EXTERNAL PLANT NOISE ASSESSMENT

ROYAL FREE HOSPITAL, CAMDEN

The Richard Stephens Partnership Ltd

REPORT NO. 2061913-RSKA-RP-001

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General notes

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Signature:	L. GAGE	Signature:	
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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.
This work has been undertaken in accordance with the quality management system of RSK Acoustics Ltd.

Contents

1 Introduction

1.1 Rationale for Acoustic Surveying Works

It is proposed that three existing external chiller units are to be replaced at the Royal Free Hospital, Pond Street, London NW3 2QG. The proposed replacement chiller units are to be installed in an identical position to the existing units in a direct one-to-one replacement.

This report details acoustic surveying works undertaken to quantify the existing noise climate surrounding the Royal Free Hospital and demonstrates compliance with the local planning authority's guidance for the proposed external plant installation.

1.2 Site Description

The site, located at the Royal Free Hospital, Pond Street, London NW3 2QG, is a major teaching hospital in the Hampstead area of London. The site and surrounding area is illustrated within Appendix A 2061913-SP-001.

A description of the surrounding area is detailed below:

- **North** - Pond Street is a well-trafficked road comprising of commercial and residential properties. A stretch of railway runs approximately 120m from the site boundary, with Hampstead Heath London Overground Station existing approximately 140m from the site.
- **East** –Anne Bryans House is an apartment building on Fleet Road.
- **South** – A large quantity of residential properties sit within Aspern Grove.
- **West** – Hampstead Hill School exists neighbouring Rosslyn Hill and Pond street. A number of residential properties also exist on Rosslyn Hill. Belsize Park London Underground Station (Northern Line) exists approximately 190m from the site boundary.

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

2 Environmental Survey

2.1 Methodology & Instrumentation

An unattended noise survey was undertaken at the site between the following dates and times:

- Start: 11h45 14th June 2023
- End: 11h45 20th June 2023

Measurements were undertaken at two locations, indicated as MP1 and MP2 within Appendix A and are described as follows:

- MP1: On a flat roof of the Royal Free Hospital at fourth floor level, opposite to Belle Vue Apartments, Rowland Hill Street, London.
- MP2: At ground level in front of the Royal Free Hospital, adjacent to Pond Street

These measurement positions were selected to represent the noise climate at nearby residential windows to the opposite side of Rowland Hill Street and Pond Street respectively.

Pictures of monitoring installed at these measurement positions are illustrated within Appendix B.

In both cases, the measurement positions were suitably positioned and screened from any existing operational plant equipment to ensure a representative measurement.

Measurements of the L_{Aeq}, L_{A90} and L_{Amax} indices were recorded over consecutive 15-minute periods (see the glossary of this report for an explanation of the noise units used) for the duration of the survey at both measurement positions using the equipment listed within Table 1 below.

Item	Manufacturer	Type	Serial No.	Calibration Due
Sound Level Analyser x2	Norsonic	118	31798 & 32217	10/08/24 & 13/08/23
Acoustic Calibrator	Norsonic	1251	30791	10/08/23
Weatherproof Windshield x2	Norsonic	1212	N/A	N/A

Table 1 Equipment used during unattended noise survey

The microphones were fitted within weatherproof windshields and the sound level meters were calibrated before and after the survey to confirm an acceptable level of accuracy. The calibration drift from commencement to end is noted within Table 2 below.

Sound Level Meter Serial No.	Measurement Position	Calibration Before	Calibration After
31798	MP1	114 dB	113.9 dB
32217	MP2	114 dB	113.9 dB

Table 2 Calibration of sound level meters before and after survey

3 Environmental Acoustic Survey Results

3.1 Time Histories

The time histories for both measurement positions are illustrated within Appendix C.

At both measurement positions between the hours of 15h30 – 19h45 on the 18th June and 05h15 – 08h00 on the 20th June, the noise data has been excluded from our assessment due to rainfall and unfavourable weather conditions affecting the measurements.

At measurement position 2 it is noted that noise level peaks often occur throughout the survey period. This may be due to siren noise from emergency services vehicles which frequently pass through the area due to proximity of the hospital.

3.2 Representative Background Noise Levels

We understand that the proposed plant equipment will operate within both daytime and night-time periods. As such both daytime and night-time noise criteria will be assessed against.

Section 8.1.3 and 8.1.4 of BS 4142:2014+A1:2019 state the following:

"… the background sound level used for the assessment should be representative of the period being assessed…"

"This level should account for a range of background sound levels and should not automatically be assumed to be either the minimum or modal value."

A representative background noise level has thus been derived for measurement position 1 and 2 respectively for both daytime and night-time periods. This has been carried out in compliance with BS 4142:2014+A1:2019. These are illustrated within Table 3 below.

		Representative Background Noise Level, $L_{A90,\ 15min}$(dB)	
Position	Description	Daytime Hours (07h00-23h00)	Night-time Hours (23h00-07h00)
MP1	Fourth floor level opposite Belle Vue Apartments on Rowland Hill Street	54	53
MP2	Street level in front of Royal Free Hospital adjacent to Pond Street	51	46

Table 3 Measured representative background noise levels

Histograms of these results per respective measurement position are illustrated within Appendix D.

4 Plant Noise Emission Limits

4.1 Local Authority and Standard Guidance

4.1.1 Camden Local Plan

The Local Plan issued by Camden London Borough Council (July 2017), states the following regarding amenity protection from noise pollution within Policy A4: Noise and Vibration:

"The Council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden Noise Vibration Thresholds (Appendix 3). We will not grant planning permission for:

A) developments likely to generate unacceptable noise and vibration impacts; or

B) development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

We will only grant permission for nose generating development, including any plant ad machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the deliveries and construction phases of development."

Within Appendix 3 of the Camden Local Plan, the following is stated regarding industrial and commercial noise sources:

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

The following table is illustrated within the Camden Local Plan (Appendix 3, Table C):

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}

Figure 1 Camden Local Plan 2017, Appendix 3, Table C

The following commentary is provided to the above table:

*"*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.*

***levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

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

4.1.2 BS 4142:2014+A1:2019

When considering noise emission from plant, it is normal to follow guidance in BS 4142:2014+A1:2019. Section 1.1 of this standard states the following:

"This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) sound from industrial and manufacturing processes;

b) sound from fixed installations which comprise mechanical and electrical plant and equipment

c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and

d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site."

The methodology in the standard compares the measured or calculated rating level of the noise from the source and compares it to the representative existing measured LA90 background noise level for the period concerned.

The higher the excess of rating level over background noise level, the greater the likelihood of an adverse noise impact. BS 4142:2014+A1:2019 gives the following guidance:

"Typically, the greater this difference, the greater the magnitude of the impact.

A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

4.2 Plant Noise Limits

Based on the above, the noise limits a set out below in Table 4 are proposed:

		Plant Noise Emission Limits, L_{ArTr}, (dB) *(for plant with no distinguishing features)*	
Position	Description	Daytime Hours (07h00-23h00)	Night-time Hours (23h00-07h00)
AP1	Belle Vue Apartments	44	43
AP2	31 Pond Street	41	36
AP3	Anne Bryans House	41*	36*

Table 4 Plant noise emission limits at the nearest residential properties

*For Anne Bryans House apartment building, we have selected plant noise limits derived from MP2 due to this recording the lowest background noise levels to provide a robust assessment.

The noise limits are to apply at 1 m from the nearby residential windows. Any plant with a tonal component would be subject to a further penalty, in line with BS 4142:2014+A1:2019. These limits apply to all mechanical services items being installed when running at duty with all items running concurrently during the relevant period.

We note that there are additional residential receptors within the vicinity of the site, however these are further away from the plant than those assessed. Therefore if the noise limits are met at the chosen receptors, then they will also be met at other residential receptors within the general area.

5 Plant Noise Assessment

5.1 Proposed Installation

The below table details the noise emitting building services plant equipment that is proposed for installation:

Plant Item	Description	Location
Chiller 301	Sintesis Advantage CGAF 060 XE XLN	South Wing
Chiller 401	CONQUEST CGAX 60 SE LN	West Wing
Chiller 402	Sintesis Advantage CGAF 060 XE XLN	East Wing

Table 5 Proposed items of plant

5.2 Methodology

Noise levels have been calculated at AP1, AP2, and AP3 1m from the residential facades of Belle Vue apartments top floor, 31 Pond Street and Anne Bryans House respectively. These positions are shown in the appendix A site plan.

The assessment has taken into account radiation and distance losses, screening and façade reflections where each are appropriate. Due to the possibility of the plant running 24/7, noise levels are assessed to the more stringent night-time noise target.

5.3 Results

Plant noise emission have been calculated for chillers 301 and 401 with the proposed acoustic packages installed and the attenuation they will provide.

In line with BS 4142:2014+A1:2019, no corrections for acoustic characteristics have been applied to the calculated plant noise emissions at the noise sensitive receptors.

With the proposed plant installation and implementation of acoustic packages, we assess the following noise levels at the receptors:

Location	Plant Noise Emission, $L_{Ar,Tr}$ dB / Limit (dB)
AP1 – Belle Vue Apartments	39 / 43
AP2 – 31 Pond Street	25 / 36
AP3 – Anne Bryans House	34 / 36

Table 6 Plant noise emissions at the noise sensitive receptors

From the results set out in Table 6 above, it can be seen that noise levels from the proposed plant installation will be below the limit from guidance set out in the Camden Local Plan and well below the existing background noise level, thereby presenting a low impact as per the methodology set out within BS 4142:2014+A1:2019.

Summary of plan emissions are provided in appendix E with levels at noise sensitive receptors provided in appendix F. Full calculation sheets are available on request.

5.3.1 Mitigation

The results of our assessment of the proposed plant installation indicate that no further mitigation of the plant noise emissions is required to meet the plant noise limits.

6 Summary

Three existing chiller units are to be replaced at the Royal Free Hospital, Pond Street, London. An environmental noise survey was undertaken by RSK Acoustics to establish the existing noise climate at nearby noise sensitive receptors.

An assessment of the noise emission from the units has been undertaken to nearby noise sensitive receptors accounting for guidance found in BS 4142:2014+A1:2019, in accordance with the Local Planning Authority guidance.

It is demonstrated that noise levels from the proposed installations at the nearest noise sensitive receptors will meet the noise limits set out in the Camden Local Plan, confirming compliance.

Glossary

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_{n}.

Appendix A – 2061913-SP-001

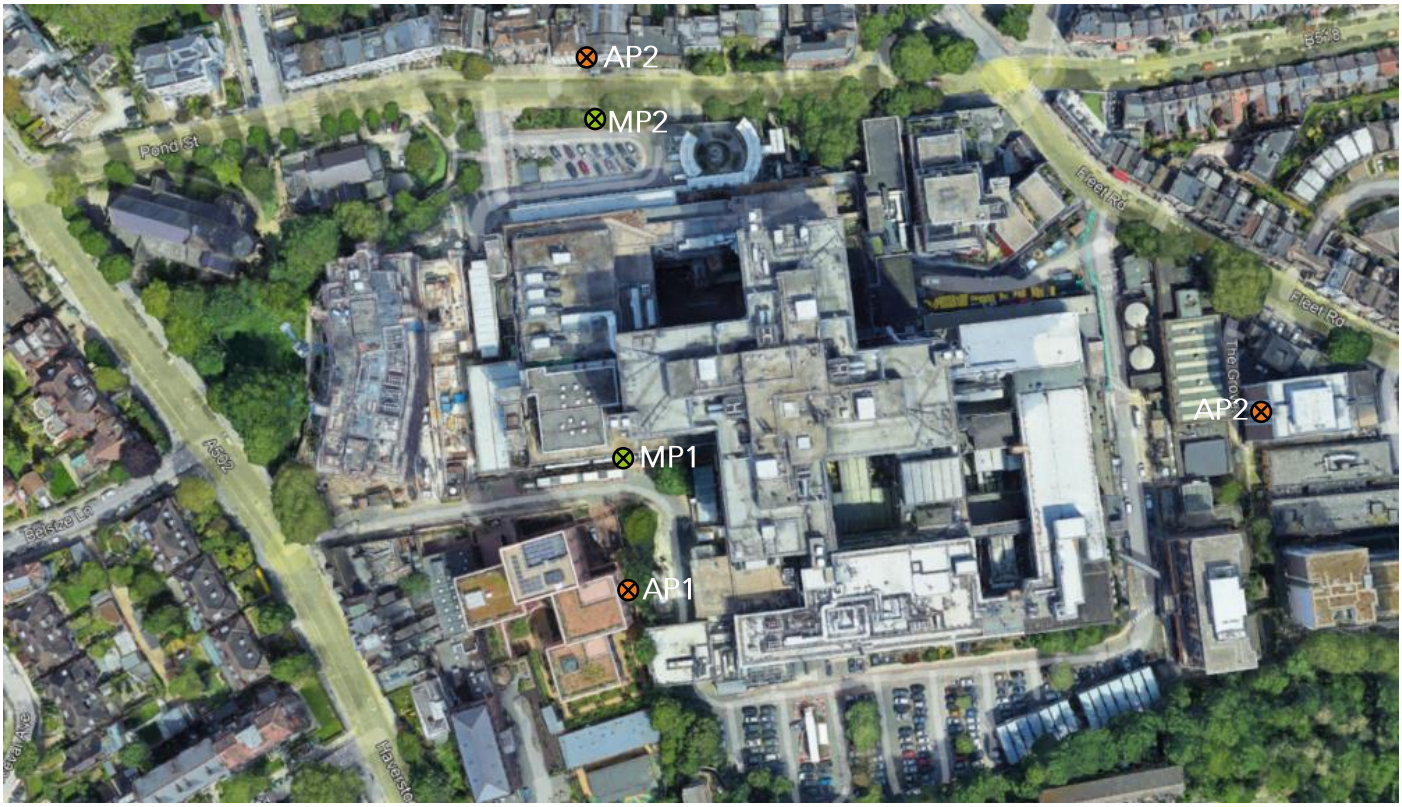

Figure 2 Site Plan Illustrating Measurement and Assessment Positions

Appendix B – 2061913-PHO-001/002

Figure 3 MP1

Figure 4 MP2

Appendix C – 2061913-TH-001/002

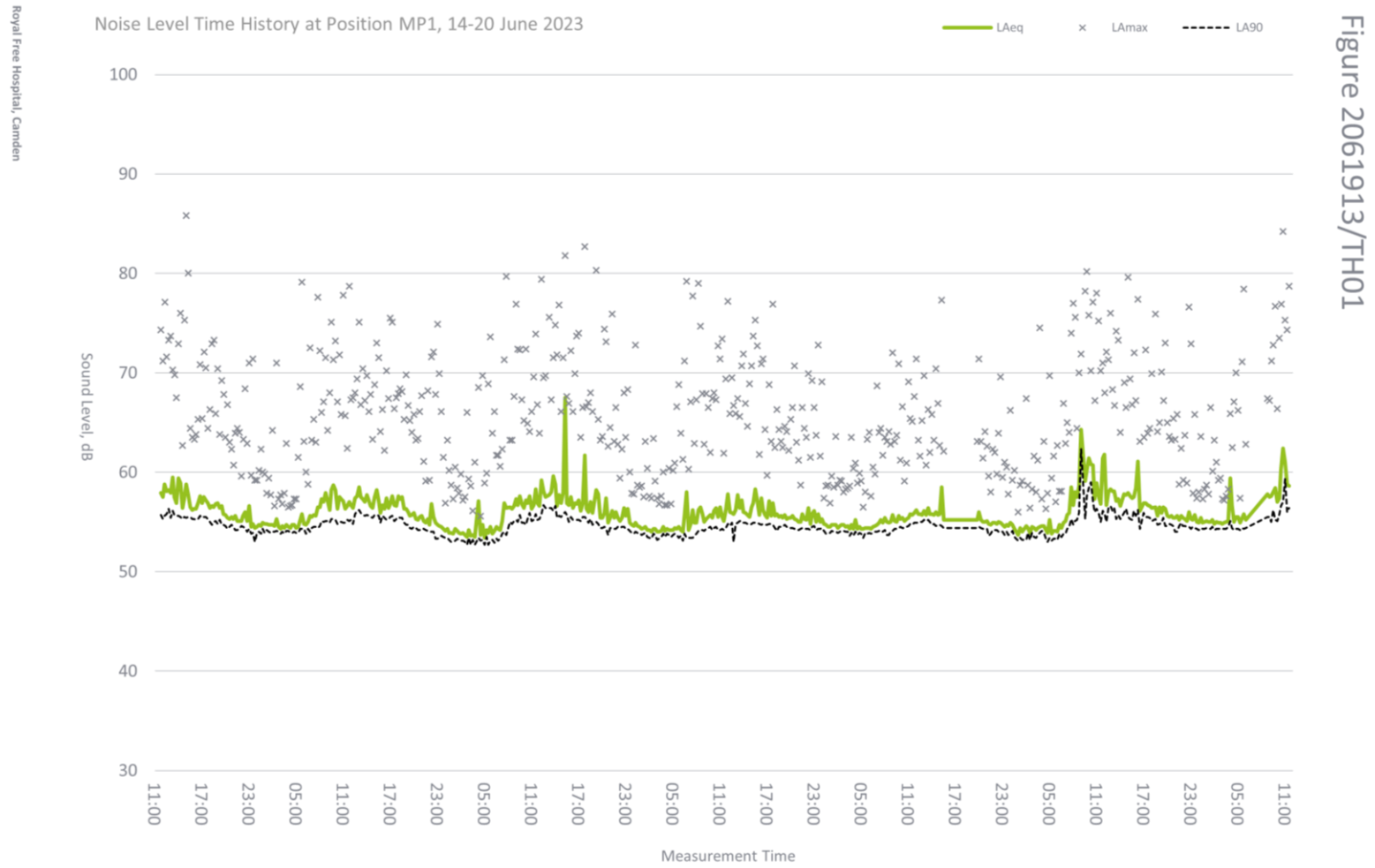

Figure 2061913/TH01

Figure 5 MP1 Time History

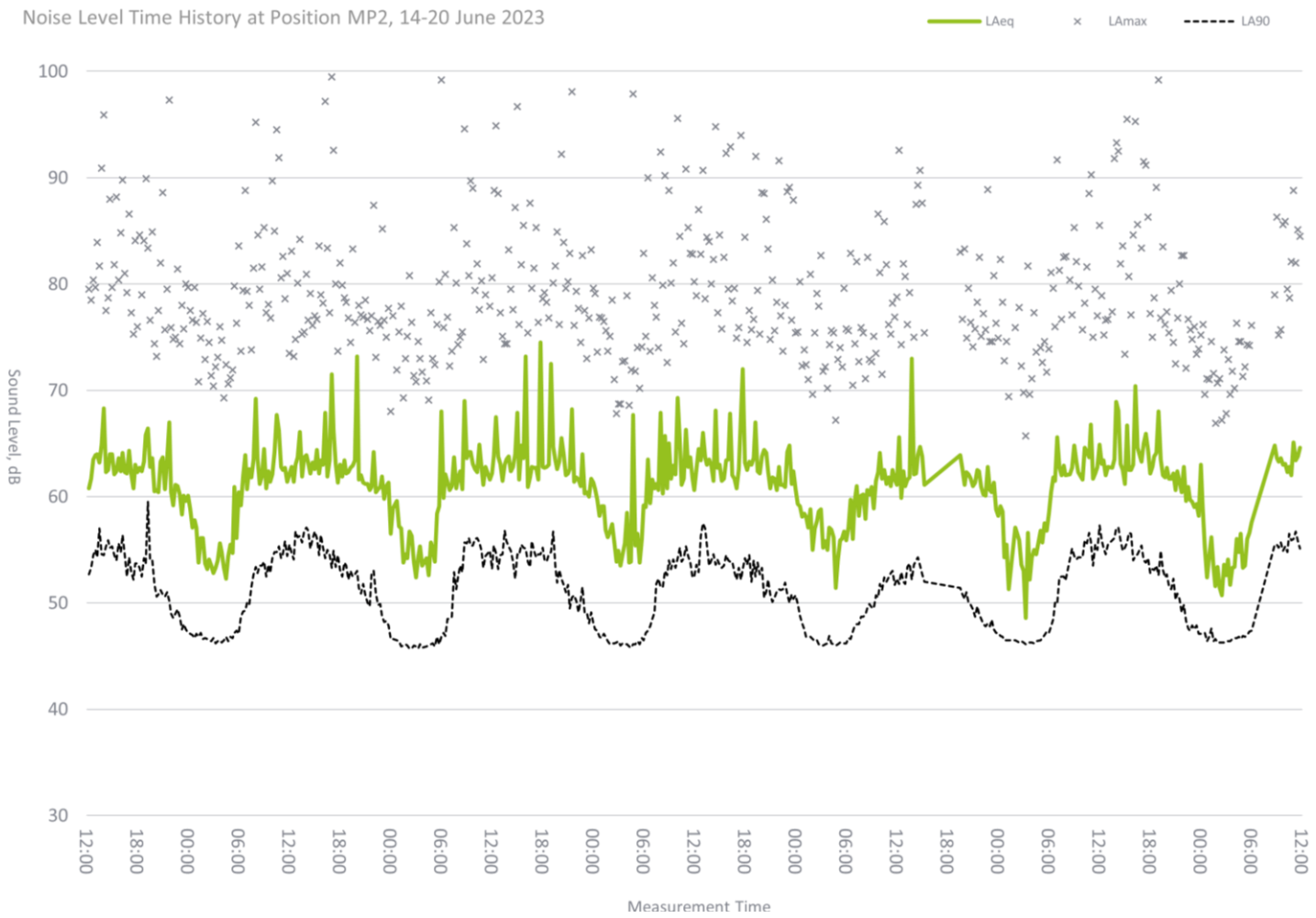

Figure 2061913/TH02

Figure 6 MP2 Time History

Appendix D – 2061913-HST-001/002

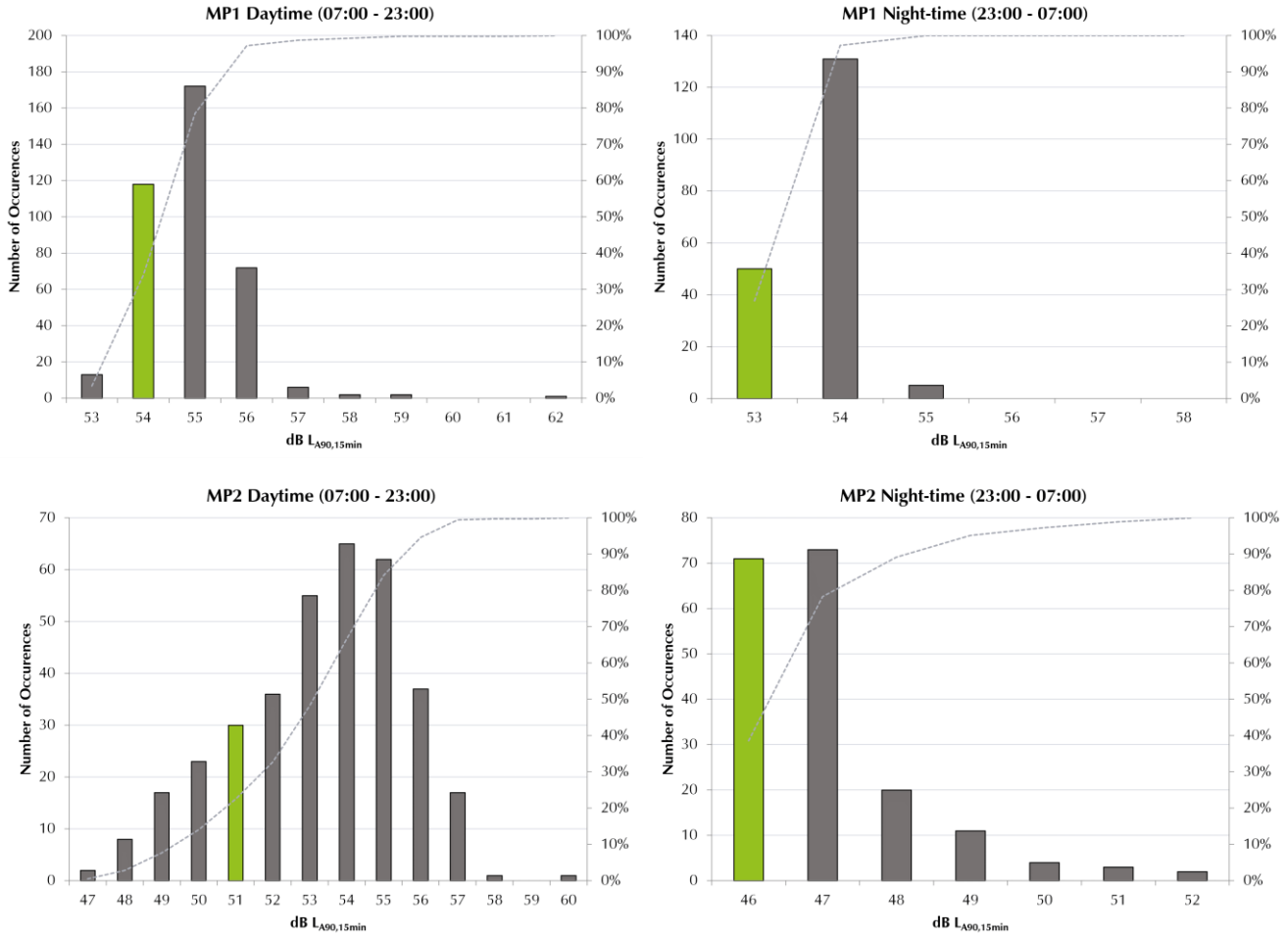

Figure 7 Representative Background Noise Level Histograms

Appendix E – 2061913-PNS-001

Job No.	Job Title			
Date Created	By	Date Revised	Rev	Sheet
23 Jun 2023	MQ	28 Jun 2023	3	1
Date Reviewed	By	Review Type	Review Status	

Schedule of Plant

Item / Description		Rating/Broadband/Input Rating	dB	dB(A)	Octave Band Centre Frequency, Hz 31.5	63	125	250	500	1k	2k	4k	8k
Chiller 301 South	Lp at 1m			57		75.0	67.0	59.0	52.0	46.0	44.0	39.0	35.0
Chiller 401 West	Lp at 1m			55		47.0	60.0	54.0	54.0	50.0	46.0	36.0	28.0
Chiller 402 East	Lw			89		99.0	95.0	90.0	86.0	83.0	81.0	75.0	70.0

Appendix F – 2061913-CS-001/003

Job No.	Job Title			
Date Created	By	Date Revised	Rev	Sheet
27 Jun 2023	MQ	29 Jun 2023	4	6
Date Reviewed	By	Review Type	Review Status	

AP1 - Belle Vue Appartments

	Rating/Broadband/Input			Octave Band Centre Frequency, Hz								
Item / Description	Rating	dB	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Chiller 301			39 (A)	0.0	57	49	41	34	28	26	21	17
Total at Receptor			39 (A)		57	49	41	34	28	26	21	17
Noise Limit			**43.0**									

Job No.	Job Title			
Date Created	By	Date Revised	Rev	Sheet
27 Jun 2023	MQ	29 Jun 2023	3	5
Date Reviewed	By	Review Type	Review Status	

AP2 - 31 Pond Street

Item / Description		Rating/Broadband/Input Rating	dB	dB(A)	Octave Band Centre Frequency, Hz 31.5	63	125	250	500	1k	2k	4k	8k
Chiller 401	0	0.0	0.0	25 (A)	0.0	20	32	25	24	18	12	-1	-12
Total at receptor				25 (A)		20	32	25	24	18	12	-1	-12
Noise Limit				**36.0**									

Job No.	Job Title			
Date Created	By	Date Revised	Rev	Sheet
27 Jun 2023	MQ	29 Jun 2023	2	7
Date Reviewed	By	Review Type	Review Status	

AP3 - Anne Bryans House

	Rating/Broadband/Input			Octave Band Centre Frequency, Hz								
Item / Description	Rating	dB	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Chiller 402			34 (A)		48	43	37	31	25	20	11	3
Total at Receptor			34 (A)		48	43	37	31	25	20	11	3
Noise Limit			36.0									

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