SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Highgate Studios, Kentish Town

Acoustic planning report

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Version	Date	Comments	Author	Reviewer
A	11 Mar 24		James Pinner	Mark Howarth
B	2 May 24	Inclusion of attenuation to MEP proposals	Jessica Wright	Mark Howarth

Summary

Sandy Brown has been commissioned by Kentish Town UK Office Propco Limited to provide acoustic advice in relation to the proposed development at Highgate Studios, Kentish Town.

An environmental noise survey has been carried out to determine the existing sound levels in the area. The noise survey was performed between 13 May 2022 and 17 May 2022. The representative background sound levels from the noise survey at the site were:

- $L_{A90,15min}$ 53 dB during the day and $L_{A90,15min}$ 50 dB during the night to the north
- $L_{A90,15min}$ 51 dB during the day and $L_{A90,15min}$ 41 dB during the night to the south.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises will be limited to be 10 dB below the background noise levels at the noise sensitive premises.

If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied, and the limits will be more stringent than those set. London Borough of Camden stipulate that if tonal components are present, limits should be set 5 dB lower.

Entertainment noise limits have been set based on guidance within London Borough of Camden's Local Plan 2017.

The plant noise egress assessment has been carried out including the proposed attenuation measures. Discussion on the unit 100 condenser attenuation have been provided. With the recommended attenuation included to Unit 100 condenser, the overall daytime plant noise egress limits are expected to be met, however the proposed split plant noise limits for Phase 1 only would be exceeded at one noise sensitive receiver (NSP 2).

Contents

1 Introduction

Sandy Brown has been commissioned by Kentish Town UK Office Propco Limited to provide acoustic advice in relation to the proposed development at Highgate Studios, Kentish Town.

As part of this, an environmental noise survey is required, the purpose of which is to establish the existing background sound levels in the vicinity of nearby noise sensitive premises and to set appropriate limits for noise egress from building services plant.

This report presents the survey method and results a discussion of acceptable limits for noise emissions from building services plant and a plant noise assessment of the proposed plant equipment.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1.

The site consists of a number of existing buildings with Highgate Road to the east, Sanderson Close to the north and Carker's Lane to the south, running partially through the site. The position of the site is outlined in red.

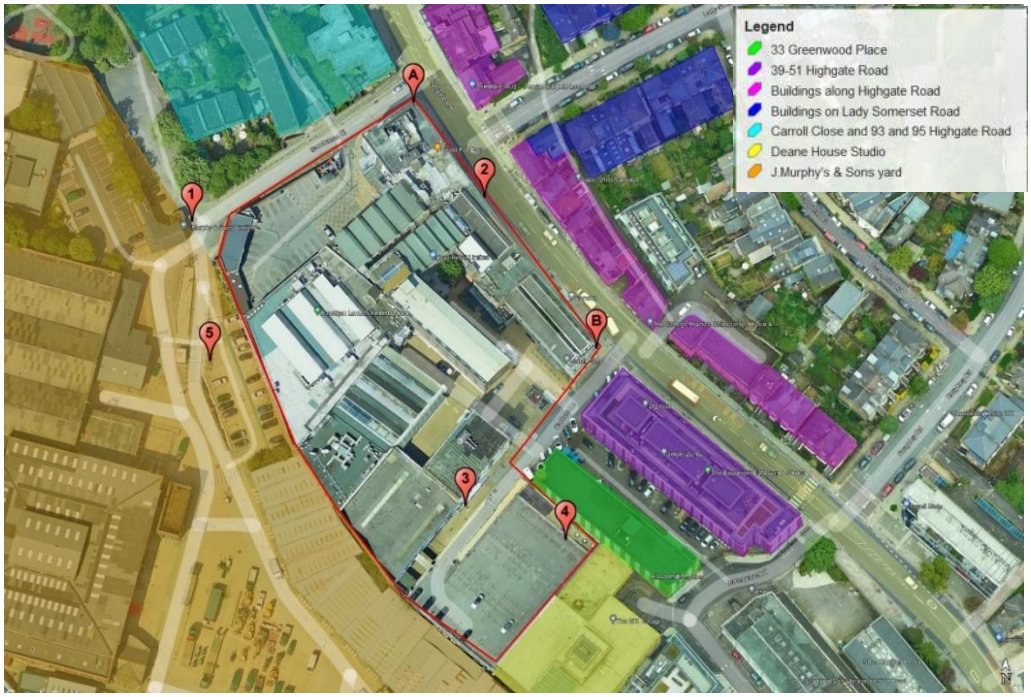


Figure 1 Aerial view of site (courtesy of Google Earth Pro)

2.2 Adjacent premises

The adjacent premises have been established to be as follows, as highlighted in Figure 1:

1. 39-51 Highgate Road – Mixed use residential and commercial premises in purple to the south east of the site
2. 33 Greenwood Place – Commercial premises in green to the south east of the site
3. Deane House Studio – Commercial premises at in yellow to the south of the site
4. Buildings opposite the site along Highgate Road – Mixed use residential and commercial premises in pink to the east of the site
5. Carroll Close and 93 and 95 Highgate Road – Residential premises in light blue to the north of the site
6. Buildings on Lady Somerset Road – Residential premises in navy blue to the north east of the site
7. J.Murphy's & Sons yard – Commercial/Industrial premises in orange to the west of the site.

3 Development proposals

Internal refurbishment works are proposed to the site. This includes installation of new mechanical plant equipment.

4 Assessment criteria

4.1 Building services noise egress criteria

4.1.1 Standard guidance

BS 4142:2014:+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at nearby noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

4.1.2 Local Authority criteria

In relation to noise egress from industrial and commercial noise sources, London Borough of Camden's local plan (June 2017) states:

"*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 (15 dB if tonal components are present) should be considered as design criterion."*

Based on the extract from Camden Local Plan, all external plant must be such that the cumulative noise 1 m away from the windows of the nearest noise sensitive receptors is 10 dB below the representative measured background level ($L_{A90,\ 15\ min}$).

As per Camden Local Plan 2017, noise emissions from emergency plant items should be no greater than 10 dB above the background sound level ($L_{A90,\ 15\ min}$).

4.2 Entertainment noise egress criteria

As per the Camden Local Plan 2017 criteria and the average ambient noise levels based on measured noise levels entertainment noise from customer activities should not exceed the following levels at within gardens used for amenity of the nearest noise sensitive premises. As NSP 1, 39-51 Highgate Road, does not appear to have a garden for amenity use, it is proposed that the same limits should apply at 1 m from the facade of the building.

Table 1 Entertainment noise egress criteria (free field level)

Location of residential NSP	Entertainment noise limit, $L_{Aeq,5min}$ (dB) to meet LOAEL		
	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
To the north side of the site [1]	55	50	46
To the south side of the site [2]	55	54	50

[1] Based on logger location A

[2] Based on logger location B

For entertainment noise from amplified sound the noise limits in internal spaces are summarised in Table 2.

Table 2 Summary of Camden Local Plan 2017 guidance on entertainment noise

Room	Period	Noise limit
Bedrooms	23:00-07:00	NR 25 ($L_{eq,15min}$)
All habitable rooms	07:00-23:00	NR 35 ($L_{eq,15min}$)

5 Noise survey method

The survey included unattended and attended noise measurements.

5.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over 5 days.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements were taken over 15 minute periods between 13 May 2022 and 17 May 2022 at two locations. The equipment was installed and collected by Paul Monaghan and Serena Joynes.

The measurement location used during the survey is indicated in Figure 1, denoted by letters ‘A’ and ‘B’. Photographs showing the measurement locations are provided in Figure 2. These locations were chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.

Figure 2 Photograph of unattended measurement locations (Left – location A, Right – location B)

Both unattended measurement locations were on rooftops, with location A approximately 16 m above ground height and location B approximately 8 m above ground height. Each microphone was located approximately 1.5 m above roof level. Both locations are considered to be free field.

5.2 Attended measurements

Attended sample measurements were taken by Paul Monaghan and Serena Joynes at 5 locations around the site. These are indicated in Figure 1 as locations 1 to 5. The attended measurements were carried out on 13 May 2022 for locations 1 and 2 and 17 May 2022 for locations 3, 4 and 5, over 5 minute periods.

At locations 1 and 2, the microphone was mounted on a tripod approximately 1.2 m above the ground level. At locations 3 to 5, the microphone was mounted on a tripod approximately 1.8 m above the ground level. At all locations, the microphone was located at least 3 m from any other reflective surface As such, all measurements can be considered to be free field. Details of the equipment used and the noise indices measured are provided in Appendix A.

Dominant noise sources occurring during the measurements were noted.

Figure 3 Photograph of attended measurement locations (Left – location 1, Right – location 2)

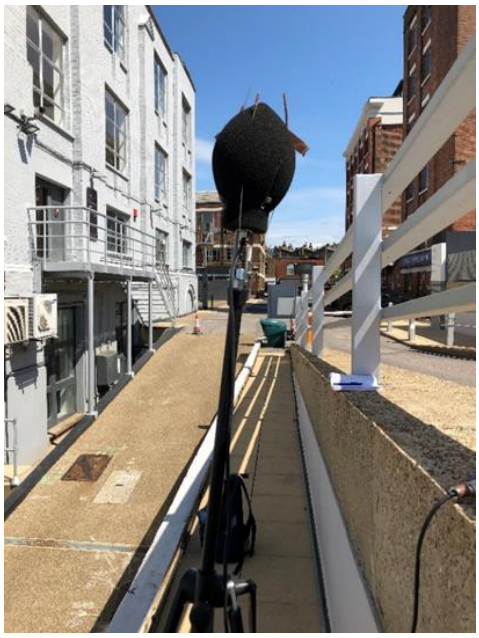
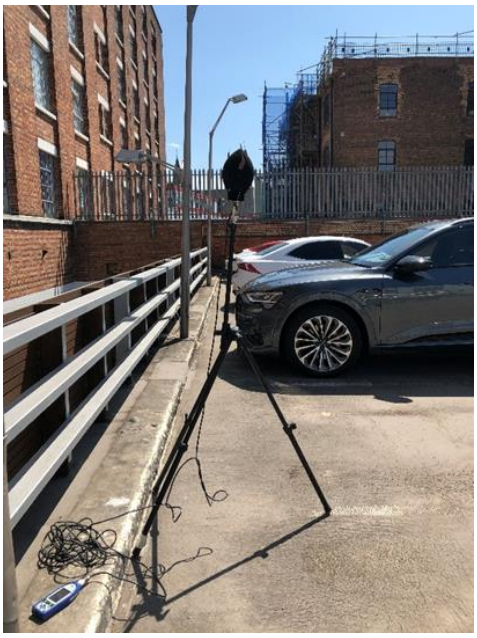



Figure 4 Photograph of attended measurement locations (Left – location 3, Right– location 4)

Figure 5 Photograph of attended measurement location 5

5.3 Weather conditions

Weather conditions during the survey are described in Appendix A.

6 Noise survey results

6.1 Observations

The dominant noise sources observed at the site during the survey were from road traffic noise from Highgate Road.

Less significant noise sources included road traffic noise from side roads such as Sanderson Close to the north and Carkers Lane to the south. For location A, noise from building services plant was audible but not dominant during the daytime.

6.2 Noise measurement results

6.2.1 Unattended measurement results – Location A

A graph showing the results of the unattended measurements is provided in Appendix B.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 3.

Table 3 Ambient noise levels measured during the unattended survey

Date	Day (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
13 May 2022	-	57
14 May 2022	61	56
15 May 2022	59	55
16 May 2022	60	55
Average	60	56

For the purpose of setting entertainment noise limits, the noise levels measured for day, evening and night are set out in Table 4

Table 4 Ambient noise levels measured during the unattended survey

Date	Day (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
13 May 2022	-	59	57
14 May 2022	61	61	56
15 May 2022	59	58	55
16 May 2022	60	58	55
Average	60	59	56

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 6 and Figure 7.

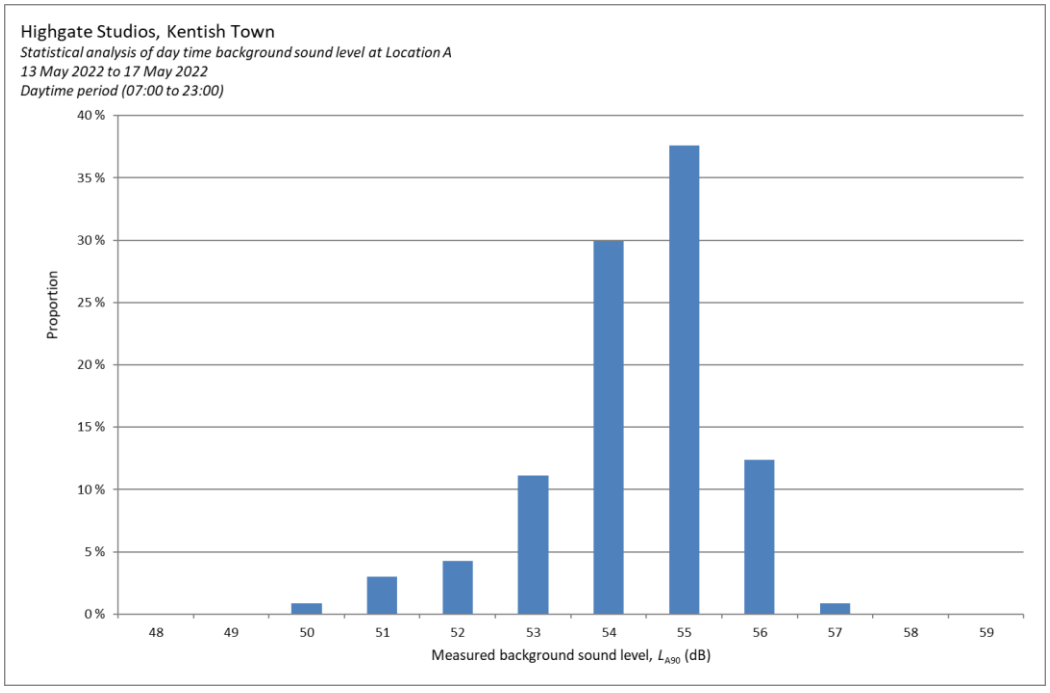


Figure 6 Daytime statistical analysis – Location A

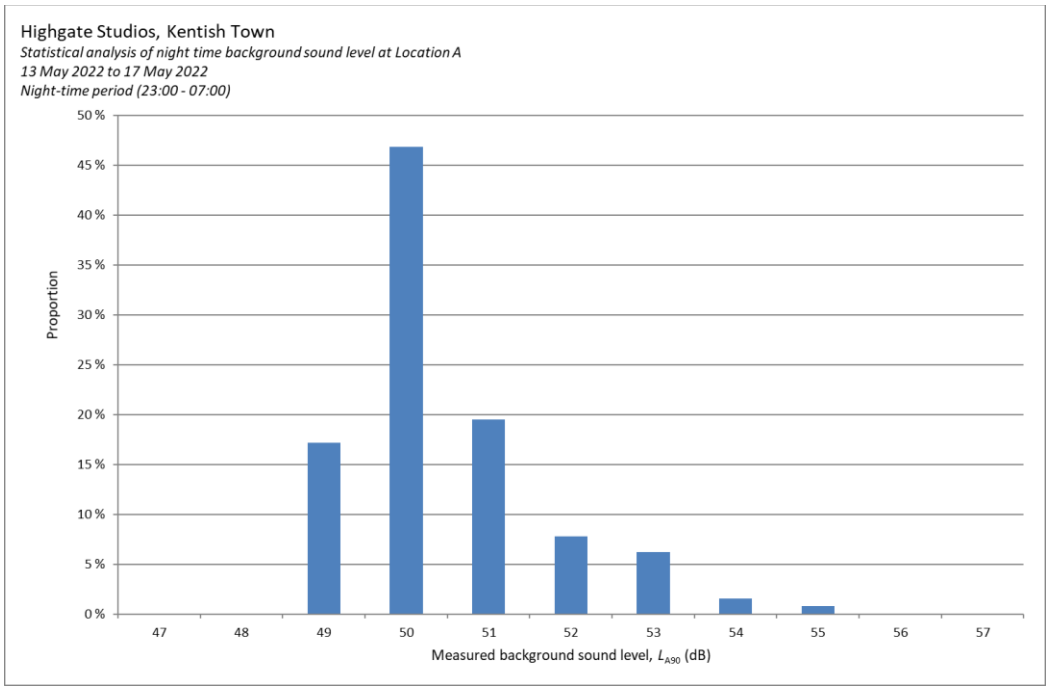


Figure 7 Night time statistical analysis – Location A

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 53 dB during the daytime and $L_{A90,15min}$ 50 dB at night.

There was building services plant nearby to the logging location on the roof. Whilst this was not dominant during the daytime, it is likely that this is the cause of the constant noise level of L_{A90} 50 dB at night. From comparison, at location B, the noise level at night reduces to L_{A90} 41 dB. Considering that both unattended noise loggers were located close to Highgate Road, which noted to be the dominant noise source at both locations, it is unlikely that the noise level would vary by 9 dB at night time. Therefore, the night time noise level at location A has been discounted when setting plant noise limits for the scheme.

6.2.2 Unattended measurement results – Location B

A graph showing the results of the unattended measurements is provided in Appendix B.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 3.

Table 5 Ambient noise levels measured during the unattended survey

Date	Day (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
13 May 2022	-	62
14 May 2022	66	60
15 May 2022	64	59
16 May 2022	65	59
Average	65	60

For the purpose of setting entertainment noise limits, the noise levels measured for day, evening and night are set out in Table 6.

Table 6 Ambient noise levels measured during the unattended survey

Date	Day (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
13 May 2022	-	63	62
14 May 2022	66	66	60
15 May 2022	64	63	59
16 May 2022	65	63	59
Average	65	64	60

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 8 and Figure 9.

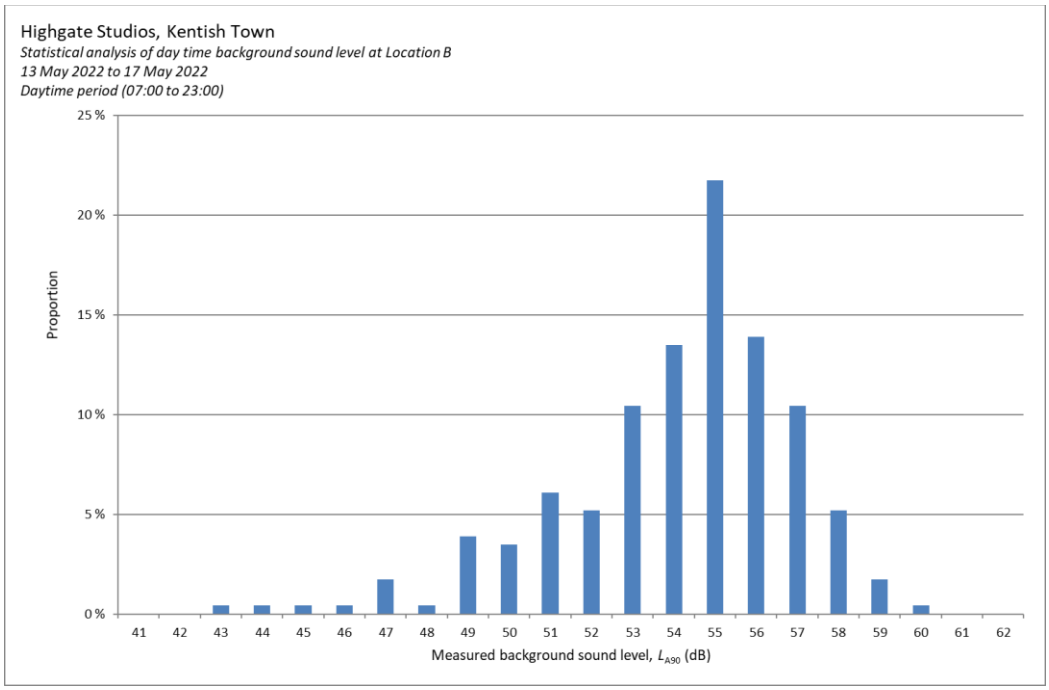


Figure 8 Daytime statistical analysis – Location B

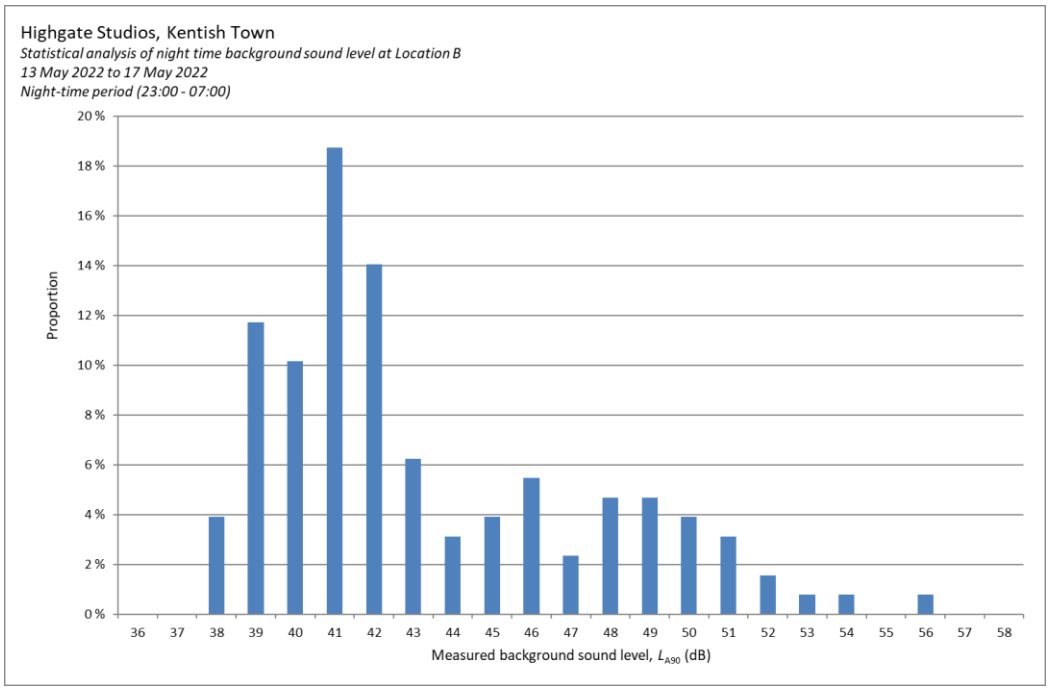


Figure 9 Night time statistical analysis – Location B

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 51 dB during the daytime and $L_{A90,15min}$ 41 dB at night.

6.2.3 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 7. All measurement locations are considered to be free field.

Table 7 Noise levels and key noise sources from attended measurements

Location	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{A1,5min}$	$L_{A90,5min}$	
1	13 May 22 17:36	54	60	51	Plant noise from grilles nearby serving Pure Gym dominating. Other sources included road traffic from Highgate road and Sanderson Close.
1	13 May 22 17:42	54	62	50	As above.
1	13 May 22 17:47	56	67	50	As above.
2	13 May 22 17:54	69	77	58	Road traffic from Highgate road was dominant. Some noise from pedestrians.
2	13 May 22 18:00	71	79	60	As above.
2	13 May 22 18:05	69	77	60	As above.

Location	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{A1,5min}$	$L_{A90,5min}$	
3	17 May 22 11:50	47	52	42	Road traffic from Highgate Road dominant. Less dominant sources included noise from pedestrians, wildlife noise (bird song).
3	17 May 22 11:55	49	59	42	As above, with contributions from train line to the south of site.
3	17 May 22 12:00	48	57	42	As measurement at 11:50.
4	17 May 22 12:08	51	58	46	Dominant source was train line to the south of the site with train pass bys every 1 to 2 minutes. Road traffic from Highgate Road and from cars turning into the car park. Some noise from pedestrians. There was also intermittent construction noise noted, consisting of mostly drilling from a site to the south east.
4	17 May 22 12:13	49	56	45	As above.
4	17 May 22 12:19	55	67	44	As above, however intermittent construction noise was noted to be more dominant.

Location	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{A1,5min}$	$L_{A90,5min}$	
5	17 May 22 12:31	50	56	47	Plant from Pure Gym dominant. Road traffic from Highgate Road and Sanderson close. Noise from occasional air traffic and rail traffic from train line to the south of the site with train pass bys every 2 to 3 minutes. Some pedestrian noise. Traffic noise from cars and vans entering the car park with some vans idling at the barrier for 1 to 2 minutes.
5	17 May 22 12:38	57	65	47	As above, with vans influencing L_{Aeq} a noise level. The L_{A1} noise level was likely caused by rail noise.
5	17 May 22 12:43	56	69	48	As above.

6.3 Basic limits

6.3.1 Normally operating plant

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new normally operating plant should not exceed the limits set out in Table 8.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as free-field levels.

Table 8 Plant noise limits at 1 m from the nearest noise sensitive premises

NSP	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)[5]
1 [2]	41	31
2 and 3[3]	35	-
4 to 7[4]	43	31

[1] The limits set out in Table 8 do not include any attention catching features. Penalty corrections for attention catching features may be significant and will need to be considered as the building services design progresses. This is discussed in Appendix D.

[2] Based on noise levels measured at location B

[3] Based on attended measurement location 4

[4] Based on noise levels measured during the day at location A and during the night at location B

[5] Night time plant noise egress limits are considered to only apply to residential premises and not commercial premises

For premises within the development, plant noise egress limits will be set as the design develops.

To allow for plant noise contributions for further phases, it is recommended that there is a 3 dB split allowed for within the plant noise limits. On this basis, the noise limits for Phase 1 would be as detailed in Table 9.

Table 9 Plant noise limits at 1 m from the nearest noise sensitive premises – Phase 1

NSP	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)[5]
1 [2]	38	28
2 and 3[3]	32	-
4 to 7[4]	40	28

[1] The limits set out in Table 8 do not include any attention catching features. Penalty corrections for attention catching features may be significant and will need to be considered as the building services design progresses. This is discussed in Appendix D.

[2] Based on noise levels measured at location B

[3] Based on attended measurement location 4

[4] Based on noise levels measured during the day at location A and during the night at location B

[5] Night time plant noise egress limits are considered to only apply to residential premises and not commercial premises

6.3.2 Limits – Emergency/life-safety plant

Based on the results of the environmental noise survey, and the typical requirements of the London Borough of Camden the recommended cumulative external noise egress limits for proposed emergency and life-safety plant items are set out in Table 10. These are based on emergency and life-safety plant items only operating for short periods and are subject to agreement with London Borough of Camden. The limits apply at 1 m from the worst affected windows and are presented as free field levels.

Table 10 Recommended maximum external noise egress limits for emergency and life-safety plant

NSP	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)[5]
1	61	51
2 and 3	55	-
4 to 7	63	51

7 Plant noise egress assessment

7.1 Basis

The plant noise assessment has been based on information received from RED on 1 March 2024 and 9, 10 April 2024 and proposed attenuation measures received on 3 April 2024.

It is understood that the units proposed are for Phase 1 of the scheme.

7.2 Proposed plant items

The following items of plant have been proposed to the rooftop of various buildings within the site:

- 10 condenser units
- 9 MVHR units with intake and exhaust terminations to the rooftop.

A mark-up of the plant item locations is provided in Figure 10, with condenser units highlighted in red.

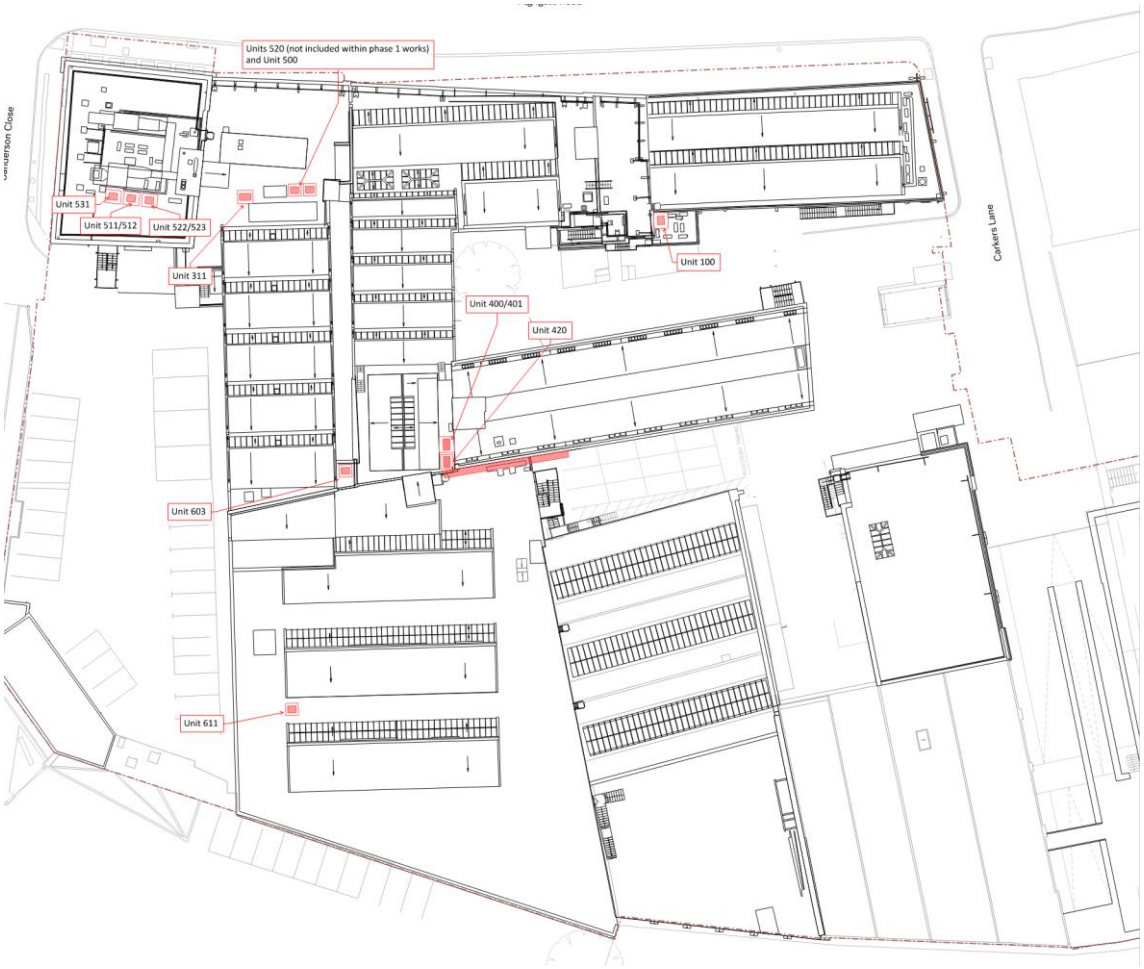


Figure 10 Mark-up of proposed plant item locations

7.3 Plant noise data

Manufacturers noise data for the proposed condenser units is provided in Table 11. Noise limits have been set at the MVHR ductwork terminations of L_w 55 dBA.

Table 11 Manufacturers noise data for proposed plant

Plant item	Sound pressure level at 1 m, (dB) Octave-band centre frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	Total
PURY-EM200YNW-A1	69	61	61	58	52	48	48	43	59
PURY-EM250YNW-A1	69	63	62	60	54	50	51	44	61
PURY-EM300YNW-A1	75	70	69	66	61	57	52	48	67
PURY-EM400YNW-A1	81	70	70	68	62	59	54	49	69
PURY-EM500YNW-A1	66	64	66	63	57	57	53	49	65

The following sound power level spectrums have been assumed based on the broadband sound power levels quoted in manufacturer's data and the sound pressure level spectrums within Table 3.

Table 12 Sound power levels used for assessment

Plant item	Sound power level, L_w (dB) Octave-band centre frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	Total
PURY-EM200YNW-A1	88	80	80	77	71	67	67	62	78
PURY-EM250YNW-A1	88	82	81	79	73	68	70	63	80
PURY-EM300YNW-A1	94	90	88	85	80	76	72	68	87
PURY-EM400YNW-A1	100	89	89	87	81	78	73	68	88
PURY-EM500YNW-A1	86	84	85	82	77	76	73	68	84

A summary of the proposed condensers is set out below:

- Unit 100– PURY-EM500YNW-A1
- Unit 311 – 2 No. PURY-EM200YNW-A1
- Unit 500 – PURY-EM200YNW-A1
- Unit 603 – PURY-EM200YNW-A1
- Unit 420 – PURY-EM400YNW-A1
- Unit 400 – PURY-EM400YNW-A1
- Unit 611 – PURY-EM250YNW-A1
- Unit 531 – PURY-EM300YNW-A1
- Unit 511/512 – PURY-EM300YNW-A1
- Unit 522/523 – PURY-EM300YNW-A1.

7.3.1 Proposed attenuation measures

Attenuation in the form of acoustic enclosures are proposed to the condensers. Reduction values have been detailed from Ambient Acoustics as received in an email on 3 April 2024 via RED. The proposed enclosures are set out in Table 13.

Table 13 Acoustic enclosure reduction value

	Reduction value (dB) Octave-band centre frequency (Hz)							
Enclosure	63	125	250	500	1000	2000	4000	8000
12 dBA rated enclosure	3	5	10	12	15	16	13	11
16 dBA rated enclosure	5	9	14	20	30	30	27	20
18 dBA rated enclosure	6	10	14	20	30	33	30	22

The following enclosures are proposed to each unit:

- 311 – 16dBA rated free-standing combined enclosure
- 500 – 12dBA rated free-standing enclosure
- 603 – 12dBA rated free-standing enclosure
- 420 – 12dBA rated free-standing enclosure
- 400 – 16dBA rated free-standing enclosure
- 611 – 12dBA rated free-standing enclosure
- 531 – 18dBA rated free-standing enclosure
- 511/512 – 18dBA rated free-standing enclosure
- 522/523 – 18dBA rated free-standing enclosure.

The enclosures are the following heights:

- 12 dBA rated enclosure – 2.255 m
- 16 dBA rated enclosure – 2.555 m
- 18 dBA rated enclosure – 2.855 m.

The broadband sound power levels post attenuation have been based on the overall dBA reduction value stated by the supplier.

7.3.2 Operational hours

It is understood that plant items will be capable of operated during normal office hours only, ie only during the day (07:00-23:00) and not during the night (23:00-07:00). The assessment considers all plant operating simultaneously which is considered to be worst-case and unlikely to regularly occur in practice.

7.3.3 Existing barrier on rooftop

It has been assumed that the existing barrier shown in Figure 11 will be retained. This has been modelled to be solid, imperforate and continuous and is highlighted in red.

Figure 11 Aerial view of the site (courtesy of Google Earth Pro)

7.3.4 Methodology

An assessment of the plant items has been undertaken to each of the nearest noise sensitive windows. The calculation has been undertaken through 3D computer modelling in the software CadnaA, and is based on the manufacturer's sound level data, where attenuation is due to both the distances between source and receiver. A screenshot from this model is provided in Figure 12.

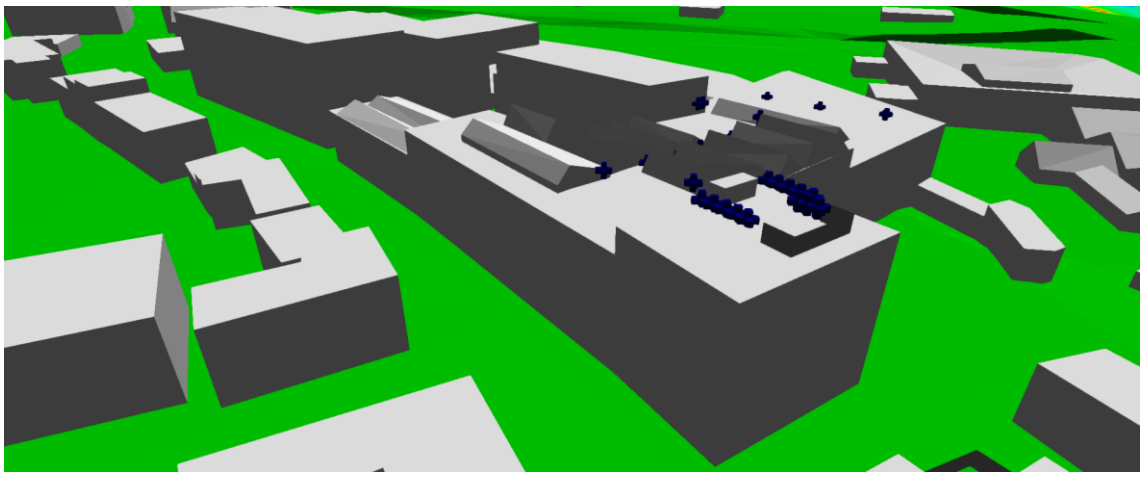


Figure 12 Screenshot of computer model

7.4 Predicted noise levels

An assessment has been carried out to predict the noise level at the nearby noise sensitive premises. Comment on recommended mitigation measures to Unit 100 condenser have been provided in Section 7.4.2.

7.4.1 Summary of noise levels

A summary of the predicted noise levels at the facade of each of the NSPs is set out in Table 14 both with and without the recommended mitigation to the Unit 100 condenser.

Table 14 Predicted noise level at the nearest NSPs with and without contributions from unit 100 condenser

NSP	Predicted sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)			
	Overall day plant noise limit (07:00 to 23:00)	Phase 1 day plant noise limit (07:00 to 23:00)	With Unit 100 condenser not attenuated	With Unit 100 condenser including recommended attenuation as detailed in Section 7.4.2
1	41	38	53	37
2	35	32	52	35[1]
3	35	32	25	24
4	43	40	37	37
5	43	40	39	39
6	43	40	38	37
7	43	40	37	37

[1] This would exceed the noise limit set for Phase 1 works only, but would still meet the overall daytime noise limit at this receiver.

The recommended split in plant noise limits to allow for phasing can be achieved for NSP 1 and NSP 3 to 7.

It should be noted that the noise level at NSP 2 is driven by condensers serving the following spaces, Unit 500, 311, 611 along with Unit 100 condenser. If further attenuation is applied to these units, the recommended attenuation to Unit 100 could reduce, and this may allow for the Phase 1 proposed daytime plant noise limit to be achieved in this location, subject to further review.

7.4.2 Recommended Unit 100 condenser attenuation

It is recommended that the Unit 100 condenser is provided with an acoustic enclosure to provide at least 24 dBA of attenuation to achieve a sound power level of L_w 60 dBA.

8 Conclusion

The representative background sound levels from the noise survey were $L_{A90,15min}$ 53 dB during the day, and $L_{A90,15min}$ 50 dB during the night to the north of the site, and $L_{A90,15min}$ 51 dB during the day, and $L_{A90,15min}$ 41 dB during the night to the south of the site.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises will be limited to be 10 dB below the background noise levels at the noise sensitive premises.

These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent than those set out above. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied. London Borough of Camden stipulate that if tonal components are present, limits should be set 5 dB lower.

Noise limits for entertainment noise egress have been set based on London Borough of Camden Local Plan 2017. Noise egress from the site will need to be suitably controlled to meet the limits.

The plant noise egress assessment has been carried out including the proposed attenuation measures. Discussion on the unit 100 condenser attenuation have been provided. With the recommended attenuation included to Unit 100 condenser, the overall daytime plant noise egress limits are expected to be met, however the proposed split plant noise limits for Phase 1 only would be exceeded at one noise sensitive receiver (NSP 2).

Appendix A

Survey details

Equipment

The attended noise measurements were taken using a B&K Type 2250 sound level meter and a Rion NL-52 sound level meter.

The unattended noise measurements were taken using Rion NL-52 sound level meters.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	2250/3011096	Brüel & Kjær	12 Mar 23	UCRT21/1348, UTRC21/1352
Microphone	4189/3060575	Brüel & Kjær	12 Mar 23	UCRT21/1348, UTRC21/1352
Pre-amp	ZC0032/25430	Brüel & Kjær	12 Mar 23	UCRT21/1348, UTRC21/1352
Calibrator	4231/3017675	Brüel & Kjær	11 Mar 23	UCRT21/1345
Sound level meter	NL-52/00264531	Rion	23 Jun 22	TCRT20/1331
Microphone	UC-59/09678	Rion	23 Jun 22	TCRT20/1331
Pre-amp	NH-25/64656	Rion	23 Jun 22	TCRT20/1331
Calibrator	NC-75/35013664	Rion	16 Nov 23	TCRT21/1800
Sound level meter	NL-52/00264550	Rion	29 Jul 22	TCRT20/1422
Microphone	UC-59/09698	Rion	29 Jul 22	TCRT20/1422
Pre-amp	NH-25/64675	Rion	29 Jul 22	TCRT20/1422
Calibrator	NC-74/34367631	Rion	29 Jul 22	TCRT20/1419

[1] Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{A1,T}$ The A-weighted sound pressure level exceeded for 1% of the measurement period (T) over which a noise is measured.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Weather conditions

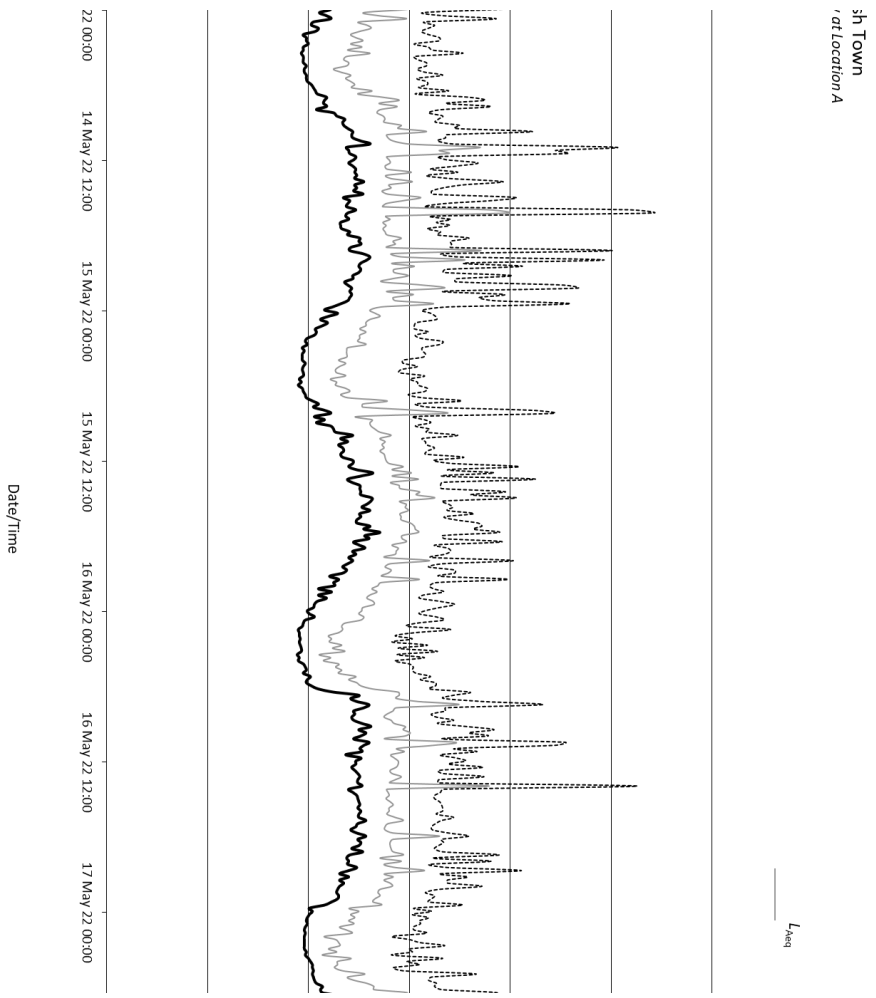
During the attended noise measurements, the weather was generally clear and dry and no rain occurred. Wind speeds were generally less than 5 m/s.

During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 10 to 15°C at night and 11 to 23°C during the day, and the wind speed was less than 5 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

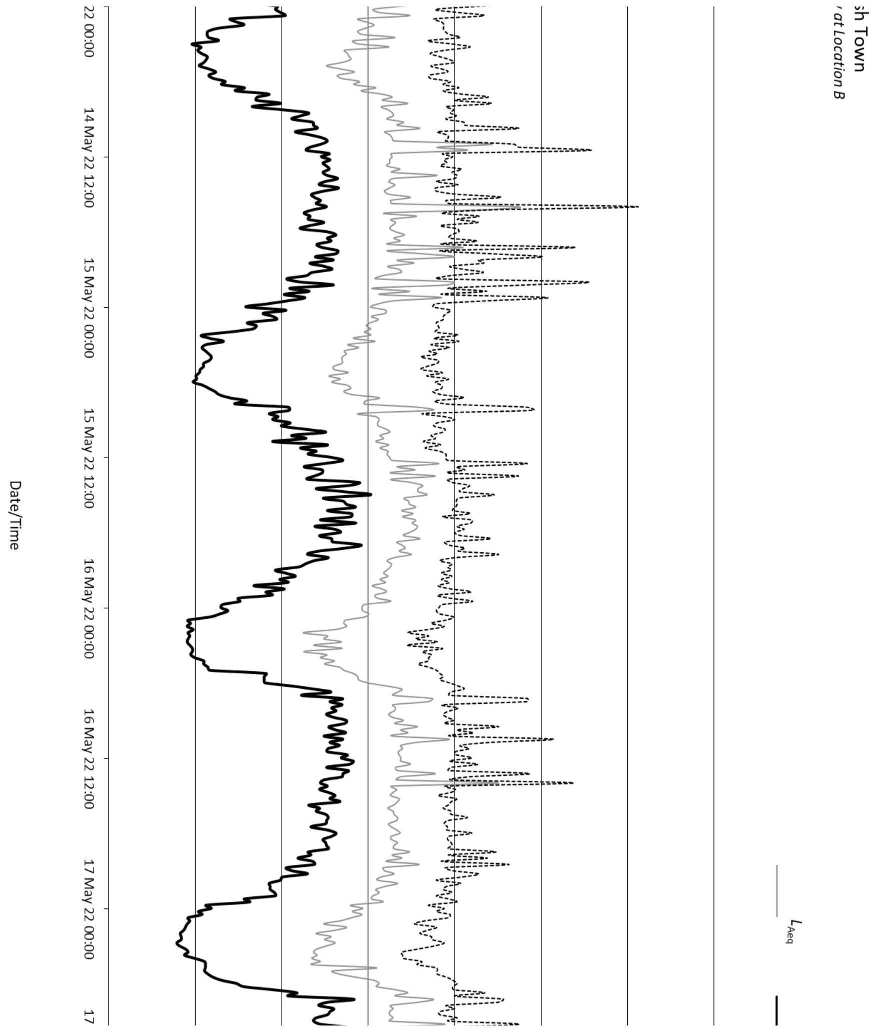
Appendix B

Results of unattended measurements at Location A



Appendix C

Results of unattended measurements at Location B


22 00:00
14 May 22 12:00
15 May 22 00:00
15 May 22 12:00
16 May 22 00:00
16 May 22 12:00
17 May 22 00:00
17
Date/Time
L_{Aeq}

Appendix D

BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.