Paragon
Acoustic Consultants

Project:	35 Great James Street, London WC1N 3HB			
Client:	Environmental Engineering Partnership			
Report Title:	Environmental Noise Assessment			
Author:	F Zeolla MIOA		**Date:**	29/03/2017
Checked:	J Gillott MIOA		**Date:**	29/03/2017
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Contents

1.0 Introduction

It is proposed to install new mechanical air conditioning equipment at the property known as 35 Great James Street, London.

Paragon Acoustic Consultants Ltd has been commissioned to conduct an environmental noise survey to obtain statistical noise data to characterise the existing local background and ambient noise climate at the site and to derive noise limits to atmosphere based on Local Authority Noise Policy and other relevant guideline documents. This information is used to determine if the proposed new mechanical plant selections will meet with the derived noise limits.

If deemed necessary, effective mitigation measures shall be introduced as necessary to achieve the Local Authority Noise Policy requirements.

This practice has been advised that the operational period of the proposed mechanical plant will be between 07:00 – 19:00 hours only.

2.0 Site Description and Proposed Plant Location

2.1 Site Description

The site under consideration is situated at 35 Great James Street, London, WC1N 3HB, within the London Borough of Camden.

The site is a terraced property comprising 5 storeys (basement to 3rd floor), with its front façade facing eastwards onto the highway of Great James Street. The adjoining terraced properties of number 34 to the North and number 36 to the South are of similar height to the site under consideration.

There are further 5 storey properties (basement to 3rd floor) to the East of the site, on the opposite side of the highway of Great James Street.

To the rear of the site is the flat roof area over the 1st floor, where it is proposed to install new plant. Beyond the site boundary (towards the west) are the rear facades of properties in Emerald Street. These properties extend up approximately 3 – 4 floors above ground. In general, there are no windows on these properties which overlook the flat roof area of the site, with the exception of a single window which pertains to the property situated at 10-12 Emerald Street. The council tax valuation list does not indicate this as residential property. This is therefore considered to be the most exposed commercial property to the site.

The adjoining property of number 36 Great James Street is indicated on the council tax valuation list as residential use, and has windows at the rear which overlook the flat roof area of the site. In addition, it is noted that this property has building work in progress which includes the construction of a new two storey dwelling area. The windows of number 36 are considered to be the most exposed and hence the nearest noise sensitive residential receptor.

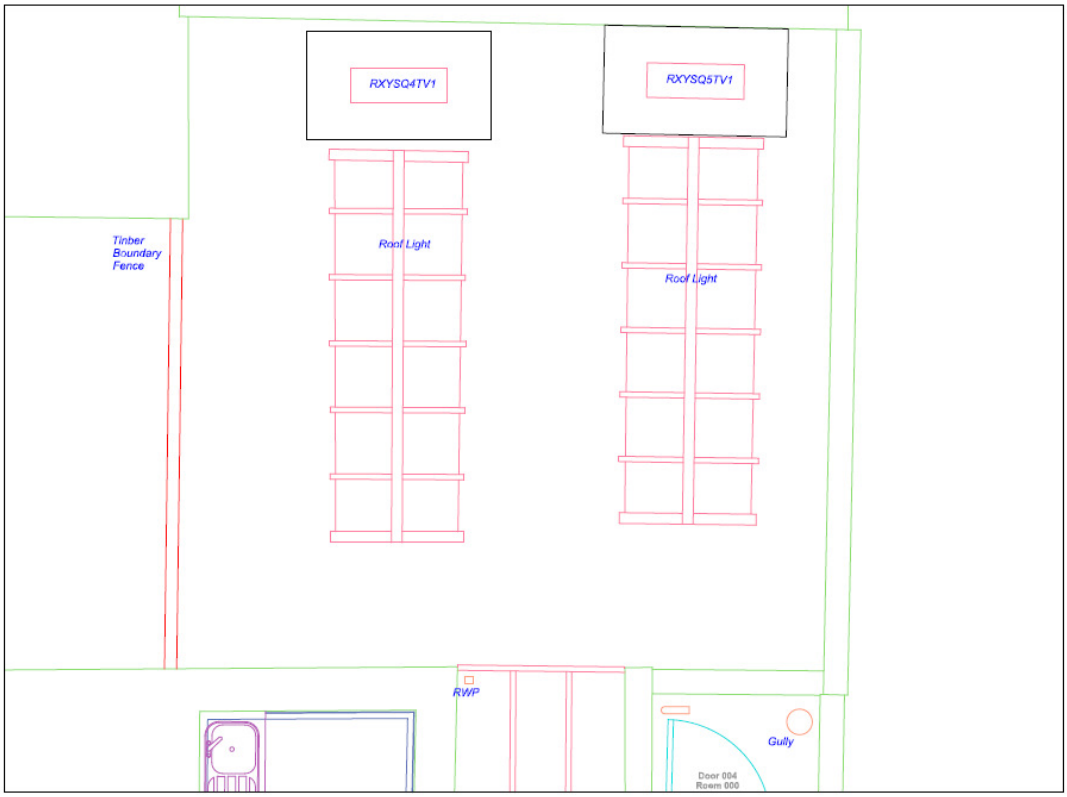
The council tax valuation list does not indicate any residential usage at the adjoining property of number 34 Great James Street. However number 33 Great James Street is listed as residential use. The upper floors of this property may have partial line of sight to the flat roof area of the site.

The site is illustrated by plan in Appendix A.

2.2 Proposed Plant Location

The proposed location of the plant has been advised by Messrs Quantem Consulting LLP. An extract of drawing indicating the proposed plant location is shown below

Figure 1: Proposed Plant Location



3.0 Existing Noise Climate

3.1 Road Traffic

Due to the layout of surrounding buildings, the rear of the site is situated within a location that is shielding from major road vehicular traffic noise. Nonetheless, middle distance road traffic low frequency “rumble” and individual “event” type emissions were audible to the surveyor.

3.2 Rail Traffic

Rail traffic noise events were not observed during the manned period at the start and end of the survey.

3.3 Aircraft

Aircraft overflights were not observed during the manned period at the start and end of the survey, although it is likely that the noise levels measured will include contributions from medium and high altitude aircraft.

3.4 Mechanical Noise Sources

Numerous items of mechanical plant items were observed that were associated with third party properties. It could not be established whether the items of plant were operating, however, it is assumed that their contribution to the overall noise climate will have been included within the readings measured. It is taken that all mechanical plant associated with third party premises is operating within legal noise limits and has planning permission.

4.0 Environmental Noise Survey

4.1 Measurements

The noise monitoring took place between the following dates / times:

- Start : 20/02/2017 at 09:00 hours
- End : 21/02/2017 at 11:00 hours

The noise monitoring was generally un-manned and was undertaken at the location as described below.

- **MP1**: Centre of the 1st floor flat roof area at the rear of the site, approximately 1.8m above roof level.

The measurement location is illustrated on the site layout drawing in Appendix A.

Various statistical broad-band and spectral sound pressure level measurements were obtained during the survey. A measurement time interval Tm = 15 minutes was used for sampling. Measurements of the percentile level $L_{A90,T}$ were made using time weighting F as per clause 3.4 of BS 4142:2014.

The quantities recorded included:

- **L_{Aeq}:** the equivalent continuous A-weighted sound pressure level over the measurement period
- **L_{Amax}:** the maximum A-weighted sound pressure level for the measurement period
- **L_{A10}:** the A-weighted sound pressure level exceeded for 10% of the measurement period
- **L_{A90}:** the A-weighted sound pressure level exceeded for 90% of the measurement period

4.2 Weather during survey period

The weather conditions at the start of the manned period of the survey were dry with a slight breeze, estimated at less than 5m/s, and at the end of the survey the conditions were similar. The weather forecast for the survey period did not indicate that adverse weather conditions were likely.

4.3 Instrumentation

Sound pressure level measurements were obtained using the following instrumentation complying with the Type 1 specification of BS EN 60804, BS EN 60651, BS EN 60942, BS EN 61260, and BS EN 61672-1:

- Norsonic Type 118 Sound level analyser, serial number 31663
- Norsonic Type 1225 ½" microphone

Additionally, the following equipment was used:

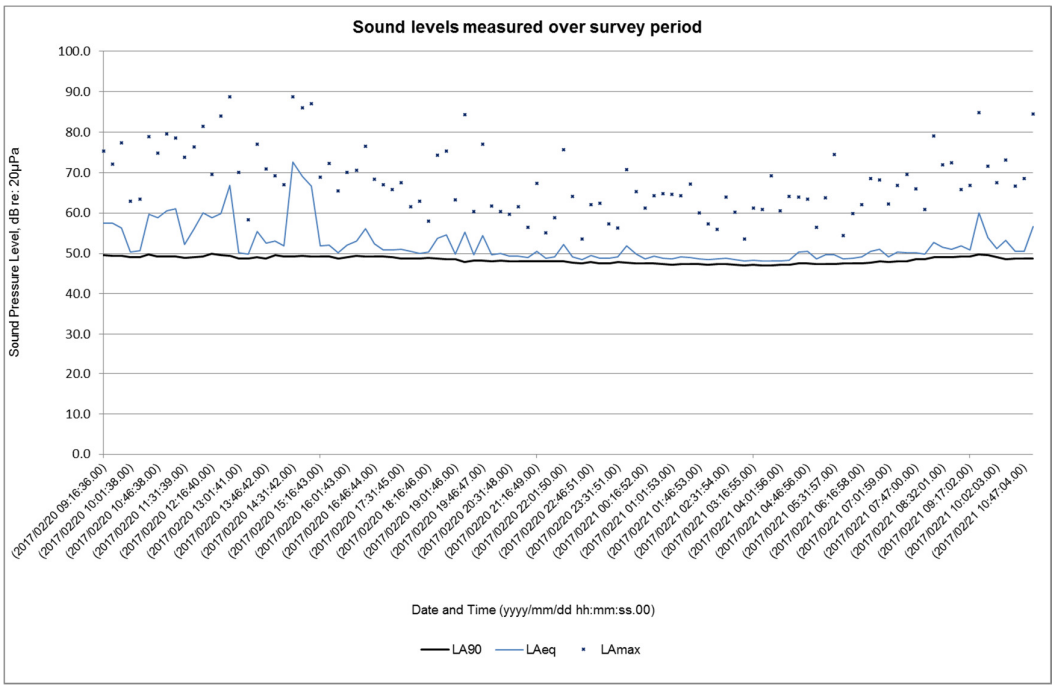
- Weather protection kit
- NOR 1212 microphone outdoor protection kit
- Tripod

Calibration checks were made prior to and after completion of measurements using a Norsonic Type 1251 acoustical calibrator complying with Class 1 of BS EN 60942, calibration level 114.0 dB ± 0.3 dB, @ 1.0 kHz. All instrumentation carries a current manufacturer's certificate of conformance a copy of which is available upon request.

4.4 Results

The recorded survey data is shown within Appendix B. Broadband sound pressure level data over the survey period (L_{A90} background levels, L_{Aeq} and L_{Amax} measurements) are shown graphically below:

Figure 2: Graphical Survey Data



The lowest recorded daytime, evening and night-time background sound levels are summarised below:

Table 1: Lowest recorded background sound levels

Measurement Position	Daytime 07:00-19:00 $L_{A90,(15\ min)}$	Evening 19:00-23:00 $L_{A90,(15\ min)}$	Night-time 23:00-07:00 $L_{A90,(15\ min)}$
MP1 measurement position	48 dB	48 dB	47 dB

5.0 Evaluation of External Noise Criteria

The local vicinity contains properties of mixed usage, which must be given due consideration in terms of acceptable levels of noise exposure from the new plant.

5.1 Noise Sensitive Properties

It is necessary to consider the requirements of the Local Authority. London Borough of Camden sets out their Noise Requirements within their 2010-2025 Local Development Framework Document, policy DP28 – Noise and Vibration, reproduced as follows:

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dBL_{Aeq}

This guidance is consistent with earlier documentation (Camden Noise Strategy September 2002, and UDP document adopted March 2000), which states:

New industrial developments

16.27 The Council considers that for new developments involving noisy plant/equipment or other uses, design measures should be taken to ensure that noise levels predicted at a point one metre external to sensitive facades are at least 5dB(A) less than the existing background measurement (LA90) when the equipment is in operation. Where it is anticipated that equipment will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses in the noise (bangs, clicks, clatters, thumps), special attention should be given to reducing the noise levels at any sensitive facade by at least 10dB(A) below the LA90 level.

5.2 Commercial Properties

Policy DP28 of London Borough of Camden 2010-2025 Local Development Framework Document does not provide noise requirements for commercial properties. However, reference is made to earlier documentation (Camden Noise Strategy September 2002, and UDP document adopted March 2000), which states:

Standards related to specific land uses

16.36 Developers should aim to achieve the predicted noise levels indicated below in respect of the following activities:

General offices (internal).	45dB(A) LAeq,1h.
Parks and open spaces.	LA.10 55dB(A) during period of use.

This practice considers that it would be acceptable to assess noise emissions to commercial properties in line with the guidelines provided in BS 8233:2014, which is consistent with the Camden Noise Strategy.

Figure 3: BS8233:2014 table of indoor ambient noise levels

Table 2 **Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important**

Objective	Typical situations	Design range $L_{Aeq,T}$ dB
Typical noise levels for acoustic privacy in shared spaces	Restaurant	40 – 55
	Open plan office	45 – 50
	Night club, public house	40 – 45
	Ballroom, banqueting hall	35 – 40
	Living room	35 – 40

NOTE See Noise control in building services [28] and BS EN ISO 3382.

It is also reasonable to consider a noise criterion external to commercial property windows that takes account of the internal design range, plus the loss expected through an openable window. In a research study conducted for DEFRA NANR116: "Open/Closed Window Research", numerous references are provided which quantify losses through open and partially open windows:

Figure 4: DEFRA NANR16 Summary of findings

Information Source	Summary of Findings
PPG 24 (1994) [2]	A reduction of 13 dB(A) from the facade level is assumed for an open window
WHO (1999) [4]	A reduction of 15 dB from the facade level is assumed for a partially open window. (no reference)
BS 8233 (1999) [5]	Windows providing rapid ventilation and summer cooling are assumed to provide 10 - 15 dB attenuation (no specific reference)
BRE Digest 338 (1988) [6]	A partly open window has an averaged level difference, $D_{1m+av\,100\text{-}3150}$ of 15 dB
DoE Design Bulleting 26 (1972) [7]	A reduction of 5 dB(A) with a window wide open
Nelson - Transportation Noise (1987) [8]	Sound insulation of an open single window is 5 – 15 dB. (theoretical)
Mackenzie & Williamson DoE Report (1972–73) [9],[10]	A vertical sliding sash window open 0.027 m^2 (summer night-time ventilation) and 0.36 m^2 (daytime summer ventilation) provided a sound level reduction of 16 and 11 dB(A) respectively. (Lab Study)
Kerry and Ford (1973 – 74) [11], [12]	A horizontal sliding sash window open 25 mm and 200 mm provided averaged sound reduction indices, R_{av} of 14 and 9 dB respectively. (Field Study)
Lawrence and Burgess (1982 – 83) [13][14]	A vertical sliding sash open 9% of the total façade provided a sound reduction index R_w 10 dB. (Field study)
Hopkins (2004) [15]	Road traffic noise reductions through window openings resulted in reductions of between $D_{2m,n,T}$ 8 and 14 dB. (Field Study)

Table 1.1 Summary of open-window acoustic transmission literature

The findings of the study are referenced in this report to substantiate the use of a 13dB(A) loss through a partially open window.

5.3 External Noise Criteria

The derived external noise criteria which the new building services plant shall be required to achieve are shown below:

Table 2: Limiting Noise Criteria applicable at the affected premises

Plant Location	Receptor	Daytime 07:00-19:00 $L_{Aeq,(15\ min)}$	Evening 19:00-23:00 $L_{Aeq,(15\ min)}$	Night-time 23:00-07:00 $L_{Aeq,(15\ min)}$
1st floor flat roof area	Sensitive Facade [3]	43 dB [1] [2]	43 dB [1] [2]	42 dB [1] [2]
	Commercial	58 dB L_{Aeq} [2]		

[1] Note: A 5dB penalty shall be included where noise at 1 metre external to a sensitive façade has a distinguishable discrete continuous note (whine, hiss, screech, hum) and/or has distinct impulses (bangs, clicks, clatters, thumps).

[2] Note: The limiting noise levels are deemed to be considered at a position 1 metre outside the nearest affected premises.

[3] Note: Sensitive façade is deemed to include any façade with windows serving residential dwellings only.

General note: It is taken that the noise Criteria apply at the surrounding third party premises. Noise levels may be exceeded external to windows of the client's premises.

6.0 Review of Proposed Plant

6.1 Introduction

The new plant will comprise the following equipment:

- 1-number Daikin VRV IV S-series heat pump unit, model RXYSQ4TV1.
- 1-number Daikin VRV IV S-series heat pump unit, model RXYSQ5TV1.

Detailed calculations have been carried out in order to determine the likely level of airborne noise transmission outside the identified assessment locations due to the operation of the proposed new plant to be installed.

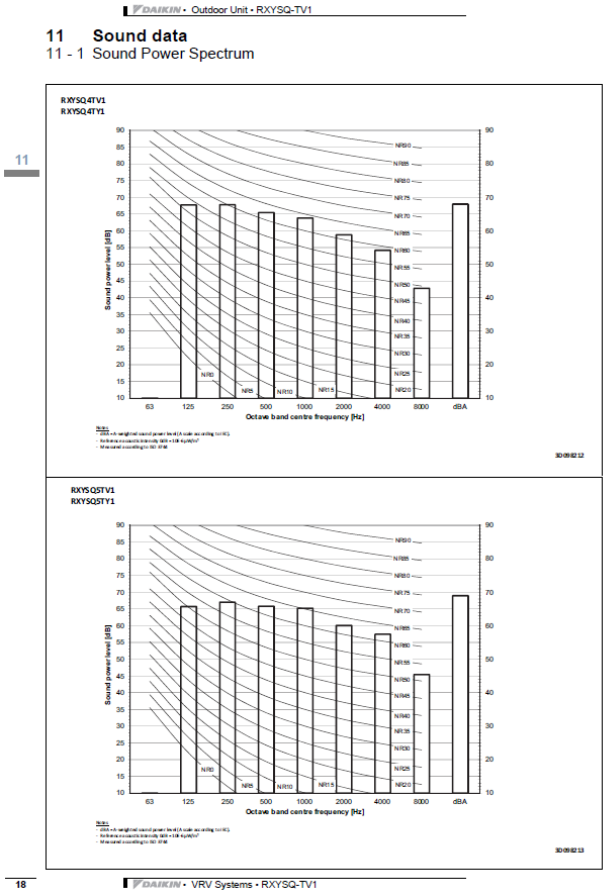
Section 2.2 details the plant location/s used in the assessment.

The following sections provide a record of the proposed new plant, the operational sound levels used as the basis for this assessment, and a specification for noise mitigation treatments.

6.2 Plant Noise Data

The noise levels / acoustic data for the proposed new plant items are shown below:

Figure 5: Noise data for proposed plant items



6.3 Predicted Plant Noise Levels

Calculations have been carried out using the data presented earlier within this report to predict the resultant sound pressure levels due to airborne transmitted noise outside the nearest exposed noise assessment position, and corresponding to the quietest period of plant operation. The predicted results are summarised below:

Table 3: Predicted Noise Levels at nearest affected premises

Plant under consideration	Worst case assessment location	Approx. distance to receiver	Direct line of sight?	Predicted Lp	Derived noise limit
New air conditioning equipment as described in Section 6.1 of this report	Existing 1st flr window at 36 Great James Street	Varies (5-6m)	Yes	56 dB	43 dB
	New 1st flr window at 36 Great James Street	Varies (4-6m)	Partial	55 dB	43 dB
	Commercial property at 10-12 Emerald Street	1.5m	Yes	63 dB	58 dB

Predictions are based on the plant operating normally at the noise levels detailed herein, and it is considered that the noise emitted from the proposed plant will not contain distinguishable discrete continuous note (whine, hiss, screech, hum) and/or distinct impulses (bangs, clicks, clatters, thumps).

It can be seen that:

- For affected third party noise sensitive residential properties, the proposed plant will not maintain the derived noise limit.
- For affected third party commercial properties, the proposed plant will not maintain the derived noise limit.

It is unlikely that significantly quieter equipment is available for equipment of similar capacity and it is understood that other locations are not available for the plant. As such, it is considered appropriate to propose noise mitigation measures to the condensers.

6.4 Noise mitigation to plant

An acoustic enclosure shall be used to house the condenser units. A specialist supplier shall provide a fit for purpose acoustic enclosure to provide the following minimum acoustic performance:

Table 4: Minimum insertion loss requirements for enclosure

Quantity	1/1 octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Minimum insertion loss (dB)	6	7	10	13	17	19	13	11

The insertion loss is hereby defined as the difference in sound pressure level with and without the enclosure in place. In order for this potential reduction in acoustic performance to be evaluated, the chosen enclosure supplier shall submit their product acoustic test data to Paragon Acoustic Consultants Limited prior to procurement / manufacture. Test data shall be provided for all of the proposed hardware products used in the construction of the enclosure and shall be obtained from an independent UKAS accredited test laboratory to provide proof that the foregoing acoustic performance will be maintained.

The dimensions of the enclosure are to be determined by the noise mitigation hardware supplier and agreed with the client.

Paragon Acoustic Consultants has considered the acoustic performance of the enclosure. The introduction of this type of structure has implications in other areas of design. As such, the client shall employ the services of other specialists to take responsibility for other areas of design associated with the introduction of such a structure. The following list is provided as an example of other areas to be considered as a minimum:

Airflow to and from condensing units: The installation of an enclosure will restrict the airflow around the condensing units. This will potentially give rise to two adverse effects as follows:

- The resistance to airflow will increase
- Heated discharge air from the condenser coils may re-circulate back into the condenser coils

The supplier of close fitting enclosure and the mechanical services consultant shall guarantee that their enclosures shall not adversely affect the performance of condensing units.

Structural: A suitably qualified consultant shall assess all structural loading as necessary.

Aesthetics: The visual appearance of the enclosures is to be agreed by the client's architect. The architect shall also consider all necessary statutory approvals and address design issues not covered by the relevant specialist consultant.

Alteration to existing services: The installation of each enclosure may require alteration to certain of the existing mechanical and electrical services in the vicinity of the proposed enclosure. In addition, the condensing units may require to be moved into close fitting enclosures. The client shall co-ordinate any such works.

Delivery and installation access: The enclosure supplier shall make appropriate arrangements for the delivery and installation of enclosures, including equipment such as cranes and scaffolding requirements.

Guarantees: The client shall obtain the necessary guarantees that the enclosure will meet the minimum insertion loss requirements as specified by this practice in the foregoing section. In addition, the client shall obtain all other guarantees as required.

Maintenance / repair / replacement: The enclosures shall allow maintenance / repair / replacement of the condensing unit equipment enclosed.

Warrantees: The client shall ensure that the warrantees provided by the condensing unit supplier/manufacturer are not invalidated by the introduction of the noise mitigation works.

Submission of final enclosure designs: The final design of the enclosures shall be submitted to Paragon Acoustic Consultants for comment prior to manufacture.

6.5 Vibration

It is recommended that the client provisions for appropriate vibration isolation mountings for the proposed mechanical plant items. It is recommended that the plant be installed on vibration isolation mounts providing a minimum of 98% isolation efficiency at all forcing frequencies using an isolation mount system approved by the plant supplier. In addition, all pipework should be suitably isolated from the building structure.

6.6 Predicted Plant Noise Levels

Calculations have been carried out to predict the noise levels at the nearest exposed noise assessment position including the insertion loss effect of the noise mitigation indicated previously. The predicted results are summarised below:

Table 5: Predicted Noise Levels at nearest affected premises with mitigation measures

Plant under consideration	Worst case assessment location	Approx. distance to receiver	Direct line of sight?	Predicted Lp	Derived noise limit
New air conditioning equipment as described in Section 6.1 of this report	Existing 1st flr window at 36 Great James Street	Varies (5-6m)	Yes	42 dB	43 dB
	New 1st flr window at 36 Great James Street	Varies (4-5m)	Partial	41 dB	43 dB
	Commercial property at 10-12 Emerald Street	1.5m	Yes	49 dB	58 dB

It can be seen that the proposed plant, together with the noise mitigation measures detailed, **would** maintain the Local Authority Noise Policy requirements for third party noise sensitive residential properties, and also for third party commercial properties.

Copies of the calculation analysis sheets to the most exposed residential and commercial receivers are included in Appendix C for reference.

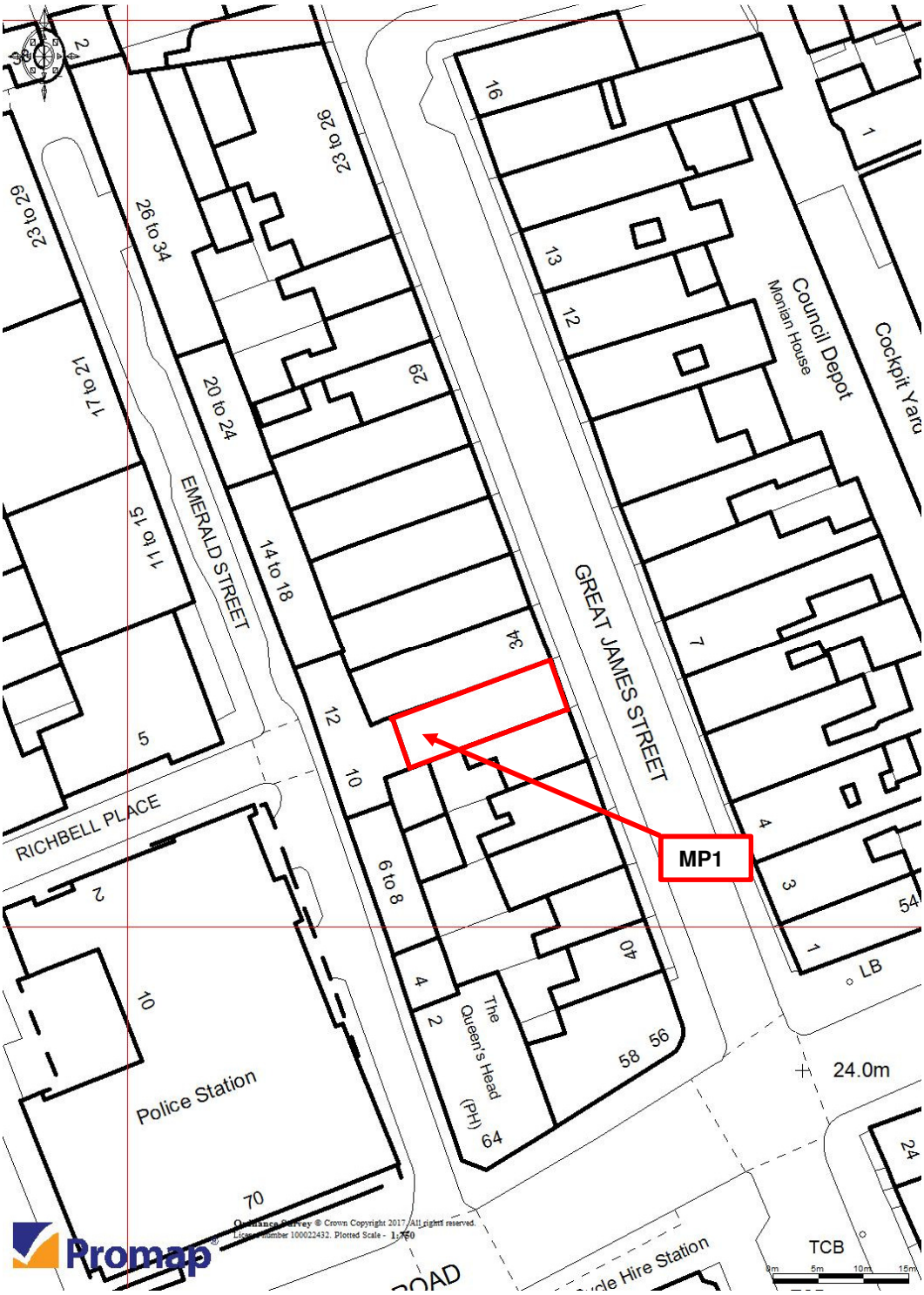
7.0 Conclusions

A background noise survey has been undertaken to determine the noise climate in the vicinity of the 1st floor flat roof area at the rear of 35 Great James Street London, where the positioning of new mechanical plant is proposed.

Appropriate external criteria have been identified on the basis of Local Authority noise policy, and predictions of the proposed mechanical plant noise emissions have been undertaken. Predictions indicate that the noise mitigation measures will be required in order to meet with the derived noise limits, and as such specification for the noise mitigation measures has been provided herein.

Following implementation and achievement of the noise mitigation recommended, it is predicted that its noise emissions will meet the existing noise policy operated by London Borough of Camden. On this basis, reservations are not expected from the planning authority on the grounds of noise. .

Appendix A: Site Plan



Appendix B: Recorded Survey Data

1st day	LAeq	LAF(max)	L10	L90
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
(2017/02/20 09:16:36.00)	57.50	75.40	59.40	49.60
(2017/02/20 09:31:37.00)	57.50	72.10	60.20	49.50
(2017/02/20 09:46:37.00)	56.30	77.30	55.40	49.40
(2017/02/20 10:01:38.00)	50.40	63.00	51.10	49.00
(2017/02/20 10:16:38.00)	50.70	63.40	51.30	49.10
(2017/02/20 10:31:38.00)	59.70	78.90	64.10	49.70
(2017/02/20 10:46:38.00)	58.80	74.80	64.20	49.20
(2017/02/20 11:01:38.00)	60.60	79.50	65.40	49.30
(2017/02/20 11:16:39.00)	61.10	78.50	65.60	49.20
(2017/02/20 11:31:39.00)	52.30	73.80	53.80	48.90
(2017/02/20 11:46:40.00)	56.10	76.30	52.80	49.00
(2017/02/20 12:01:40.00)	60.10	81.40	64.00	49.20
(2017/02/20 12:16:40.00)	58.80	69.60	63.30	50.00
(2017/02/20 12:31:40.00)	59.80	84.00	60.70	49.60
(2017/02/20 12:46:41.00)	66.90	88.80	55.70	49.50
(2017/02/20 13:01:41.00)	50.20	70.10	51.00	48.80
(2017/02/20 13:16:41.00)	49.80	58.40	50.70	48.70
(2017/02/20 13:31:42.00)	55.50	77.00	54.70	49.10
(2017/02/20 13:46:42.00)	52.50	70.90	54.40	48.80
(2017/02/20 14:01:42.00)	53.00	69.20	55.10	49.60
(2017/02/20 14:16:42.00)	51.80	67.00	53.30	49.30
(2017/02/20 14:31:42.00)	72.70	88.70	71.10	49.30
(2017/02/20 14:46:43.00)	69.00	86.00	57.10	49.40
(2017/02/20 15:01:43.00)	66.60	87.10	55.50	49.30
(2017/02/20 15:16:43.00)	51.80	68.90	53.10	49.30
(2017/02/20 15:31:43.00)	52.00	72.20	52.80	49.30
(2017/02/20 15:46:43.00)	50.20	65.40	51.00	48.80
(2017/02/20 16:01:43.00)	52.10	70.10	51.60	49.10
(2017/02/20 16:16:44.00)	53.00	70.50	54.60	49.40
(2017/02/20 16:31:44.00)	56.20	76.50	52.80	49.20
(2017/02/20 16:46:44.00)	52.40	68.40	52.70	49.30
(2017/02/20 17:01:44.00)	50.90	67.00	52.00	49.20
(2017/02/20 17:16:45.00)	50.90	65.80	52.30	49.00
(2017/02/20 17:31:45.00)	51.10	67.60	52.60	48.70
(2017/02/20 17:46:45.00)	50.50	61.50	51.80	48.80
(2017/02/20 18:01:46.00)	50.00	62.90	51.00	48.70
(2017/02/20 18:16:46.00)	50.30	58.00	51.60	48.90
(2017/02/20 18:31:46.00)	53.80	74.40	52.80	48.80
(2017/02/20 18:46:46.00)	54.60	75.40	51.50	48.60
(2017/02/20 19:01:46.00)	49.90	63.20	50.90	48.60
(2017/02/20 19:16:47.00)	55.20	84.30	51.70	47.90
(2017/02/20 19:31:47.00)	49.60	60.40	50.80	48.20
(2017/02/20 19:46:47.00)	54.50	77.10	53.10	48.30
(2017/02/20 20:01:47.00)	49.60	61.80	50.40	48.10
(2017/02/20 20:16:48.00)	50.00	60.40	51.20	48.30
(2017/02/20 20:31:48.00)	49.40	59.70	50.30	48.00
(2017/02/20 20:46:49.00)	49.30	61.60	50.20	48.00
(2017/02/20 21:01:49.00)	49.00	56.50	49.90	48.00
(2017/02/20 21:16:49.00)	50.60	67.30	50.40	48.00
(2017/02/20 21:31:49.00)	48.90	55.10	49.70	48.00
(2017/02/20 21:46:50.00)	49.20	58.90	50.00	48.00
(2017/02/20 22:01:50.00)	52.30	75.60	51.20	48.00
(2017/02/20 22:16:50.00)	49.10	64.10	49.70	47.70
(2017/02/20 22:31:50.00)	48.50	53.50	49.30	47.50
(2017/02/20 22:46:51.00)	49.50	62.00	50.50	47.90
(2017/02/20 23:01:51.00)	48.80	62.40	49.60	47.60
(2017/02/20 23:16:51.00)	48.80	57.40	49.80	47.60
(2017/02/20 23:31:51.00)	49.10	56.30	49.90	47.90
(2017/02/20 23:46:52.00)	51.90	70.80	51.00	47.80
(2017/02/21 00:01:52.00)	49.80	65.30	50.30	47.50
(2017/02/21 00:16:52.00)	48.70	61.20	49.60	47.50
(2017/02/21 00:31:52.00)	49.30	64.30	50.10	47.50
(2017/02/21 00:46:53.00)	48.80	64.80	49.60	47.30
(2017/02/21 01:01:53.00)	48.70	64.70	49.30	47.20
(2017/02/21 01:16:53.00)	49.20	64.30	49.70	47.30
(2017/02/21 01:31:53.00)	49.00	67.20	49.70	47.30
(2017/02/21 01:46:53.00)	48.70	60.00	49.60	47.40
(2017/02/21 02:01:54.00)	48.40	57.40	49.20	47.20
(2017/02/21 02:16:54.00)	48.70	56.00	49.70	47.40
(2017/02/21 02:31:54.00)	48.80	64.00	49.40	47.30
(2017/02/21 02:46:54.00)	48.40	60.20	49.40	47.20
(2017/02/21 03:01:55.00)	48.20	53.60	49.00	47.10
(2017/02/21 03:16:55.00)	48.30	61.20	49.10	47.20
(2017/02/21 03:31:55.00)	48.20	60.90	49.00	47.00
(2017/02/21 03:46:56.00)	48.20	69.30	48.90	47.10
(2017/02/21 04:01:56.00)	48.10	60.50	48.90	47.20
(2017/02/21 04:16:56.00)	48.30	64.20	49.20	47.20
(2017/02/21 04:31:56.00)	50.30	63.90	51.90	47.50
(2017/02/21 04:46:56.00)	50.60	63.50	52.20	47.50
(2017/02/21 05:01:57.00)	48.70	56.40	49.90	47.40
(2017/02/21 05:16:57.00)	49.60	63.70	49.80	47.40
(2017/02/21 05:31:57.00)	49.70	74.50	49.50	47.40
(2017/02/21 05:46:57.00)	48.60	54.50	49.60	47.50
(2017/02/21 06:01:58.00)	48.90	59.80	50.10	47.50
(2017/02/21 06:16:58.00)	49.10	62.00	50.00	47.60
(2017/02/21 06:31:59.00)	50.60	68.50	51.90	47.80
(2017/02/21 06:46:59.00)	51.10	68.20	52.50	48.10

2nd day	LAeq	LAF(max)	L10	L90
(2017/02/21 07:01:59.00)	49.10	62.30	50.00	47.90
(2017/02/21 07:17:00.00)	50.30	66.90	51.60	48.10
(2017/02/21 07:32:00.00)	50.10	69.50	50.90	48.10
(2017/02/21 07:47:00.00)	50.20	66.00	51.10	48.50
(2017/02/21 08:02:01.00)	49.90	60.90	51.00	48.50
(2017/02/21 08:17:01.00)	52.80	79.10	53.20	49.00
(2017/02/21 08:32:01.00)	51.50	72.00	52.30	49.00
(2017/02/21 08:47:01.00)	51.00	72.50	52.50	49.10
(2017/02/21 09:02:02.00)	51.80	65.80	53.40	49.20
(2017/02/21 09:17:02.00)	50.80	66.90	51.90	49.30
(2017/02/21 09:32:02.00)	60.00	84.90	60.30	49.80
(2017/02/21 09:47:03.00)	54.00	71.60	54.10	49.60
(2017/02/21 10:02:03.00)	51.20	67.60	52.60	49.00
(2017/02/21 10:17:03.00)	53.30	73.10	51.70	48.60
(2017/02/21 10:32:04.00)	50.60	66.70	51.30	48.70
(2017/02/21 10:47:04.00)	50.50	68.50	51.40	48.70
(2017/02/21 11:02:04.00)	56.70	84.50	52.80	48.80
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
00:00	0.00	0.00	0.00	0.00
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Appendix C: Calculation sheets

EXISTING RESIDENTIAL RECEIVER

project	35 Great James Street											
date	29/03/2017											
Plant	RXYSQ condenser units											
Frequency			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Daikin RXYSQ4TV1				57	57	54	53	48	43	32	**57**
Daikin RXYSQ5TV1				55	56	55	54	49	47	33	**58**
Condenser sound pressure level at distance below			6.0	59.1	59.5	57.5	56.5	51.5	48.5	35.5	**61**
distance sound pressure level measured			1								
measurement condition			1	1=free field, 2=hemisphere							
Number of units of the same noise level if not added above			1	Number units							
distance to the receiver location			5								
Source situation correction			3	dB							
correction for propagation of sound			Q	h=hemisphere, q=quarter sphere, e=eighth of a sphere							
acoustic barrier loss due to other buildings (enter as positive attenuation)			0	0	0	0	0	0	0	0	
Attenuation proposed - insertion loss (enter as positive attenuation)			6	7	10	13	17	19	13	11	
Un-attenuated condenser noise emissions											
Predicted noise levels			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Condenser sound pressure level at	1	m	6	59	60	58	57	52	48	36	**61**
correction for propagation of noise into space			6	6	6	6	6	6	6	6	
correction due to distance to receiver at	5	m	-14	-14	-14	-14	-14	-14	-14	-14	
Source situation correction			3	3	3	3	3	3	3	3	
Correction for units if not added at start of assessment	1	unit/s	0	0	0	0	0	0	0	0	
allowance for acoustic barrier loss due to other buildings			0	0	0	0	0	0	0	0	
Predicted noise level at receiver			1	54	55	53	52	47	43	31	**56**
Condenser noise emissions after enclosure											
Predicted noise levels			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Condenser sound pressure level at	1	m	6	59	60	58	57	52	48	36	**61**
correction for propagation of noise into space			6	6	6	6	6	6	6	6	
correction due to distance to receiver at	5	m	-14	-14	-14	-14	-14	-14	-14	-14	
Source situation correction			3	3	3	3	3	3	3	3	
Correction for units if not added at start of assessment	1	unit/s	0	0	0	0	0	0	0	0	
allowance for acoustic barrier loss due to other buildings			0	0	0	0	0	0	0	0	
Predicted noise level at receiver			1	54	55	53	52	47	43	31	
Attenuation proposed - insertion loss			-6	-7	-10	-13	-17	-19	-13	-11	
level after attenuation			-5	47	45	40	35	28	30	20	**42**

NEW RESIDENTIAL RECEIVER

project	35 Great James Street										
date	29/03/2017										
Plant	RXYSQ condenser units										
Frequency			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Daikin RXYSQ4TV1				57	57	54	53	48	43	32	**57**
Daikin RXYSQ5TV1				55	56	55	54	49	47	33	**58**
Condenser sound pressure level at distance below			6.0	59.1	59.5	57.5	56.5	51.5	48.5	35.5	**61**
distance sound pressure level measured			1								
measurement condition			1	1=free field, 2=hemisphere							
Number of units of the same noise level if not added above			1	Number units							
distance to the receiver location			4								
Source situation correction			0	dB							
correction for propagation of sound			Q	h=hemisphere, q=quarter sphere, e=eighth of a sphere							
acoustic barrier loss due to other buildings (enter as positive attenuation)			0	0	0	0	0	0	0	0	
Attenuation proposed - insertion loss (enter as positive attenuation)			6	7	10	13	17	19	13	11	
Un-attenuated condenser noise emissions											
Predicted noise levels			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Condenser sound pressure level at	1	m	6	59	60	58	57	52	48	36	**61**
correction for propagation of noise into space			6	6	6	6	6	6	6	6	
correction due to distance to receiver at	4	m	-12	-12	-12	-12	-12	-12	-12	-12	
Source situation correction			0	0	0	0	0	0	0	0	
Correction for units if not added at start of assessment	1	unit/s	0	0	0	0	0	0	0	0	
allowance for acoustic barrier loss due to other buildings			0	0	0	0	0	0	0	0	
Predicted noise level at receiver			0	53	54	52	51	46	42	30	**55**
Condenser noise emissions after enclosure											
Predicted noise levels			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Condenser sound pressure level at	1	m	6	59	60	58	57	52	48	36	**61**
correction for propagation of noise into space			6	6	6	6	6	6	6	6	
correction due to distance to receiver at	4	m	-12	-12	-12	-12	-12	-12	-12	-12	
Source situation correction			0	0	0	0	0	0	0	0	
Correction for units if not added at start of assessment	1	unit/s	0	0	0	0	0	0	0	0	
allowance for acoustic barrier loss due to other buildings			0	0	0	0	0	0	0	0	
Predicted noise level at receiver			0	53	54	52	51	46	42	30	
Attenuation proposed - insertion loss			-6	-7	-10	-13	-17	-19	-13	-11	
level after attenuation			-6	46	44	39	34	27	29	19	**41**

COMMERCIAL RECEIVER

project			35 Great James Street								
date			29/03/2017								
Plant			RXYSQ condenser units								
Frequency			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Daikin RXYSQ4TV1				57	57	54	53	48	43	32	**57**
Daikin RXYSQ5TV1				55	56	55	54	49	47	33	**58**
Condenser sound pressure level at distance below			6.0	59.1	59.5	57.5	56.5	51.5	48.5	35.5	**61**
distance sound pressure level measured			1								
measurement condition			1	1=free field, 2=hemisphere							
Number of units of the same noise level if not added above			1	Number units							
distance to the receiver location			1.5								
Source situation correction			0	dB							
correction for propagation of sound			Q	h=hemisphere, q=quarter sphere, e=eighth of a sphere							
acoustic barrier loss due to other buildings (enter as positive attenuation)			0	0	0	0	0	0	0	0	
Attenuation proposed - insertion loss (enter as positive attenuation)			6	7	10	13	17	19	13	11	
Un-attenuated condenser noise emissions											
Predicted noise levels			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Condenser sound pressure level at	1	m	6	59	60	58	57	52	48	36	**61**
correction for propagation of noise into space			6	6	6	6	6	6	6	6	
correction due to distance to receiver at	1.5	m	-4	-4	-4	-4	-4	-4	-4	-4	
Source situation correction			0	0	0	0	0	0	0	0	
Correction for units if not added at start of assessment	1	unit/s	0	0	0	0	0	0	0	0	
allowance for acoustic barrier loss due to other buildings			0	0	0	0	0	0	0	0	
Predicted noise level at receiver			9	62	62	60	59	54	51	38	**63**
Condenser noise emissions after enclosure											
Predicted noise levels			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Condenser sound pressure level at	1	m	6	59	60	58	57	52	48	36	**61**
correction for propagation of noise into space			6	6	6	6	6	6	6	6	
correction due to distance to receiver at	1.5	m	-4	-4	-4	-4	-4	-4	-4	-4	
Source situation correction			0	0	0	0	0	0	0	0	
Correction for units if not added at start of assessment	1	unit/s	0	0	0	0	0	0	0	0	
allowance for acoustic barrier loss due to other buildings			0	0	0	0	0	0	0	0	
Predicted noise level at receiver			9	62	62	60	59	54	51	38	
Attenuation proposed - insertion loss			-6	-7	-10	-13	-17	-19	-13	-11	
level after attenuation			3	55	52	47	42	35	38	27	**49**