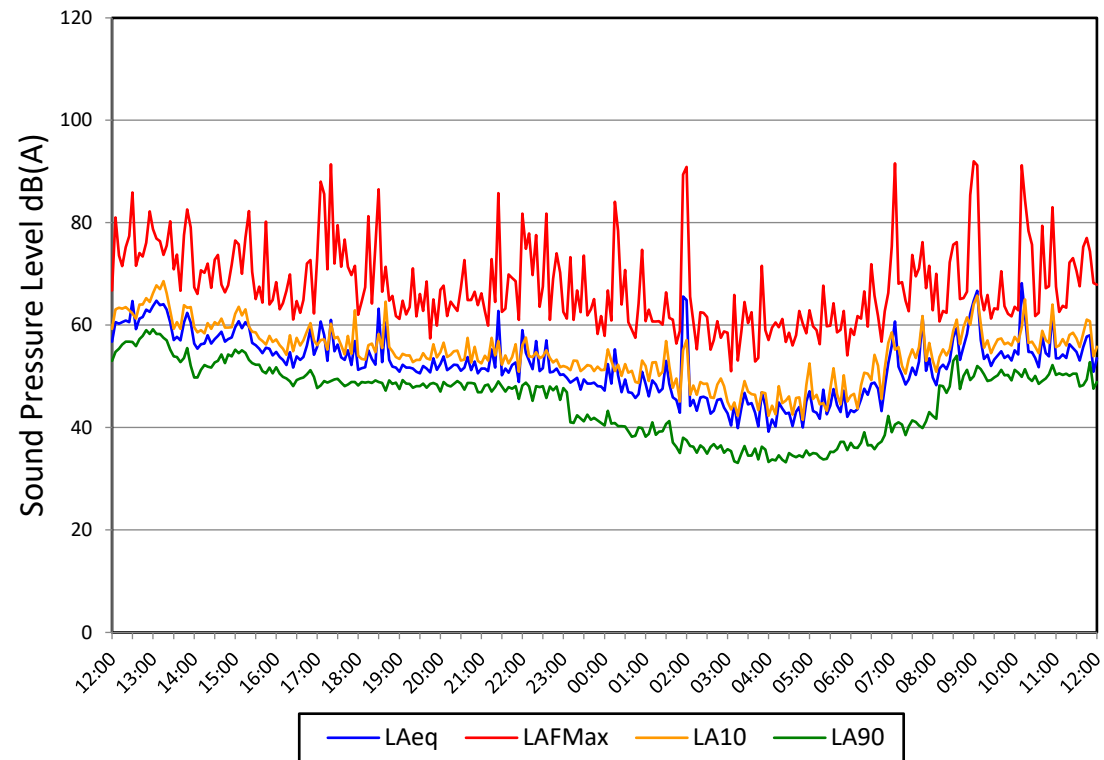
Thursday 20 June to Friday 21 June 2019

Figure AS11149/TH7



# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Inverness Terrace

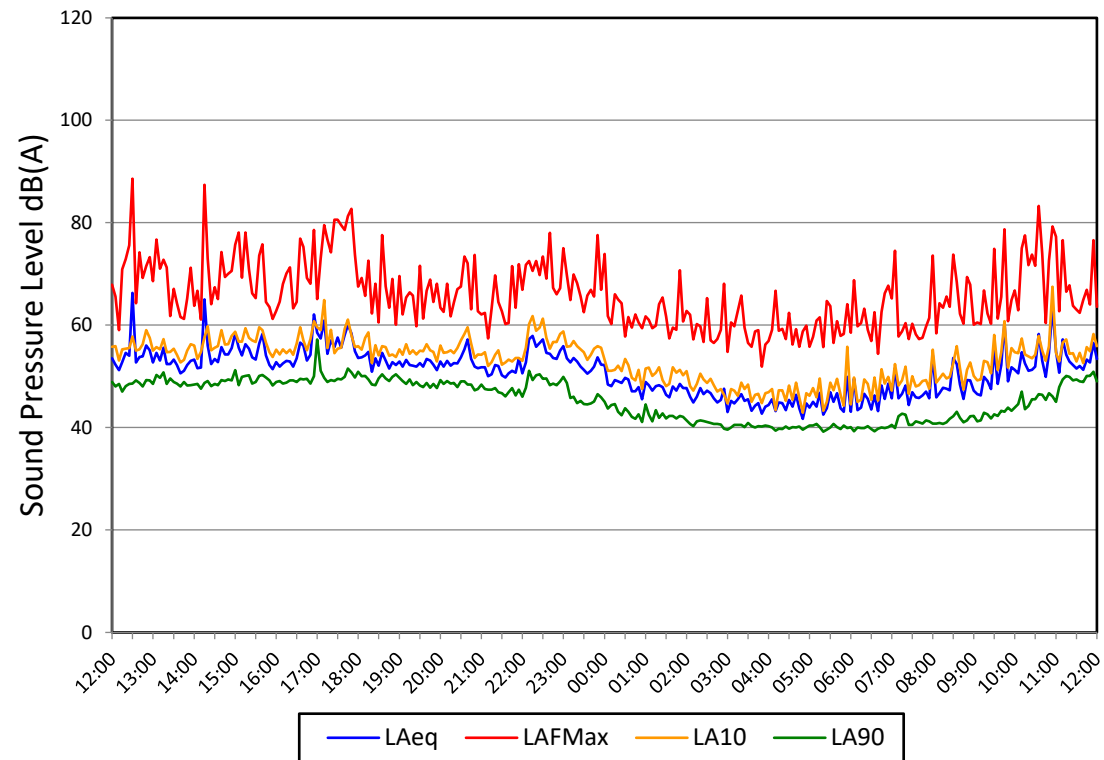


Friday 21 June to Saturday 22 June 2019

Figure AS11149/TH8

# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Inverness Terrace

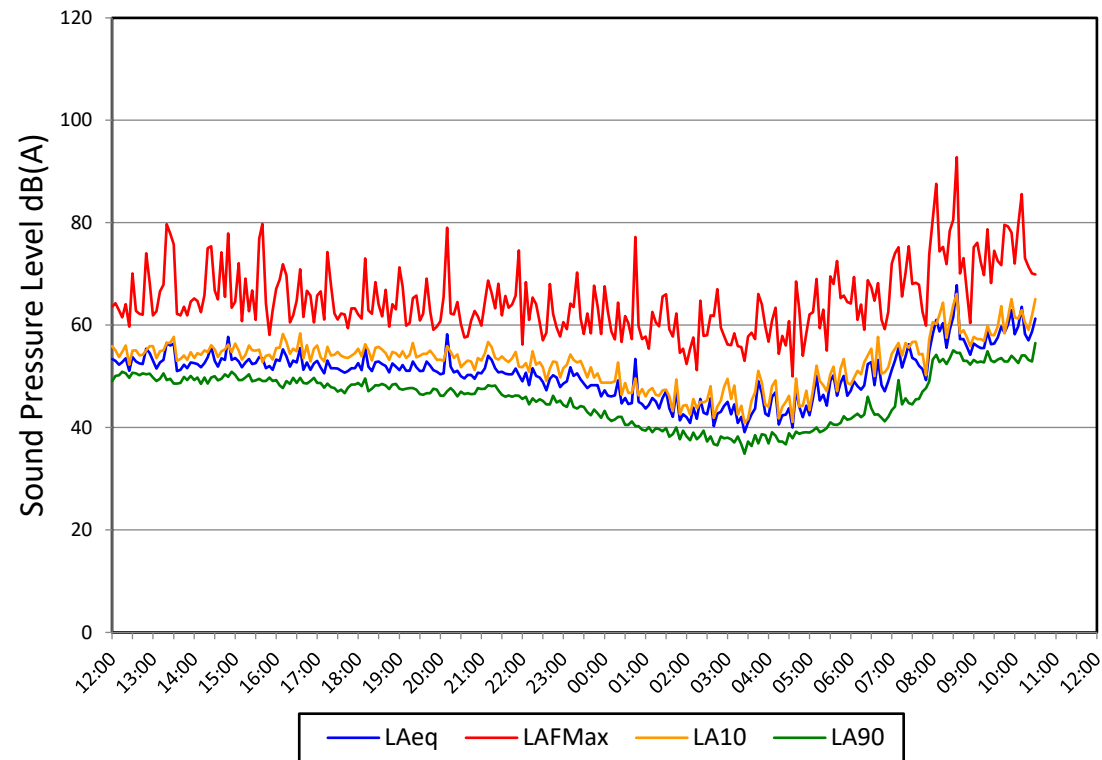


Saturday 22 June to Sunday 23 June 2019

Figure AS11149/TH9

# 114-150 Queensway & 97-113 Inverness Terrace, London

## Environmental Noise Time History: Inverness Terrace



Sunday 23 June to Monday 24 June 2019

Figure AS11149/TH10

### 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.

<b>Sound</b>	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
<b>Noise</b>	Sound that is unwanted by or disturbing to the perceiver.
<b>Frequency</b>	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'.
<b>dB(A):</b>	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 $L_A$ .
<b><math>L_{eq}</math>:</b>	<p>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).</p> <p>The concept of <math>L_{eq}</math> (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.</p> <p>Because <math>L_{eq}</math> 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.</p>
<b><math>L_{10}</math> &amp; <math>L_{90}</math>:</b>	<p>Statistical <math>L_n</math> 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, <math>L_{10}</math> is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, <math>L_{90}</math> is the typical minimum level and is often used to describe background noise.</p> <p>It is common practice to use the <math>L_{10}</math> 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.</p>

### 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
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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.

INTERPRETATION

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



**APPENDIX B**  
**AS11149 - 114-150 Queensway & 97-113 Inverness Terrace, London**  
**Plant Noise Assessment - Daytime**

**24-hour noise emissions to Cervantes Court South**

<b>Plant Room ASHP 1</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
Daikin EWYD8004ZXRA2	Lp @ 1m	65	58	53	46	39	38	33	29	<b>49</b>
Distance Loss	To 18m	-21	-21	-21	-21	-21	-21	-21	-21	
Roof Edge Screening		-8	-10	-12	-14	-17	-20	-23	-26	
<b>Total Emissions</b>		<b>36</b>	<b>28</b>	<b>20</b>	<b>11</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17</b>

<b>Plant Room ASHP 2</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
Daikin EWYD8004ZXRA2	Lp @ 1m	65	58	53	46	39	38	33	29	<b>49</b>
Distance Loss	To 22m	-22	-22	-22	-22	-22	-22	-22	-22	
Roof Edge Screening		-12	-15	-18	-21	-20	-20	-20	-20	
<b>Total Emissions</b>		<b>30</b>	<b>21</b>	<b>13</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>11</b>

<b>Retail Plant R.01</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUHY-P650YSNW-A	Lp @ 1m	81	70	69	67	61	58	55	50	<b>68</b>
Distance Loss	To 11m	-21	-21	-21	-21	-21	-21	-21	-21	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Balcony Edge Screening		-5	-5	-6	-6	-8	-9	-12	-14	<b>30</b>
<b>Total Emissions</b>		<b>52</b>	<b>39</b>	<b>33</b>	<b>27</b>	<b>17</b>	<b>12</b>	<b>12</b>	<b>6</b>	

<b>Retail Plant R.02</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUHY-P550YSNW-A	Lp @ 1m	76	70	67	65	59	56	53	49	<b>66</b>
Distance Loss	To 15m	-24	-24	-24	-24	-24	-24	-24	-24	
Louvre insertion loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>27</b>
<b>Total Emissions</b>		<b>44</b>	<b>36</b>	<b>29</b>	<b>23</b>	<b>15</b>	<b>11</b>	<b>13</b>	<b>11</b>	

<b>Retail Plant R.03</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P200YKM2	Lp @ 1m	64	61	61	58	57	52	49	41	<b>61</b>
Distance Loss	To 17m	-25	-24	-24	-24	-24	-24	-24	-24	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>20</b>
<b>Total Emissions</b>		<b>31</b>	<b>27</b>	<b>23</b>	<b>16</b>	<b>13</b>	<b>7</b>	<b>9</b>	<b>3</b>	

<b>Retail Plant R.04</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P200YKM2	Lp @ 1m	64	61	61	58	57	52	49	41	<b>61</b>
Distance Loss	To 22m	-27	-27	-27	-27	-27	-27	-27	-27	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>17</b>
<b>Total Emissions</b>		<b>29</b>	<b>24</b>	<b>20</b>	<b>13</b>	<b>10</b>	<b>4</b>	<b>6</b>	<b>0</b>	

<b>Retail Plant R.05</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P200YKM2	Lp @ 1m	64	61	61	58	57	52	49	41	<b>61</b>
Distance Loss	To 29m	-29	-29	-29	-29	-29	-29	-29	-29	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>15</b>
<b>Total Emissions</b>		<b>26</b>	<b>22</b>	<b>17</b>	<b>11</b>	<b>8</b>	<b>1</b>	<b>3</b>	<b>0</b>	

<b>Retail Plant R.06</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P200YKM2	Lp @ 1m	64	61	61	58	57	52	49	41	<b>61</b>
Distance Loss	To 31m	-30	-30	-30	-30	-30	-30	-30	-30	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	
<b>Total Emissions</b>		<b>26</b>	<b>21</b>	<b>17</b>	<b>10</b>	<b>7</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>14</b>

<b>Retail Plant R.07</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUHY-P550YSNW-A	Lp @ 1m	76	70	67	65	59	56	53	49	<b>66</b>
Distance Loss	To 37m	-31	-31	-31	-31	-31	-31	-31	-31	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	
<b>Total Emissions</b>		<b>37</b>	<b>28</b>	<b>22</b>	<b>16</b>	<b>8</b>	<b>3</b>	<b>6</b>	<b>4</b>	<b>19</b>

<b>Retail Plant R.08</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P140YKM4	Lp @ 1m	59	60	51	52	47	42	37	31	<b>53</b>
Distance Loss	To 54m	-35	-35	-35	-35	-35	-35	-35	-35	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	
<b>Total Emissions</b>		<b>17</b>	<b>15</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8</b>

<b>Total Emissions at receptor</b>	<b>53</b>	<b>42</b>	<b>35</b>	<b>29</b>	<b>21</b>	<b>16</b>	<b>18</b>	<b>15</b>	<b>33</b>
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Criterion (Weekdays): 33dB(A)

Criterion (Weekends): 34dB(A)

**APPENDIX B**  
**AS11149 - 114-150 Queensway & 97-113 Inverness Terrace, London**  
**Plant Noise Assessment - Night-time**

**24-hour noise emissions to Cervantes Court South**

<b>Plant Room ASHP 1</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
Daikin EWYD8004ZXRA2	Lp @ 1m	65	58	53	46	39	38	33	29	<b>49</b>
Distance Loss	To 18m	-21	-21	-21	-21	-21	-21	-21	-21	
Roof Edge Screening		-8	-10	-12	-14	-17	-20	-23	-26	
<b>Total Emissions</b>		<b>36</b>	<b>28</b>	<b>20</b>	<b>11</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17</b>

<b>Plant Room ASHP 2</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
Daikin EWYD8004ZXRA2	Lp @ 1m	65	58	53	46	39	38	33	29	<b>49</b>
Distance Loss	To 22m	-22	-22	-22	-22	-22	-22	-22	-22	
Roof Edge Screening		-12	-15	-18	-20	-20	-20	-20	-20	
<b>Total Emissions</b>		<b>30</b>	<b>21</b>	<b>13</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>11</b>

<b>Retail Plant R.01</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUHY-P650YSNW-A	Lp @ 1m	64	60	52	50	45	43	46	45	<b>53</b>
Distance Loss	To 11m	-21	-21	-21	-21	-21	-21	-21	-21	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Balcony Edge Screening		-5	-5	-6	-6	-8	-9	-12	-14	<b>16</b>
<b>Total Emissions</b>		<b>35</b>	<b>28</b>	<b>16</b>	<b>10</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>1</b>	

<b>Retail Plant R.02</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUHY-P550YSNW-A	Lp @ 1m	58	57	51	49	42	38	42	41	<b>51</b>
Distance Loss	To 15m	-24	-24	-24	-24	-24	-24	-24	-24	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>13</b>
<b>Total Emissions</b>		<b>26</b>	<b>23</b>	<b>13</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>3</b>	

<b>Retail Plant R.03</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P200YKM2	Lp @ 1m	64	56	52	50	49	44	38	32	<b>53</b>
Distance Loss	To 17m	-25	-24	-24	-24	-24	-24	-24	-24	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>13</b>
<b>Total Emissions</b>		<b>31</b>	<b>22</b>	<b>14</b>	<b>8</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	

<b>Retail Plant R.04</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P200YKM2	Lp @ 1m	64	56	52	50	49	44	38	32	<b>53</b>
Distance Loss	To 22m	-27	-27	-27	-27	-27	-27	-27	-27	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>11</b>
<b>Total Emissions</b>		<b>29</b>	<b>19</b>	<b>11</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	

<b>Retail Plant R.05</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
PUMY-P200YKM2	Lp @ 1m	64	56	52	50	49	44	38	32	<b>53</b>
Distance Loss	To 29m	-29	-29	-29	-29	-29	-29	-29	-29	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	<b>9</b>
<b>Total Emissions</b>		<b>26</b>	<b>17</b>	<b>8</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

Retail Plant R.06		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PUMY-P200YKM2	Lp @ 1m	64	56	52	50	49	44	38	32	<b>53</b>
Distance Loss	To 31m	-30	-30	-30	-30	-30	-30	-30	-30	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	
<b>Total Emissions</b>		<b>26</b>	<b>16</b>	<b>8</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9</b>

Retail Plant R.07		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PUHY-P550YSNW-A	Lp @ 1m	58	57	51	49	42	38	42	41	<b>51</b>
Distance Loss	To 37m	-31	-31	-31	-31	-31	-31	-31	-31	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	
<b>Total Emissions</b>		<b>18</b>	<b>16</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8</b>

Retail Plant R.08		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PUMY-P140YKM4	Lp @ 1m	63	49	47	47	42	37	33	31	<b>48</b>
Distance Loss	To 54m	-35	-35	-35	-35	-35	-35	-35	-35	
Silencer Insertion Loss		-3	-5	-9	-13	-15	-16	-11	-9	
Line of Sight Screening		-5	-5	-5	-5	-5	-5	-5	-5	
<b>Total Emissions</b>		<b>21</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7</b>

<b>Total Emissions at receptor</b>	<b>41</b>	<b>33</b>	<b>24</b>	<b>17</b>	<b>11</b>	<b>10</b>	<b>11</b>	<b>11</b>	<b>23</b>
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Criterion: 23dB(A)

**AS11149 - 114-150 Queensway & 97-113 Inverness Terrace, London**  
**Emergency Plant Noise Assessment**

**Noise emissions to Cervantes Court South**

<b>Emergency Generator</b>		<b>63 Hz</b>	<b>125 Hz</b>	<b>250 Hz</b>	<b>500 Hz</b>	<b>1 kHz</b>	<b>2 kHz</b>	<b>4 kHz</b>	<b>8 kHz</b>	<b>dB(A)</b>
DN3-AJ375S-5S1	Lw	72	75	76	73	66	62	57	50	<b>74</b>
Krev Correction		-6	-6	-6	-6	-7	-7	-9	-9	
Total Reverberant L <sub>p</sub>		67	70	71	67	59	55	48	41	
Radiating area correction		10	10	10	10	10	10	10	10	
Propagation Correction		-8	-8	-8	-8	-8	-8	-8	-8	
Distance Loss	To 18m	-25	-25	-25	-25	-25	-25	-25	-25	
<b>Total Emissions</b>		<b>44</b>	<b>47</b>	<b>48</b>	<b>44</b>	<b>37</b>	<b>33</b>	<b>25</b>	<b>18</b>	<b>45</b>

Criterion: 49dB(A)