Manchester Aquatics Centre

Environmental Noise Survey Report

27112/NIA1

24 August 2021

For:
Kier Construction Limited
Kier House
Windward Drive
Estuary Park
Speke
L24 8QR



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Hann Tucker Associates

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1.0 Introduction

As part of a refurbishment within the Manchester Aquatics Centre, a new gymnasium is proposed within the existing building as well as the installation of new plant items to the north west of the site.

Hann Tucker Associates have therefore been commissioned to conduct a baseline noise survey and assess the potential noise impact on nearby noise sensitive receptors.

This report presents our findings.

2.0 Objectives

To visit site to carry out environmental noise level measurements to establish the prevailing external noise climate in the vicinity of the site and nearby receptors.

To review the requirements of the Local Authority pertaining to entertainment noise control and subsequently set design criteria for the proposed gym.

Based on the above, to assess the potential noise impact of the gym on external receptors, providing advice on mitigation measures where necessary.

To set plant noise emission limits in line with Local Authority guidance.

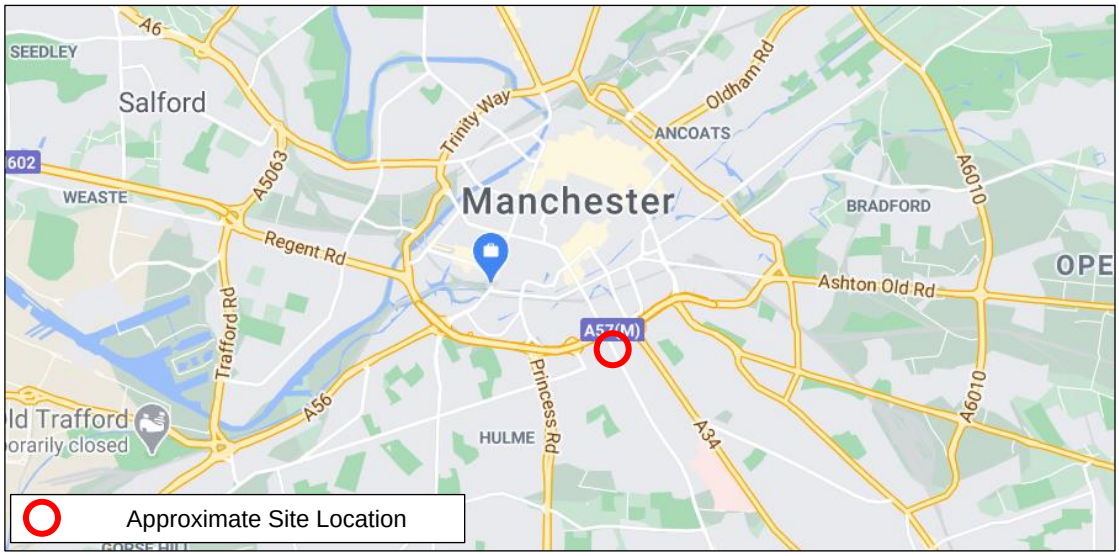
3.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

4.0 Site Description

4.1 Location

The Manchester Aquatics Centre is located on Oxford Road in Manchester. The site falls under the jurisdiction of Manchester City Council (MCC). See site location plan below.



Location Map (Map Data @ 2021)

4.2 Description

The site lies to the south of Manchester City Centre close to Manchester Metropolitan University. The site is bound by Oxford Road to the west and neighbouring buildings to all other sides. There are commercial properties and The Church of Jesus Christ of Latter-day Saints to the north-west, however the surrounding area is predominantly university buildings. The nearest residential buildings are over 180m away to the west. See site plan below.



Site Plan (Map Data @ 2021)

5.0 Acoustic Standards & Guidelines

5.1 Local Planning Requirements

Manchester City Council requirements are outlined in Section 3.0 of Manchester City Council's Planning & Noise Technical Guidance document (December 2015).

5.1.1 Noise Generated by Events and/or Music Noise

In relation to noise egress MCC state that planning applications should *"demonstrate that music noise from the proposal will not be 'audible' in nearby residential properties, assuming that the residential properties in question have their windows open. The criterion here is:*

> *"Entertainment noise (L_{Aeq}) should be controlled to 10dB below the background noise level (L_{A90}) without the entertainment noise present, in each octave band at the nearest noise sensitive location."*

5.1.2 Fixed Plant Noise Emissions

Section 3.6.1.5.1 outlines that the noise assessment for fixed plant should be based on BS 4142:2014 and the assessment must demonstrate that

> *"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location."*

5.2 National Planning Policy Framework

The following paragraphs are from the NPPF (revised February 2019):

180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

- Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

5.3 BS 4142:2014

BS 4142: 2014 describes methods for rating and assessing the effects of outdoor sound levels, of an industrial and/or a commercial nature, "*on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*".

The impact of a specific sound is indicated by subtracting the existing background noise level from the rating level (i.e. noise level from the proposed items of plant/machinery/etc plus any acoustic feature corrections). The standard states that:

- *"a difference of around +10dB or more is likely to be an indication of a significant adverse impact";*
- *"a difference of around +5dB is of marginal significance is likely to be an indication of an 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".*

The noise from the new development is expressed in terms of a rating level and given as a $L_{Aeq, T}$ noise level. The existing background noise level is expressed in terms of a $L_{A90, T}$ noise level. T is the assessment time interval, which is 1-hour for operations during daytime hours (07:00 to 23:00 hr) and 15-minutes for operations during night-time hours (23:00 to 07:00 hr).

BS 4142:2014 states that if a noise source contains an 'acoustic feature', such as tonality, intermittency or impulsiveness, an appropriate penalty should be applied.

6.0 Baseline Noise Survey

6.1 Procedure

First Survey Visit – April 2021

Fully automated environmental noise level monitoring was undertaken from 10:00 hours on Wednesday 07 April 2021 to 16:00 hours on Thursday 08 April 2021 to establish the existing daytime and night-time background noise levels to the front courtyard area (southeast of site, Oxford Road side). The equipment was set to take readings continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15-minute periods.

Fully manned noise level measurements were undertaken between 17:30 and 19:00 hours on Thursday 08 April 2021 to establish representative noise levels at the opposite end of the courtyard (close to MECD Building). Measurements were taken of the A-weighted and octave band (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over periods of not less than 10 minutes. Atypical noises were excluded as far as reasonably possible.

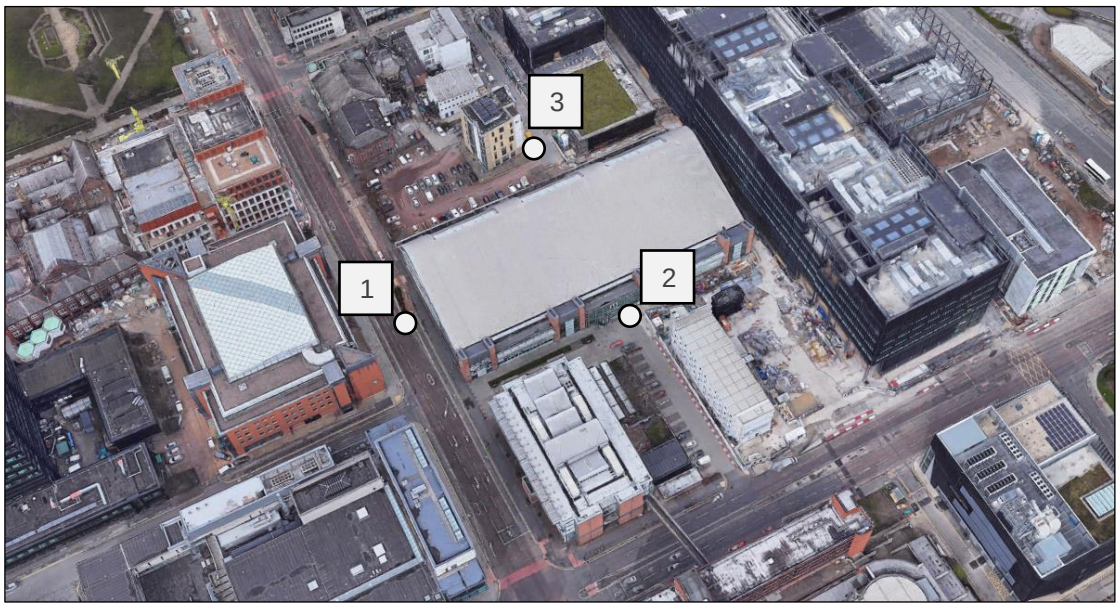
Second Survey Visit – May 2021

Fully automated environmental noise level monitoring was undertaken from 13:00 hours on Wednesday 12 May 2021 to 14:00 hours on Friday 14 May 2021 to establish daytime and night-time background noise levels to the rear of the Aquatics Centre (northwest of site). The equipment was set to take readings continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15-minute periods.

6.2 Measurement Positions

Noise levels were recorded in three locations overall, as described below.

Position	Survey	Description
1	First Visit *April*	Automated monitoring. To the west of the site with the microphone in free-field conditions approximately 2m from the near roadside edge of Oxford Road and 3m above street level.
2	First Visit *April*	Manned measurements. To the south east of the site with the microphone in free field conditions approximately 1.5m above street level.
3	Second Visit *May*	Automated monitoring. To the north west of the site with the microphone in free-field conditions approximately 2m from the near roadside edge of York Street and 3m above street level.



Site Plan showing automated noise monitoring positions (Map Data @ 2021)

6.3 Instrumentation

The instrumentation used during the survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Date of Last Calibration
Position 1 & 3 Type 1 Data Logging Sound Level Meter	Larson Davis	LxT	4568	08/04/2020
Position 2 Type 1 Data Logging Sound Level Meter	Larson Davis	LxT	5111	08/04/2020
Type 1 Calibrator	Larson Davis	Call200	3083	19/05/2020

The unmanned sound level meters were installed inside a small security box with the microphone protruding approximately 6cm out of the box via an extension cable. The box was fixed to a lamp post (on the side facing Oxford Road / York Street).

The manned sound level meter was fixed above 1.5m ground level throughput the duration of the measurements.

All sound level meters, including extension cable where applicable, were calibrated prior to and on completion of the survey and no significant changes were found to have occurred (<0.3dB).

6.4 Weather Conditions

During the periods we were on site the wind conditions were mild and the sky was overcast. Weather reports suggest that generally throughout the survey period the weather conditions were similar to this description.

For the second survey, conditions were overcast and dry with light winds upon install and collection. Local weather reports indicate some rainfall, however, these brief time periods only accounted for a small proportion of the measured results.

These conditions are considered suitable for obtaining representative measurement results.

6.5 Discussion of Noise Climate

During the periods on site the dominant noise source at all measurement positions was generally noted to be road traffic, particularly on Oxford Road and Booth Street E.

6.6 Results & Analysis

Positions 1 & 3 (Automated)

The results have been plotted on Time History Graph 27112/TH1 enclosed presenting the free-field 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at each measurement position throughout the duration of the survey.

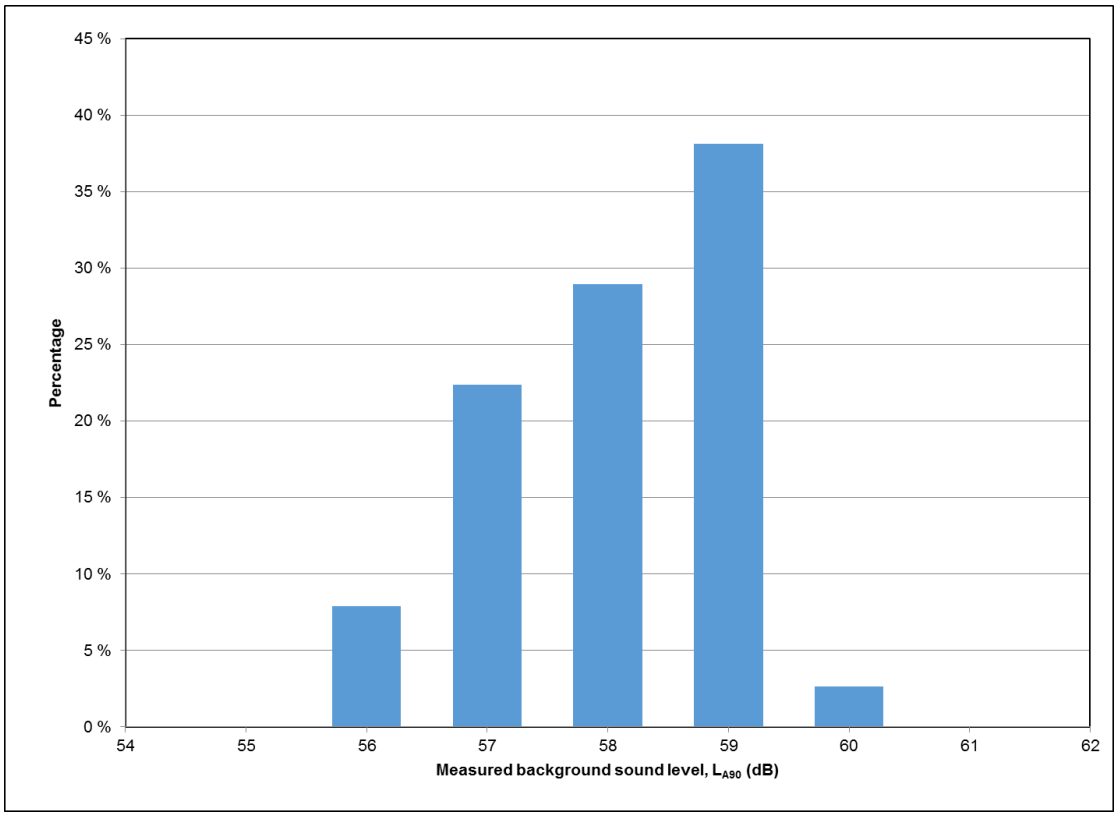
To inform an assessment of gym noise breakout, the following table presents the octave band L_{90} noise levels measured at Position 1.

Position 1	Background Sound Level (dB $L_{90,15min}$) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 19:00)	61	53	53	54	53	49	44
Evening (19:00 – 23:00)	59	50	50	51	51	45	38
Night-time (23:00 – 07:00)	47	40	41	41	41	38	33

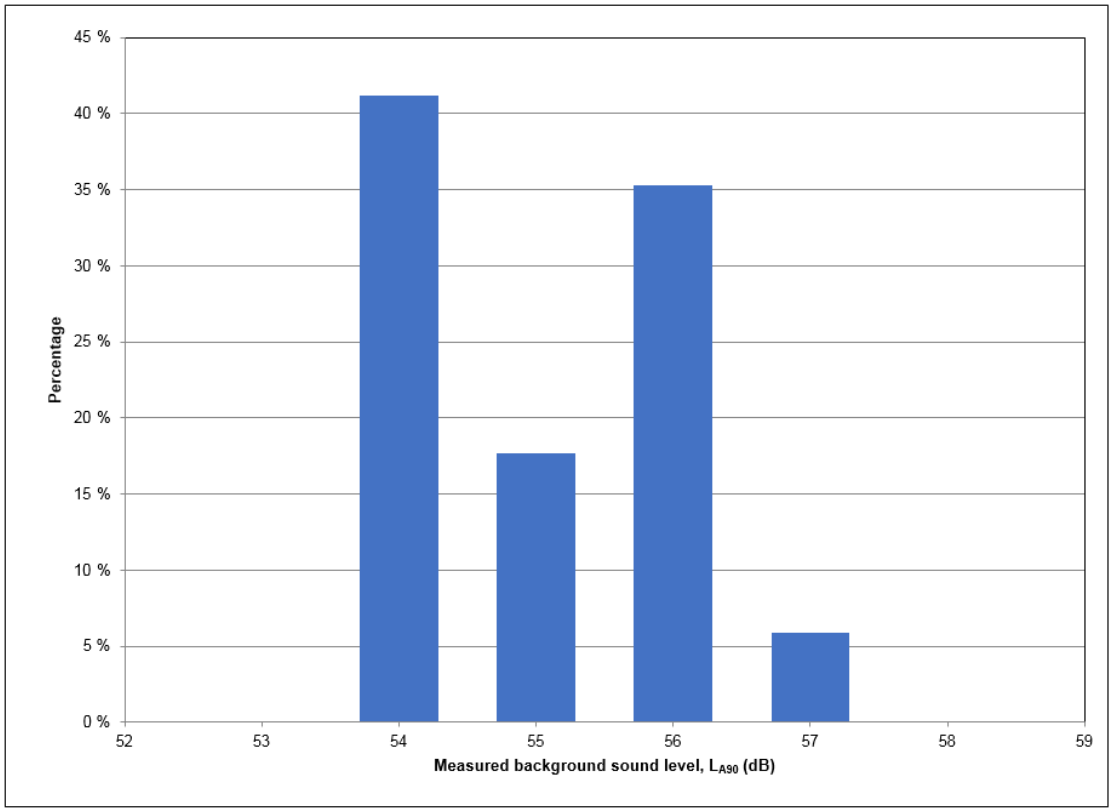
BS 4142 states that *"the background sound level must be reliable and suitably represent the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."* Taking this into account, the following histograms have been created to show each sound level (L_{90}) as a percentage for the day and night time periods.

The following table presents a summary of the typical (representative, ref. BS 4142) L_{A90} background noise levels used to inform plant noise limits.

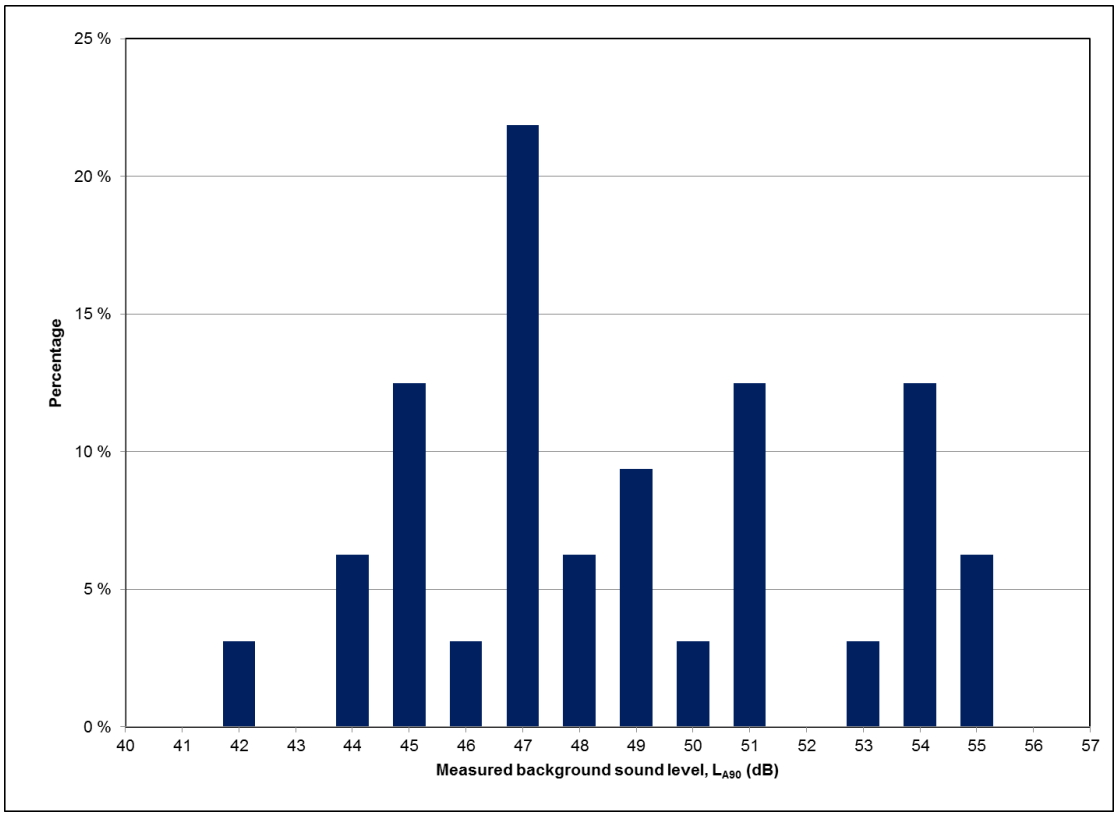
Position	Daytime (07:00 – 19:00)		Evening (19:00 – 23:00)		Night-time (23:00 – 07:00)	
	$L_{Aeq,12h}$	Typical $L_{A90,15min}$	$L_{Aeq,4h}$	Typical $L_{A90,15min}$	$L_{Aeq,8h}$	Typical $L_{A90,15min}$
1	68	57	67	54	66	45
3	65	54	58	53	63	46



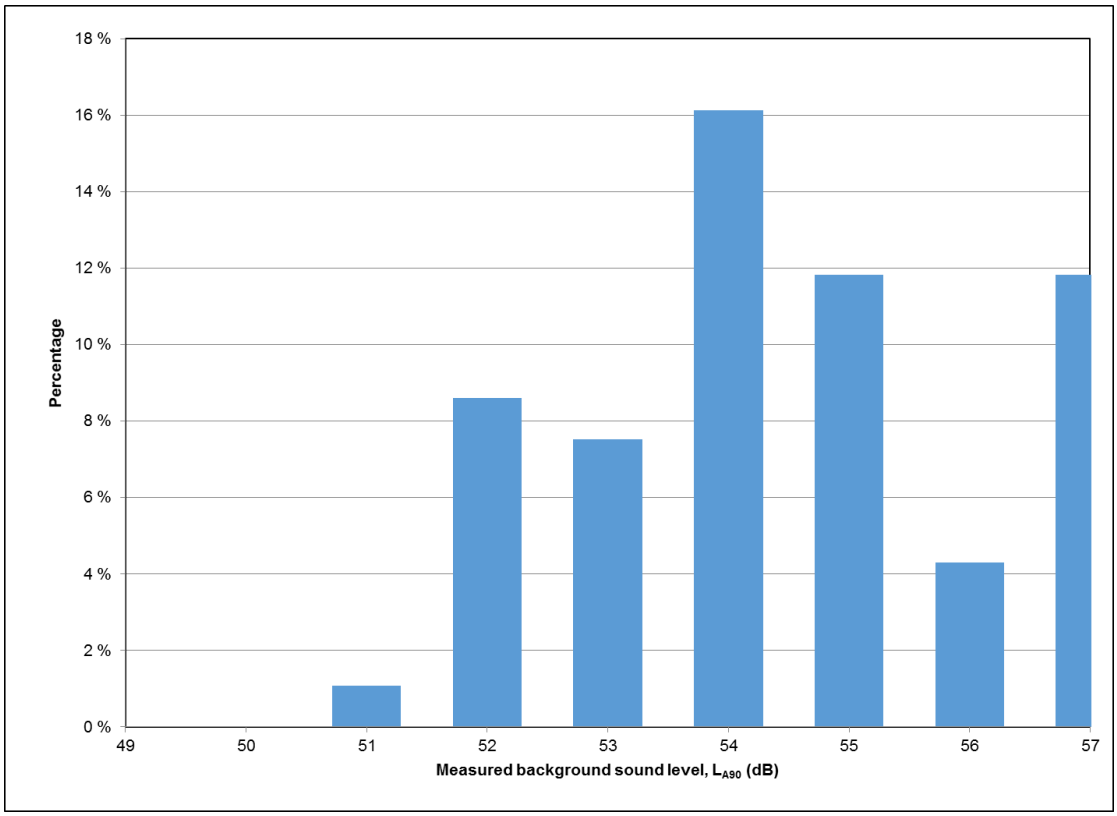
[MP1] Statistical Analysis of Daytime Background Noise Levels (07:00-19:00)



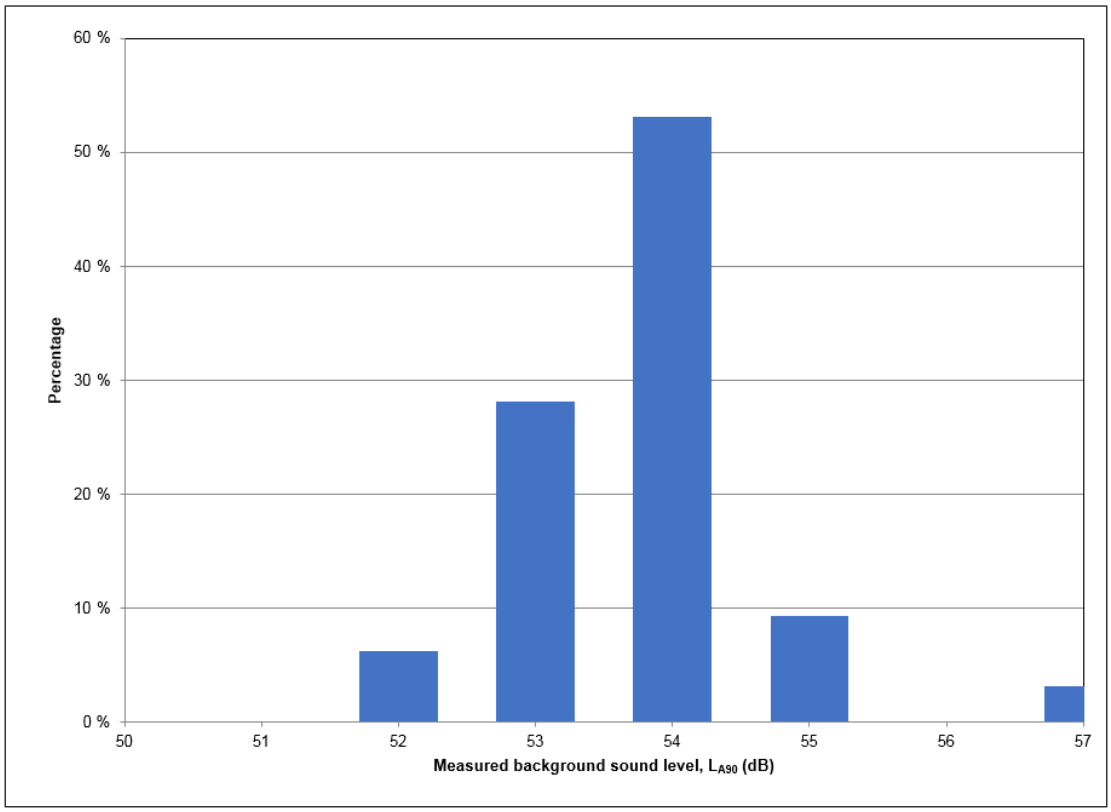
[MP1] Statistical Analysis of Evening Background Noise Levels (19:00-23:00)



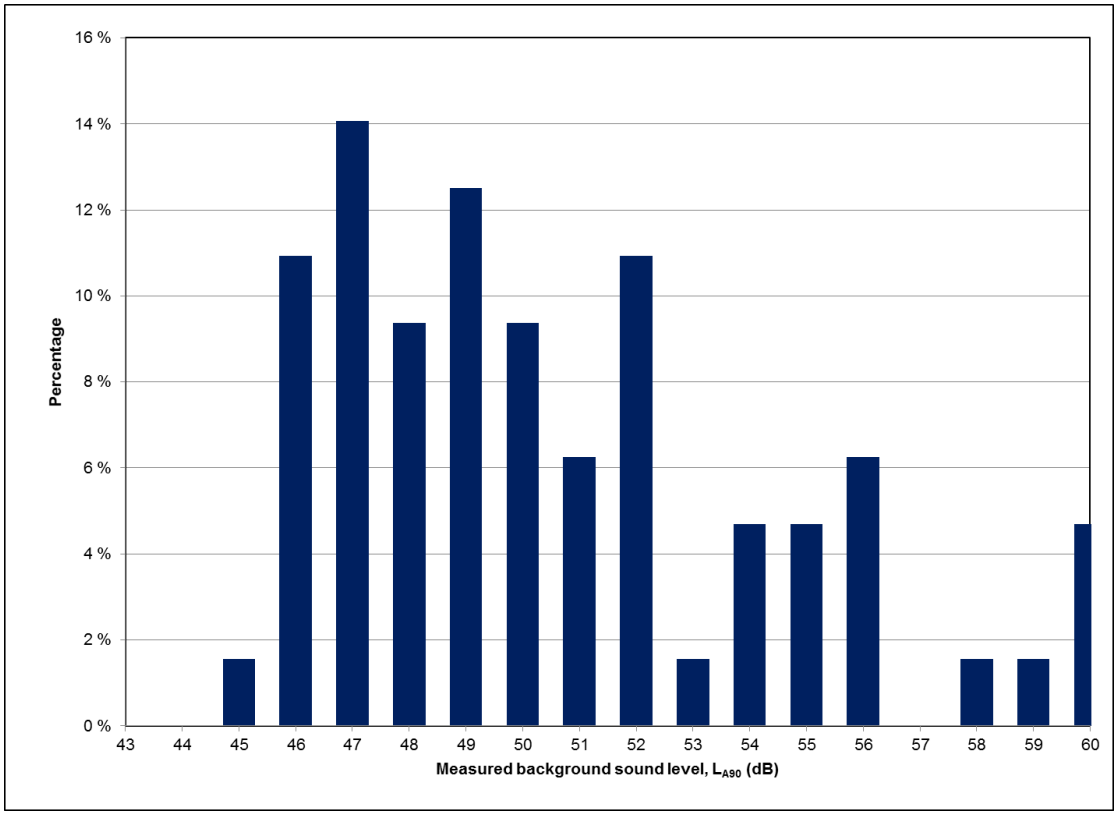
[MP1] Statistical Analysis of Night-time Background Noise Levels (23:00-07:00)



[MP3] Statistical Analysis of Daytime Background Noise Levels (07:00-19:00)



[MP3] Statistical Analysis of Evening Background Noise Levels (19:00-23:00)



[MP3] Statistical Analysis of Night-time Background Noise Levels (23:00-07:00)

Positions 2 (Manned)

A summary of the results from the manned noise level survey, as used to inform of the prevailing noise climate across the adjacencies of the site, is presented in the table below. All results are free-field levels.

Position	Start Time (mm:ss)	Measured Sound Pressure Levels (dB)	
		$L_{Aeq,15min}$	$L_{A90,15min}$
2	17:30	58 dB	55 dB
	18:15	59 dB	55 dB
	18:45	58 dB	54 dB

The above were undertaken in the absence of anomalous noise sources and from review of the trend in noise levels during the daytime at Position 1, have been considered representative of the entire daytime period (07:00 – 19:00 hours).

7.0 Operational Noise Breakout from Gym

7.1 Criteria

MCC recommends that noise (L_{eq}) breaking out through the building frontage of an 'entertainment' venue (since the gym may play music internally, the criteria for entertainment venues shall apply) should not exceed 10 dB below the background noise level (L_{90}) at all octave band frequencies at the nearest noise sensitive windows.

We would therefore propose the following criteria for entertainment noise egress.

Period	Entertainment Noise Level Limit (dB $L_{eq,15min}$) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 19:00)	51	43	43	44	43	39	34
Evening (19:00 – 23:00)	49	40	40	41	41	35	28
Night-time (23:00 – 07:00)	37	30	31	31	31	28	23

7.2 Proposed Building Fabric

We understand the façade of the development facing Oxford Road to comprise an entirely glazed frontage. The exact thickness of the existing glazing is unknown, however we understand this glazing is to be replaced as part of the refurbishment works.

The gymnasium will be fully mechanically ventilated and openable windows will not be relied upon as a means of ventilation/cooling.

7.3 Source Noise Levels

To inform our assessment of the gym, we have drawn upon previously measured noise levels to be considered as typical highest 1-hour noise levels during reasonable operation, as set out below.

Description	Reverberant Noise Level (dB $L_{eq,1hr}$) at Octave Band Centre Frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
Typical (Light background music)	70	75	75	75	75	75	75	81
Worst-case (Loud Music/Amplified Voice)	75	80	85	85	85	90	90	95

For the purposes of our assessment, we have considered the 'worst-case' noise levels set out above.

7.4 Assessment

We have assessed noise breakout to the worst affected receptors as follows:

- **Daytime (07:00 – 19:00)** Geoffrey Manton Building, 25m away
- **Evening (19:00 – 23:00)** Cavendish Hall Student Residential, 180m away
- **Night-time (23:00 – 07:00)** Cavendish Hall Student Residential, 180m away

We have calculated the required sound reduction performance of the new glazing based on the following equation for reverberant noise breakout and source noise levels above.

$$SRI = SPL_{in} - SPL_{out} + 10log_{10}\left(\frac{S}{r^2}\right) - 14$$

Where:
SRI *estimated sound reduction performance of façade element*
r *distance from radiating element to receptors*
S *approximate area of radiating element*

Daytime Assessment to Geoffrey Manton Building	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Internal noise level (dB L_{eq}) SPL_{in}	75	80	85	85	85	90	90
Distance & radiating area propagation correction (dB) $10log_{10}\left(\frac{S}{r^2}\right)$	-5	-5	-5	-5	-5	-5	-5
Internal diffuse field to external free-field hemispherical radiation correction (dB)	-14	-14	-14	-14	-14	-14	-14
Criteria (dB L_{Aeq})	51	43	43	44	43	39	34
Required sound reduction (dB *R*) *SRI*	**5**	**18**	**23**	**22**	**23**	**32**	**37**

Night-time Assessment to Cavendish Halls Student Residential	**Octave Band Centre Frequency (Hz)**						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Internal noise level (dB L_{eq}) SPL_{in}	75	80	85	85	85	90	90
Distance & radiating area propagation correction (dB) $10log_{10}\left(\frac{S}{r^2}\right)$	-22	-22	-22	-22	-22	-22	-22
Internal diffuse field to external free-field hemispherical radiation correction (dB)	-14	-14	-14	-14	-14	-14	-14
Criteria (dB L_{Aeq})	37	30	31	31	31	28	23
Required sound reduction (dB *R*) *SRI*	**2**	**14**	**18**	**18**	**18**	**26**	**31**

Based on the above, our pessimistic calculations indicate that the building façade would require the following minimum sound reduction performance to control the 'worst-case' noise levels to MCC criteria at the nearest noise sensitive locations.

Description	**Minimum Sound Reduction Performance (*R* dB) at Octave Band Centre Frequency (Hz)**						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Requirement for new glazing	5	18	23	22	23	32	37

The above performance requirements are not onerous and should be readily achievable by most generic glazing systems typical of a commercial demise.

8.0 Fixed Plant Noise Emissions

8.1 Criteria

On the basis of the aforementioned acoustic standards and the results of our surveys, we propose that the following plant noise emission limits be achieved at 1 metre (incident) from the windows of the nearest noise sensitive receptors.

Receptor Location	Plant Noise Rating Limit $L_{Ar,Tr}$ (dB)		
	Daytime (07:00 – 19:00 hours)	Evening (19:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Oxford Road	52	49	40
South (Entrance Courtyard)	52	49	40
North (York Street)	49	48	41

Noise shall be assessed in accordance with BS 4142:2014 with corrections applied for any plant emitting noise of a tonal or irregular quality.

The above shall be subject to the final approval of Manchester City Council.

8.2 Proposed Plant

We understand that 2No new cooling units are proposed to be installed behind the Manchester Aquatics Centre. The cooling units will be either the CMAF 110SE XLN AC or the CMAF 110HE XLN EC models produced by Trane. We understand the units will only operate between 7am and 11pm.

The location of the proposed units in relation to the nearest noise sensitive premises is provided below with the nearest corner of the ASHPs being 18.5 metres from the NSP.



We also understand that an Allaway Acoustics' AA306S-P enclosure for the coolers will be installed. This will be comprised of louvres on 2No sides of the enclosure and on the top.

With all of the above, we understand that the noise levels produced by the ASHPs will be 46 dBA at a distance of 10 meters (when measured in semi-anechoic conditions).

8.3 Assessment

Based on the Trane CMAF 110 SE SN noise data, with the attenuation from Allaway Acoustics' enclosure, the noise emitted from the plant will be 45 dB at the receiver. This is within the daytime and evening limits but exceeds the limit set out for night-time.

However, as the plant will only run until 11pm and The Church of Jesus Christ of Latter-day Saints closes at 9pm at the latest, the night time limits can be dismissed.

The plant noise egress calculations are presented in the table below.

Description	A-Weighted Sound Pressure Level (dB)
ASHP 1, SPL @ 10m	46
Barrier Loss (Line of Sight)	0
Distance attenuation	-3
Feature Correction (BS4142)	0
Façade Correction	0 (limits given as free field)
AHSP 1 SPL @ worst affected noise sensitive receptor	43
ASHP 2, SPL @ 10m	46
Barrier Loss (Line of Sight)	0
Distance attenuation	-5
Feature Correction (BS4142)	0
Façade Correction	0 (limits given as free field)
AHSP 2 SPL @ worst affected noise sensitive receptor	41
Cumulative Noise Level @ worst affected noise sensitive receptor	**45**

9.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the prevailing noise climate at the development site.

With the attenuation proposed by Allaway Acoustics, the sound level of the proposed plant is in line with the requirements set out by Manchester City Council.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

L_p — Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

L_w — Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

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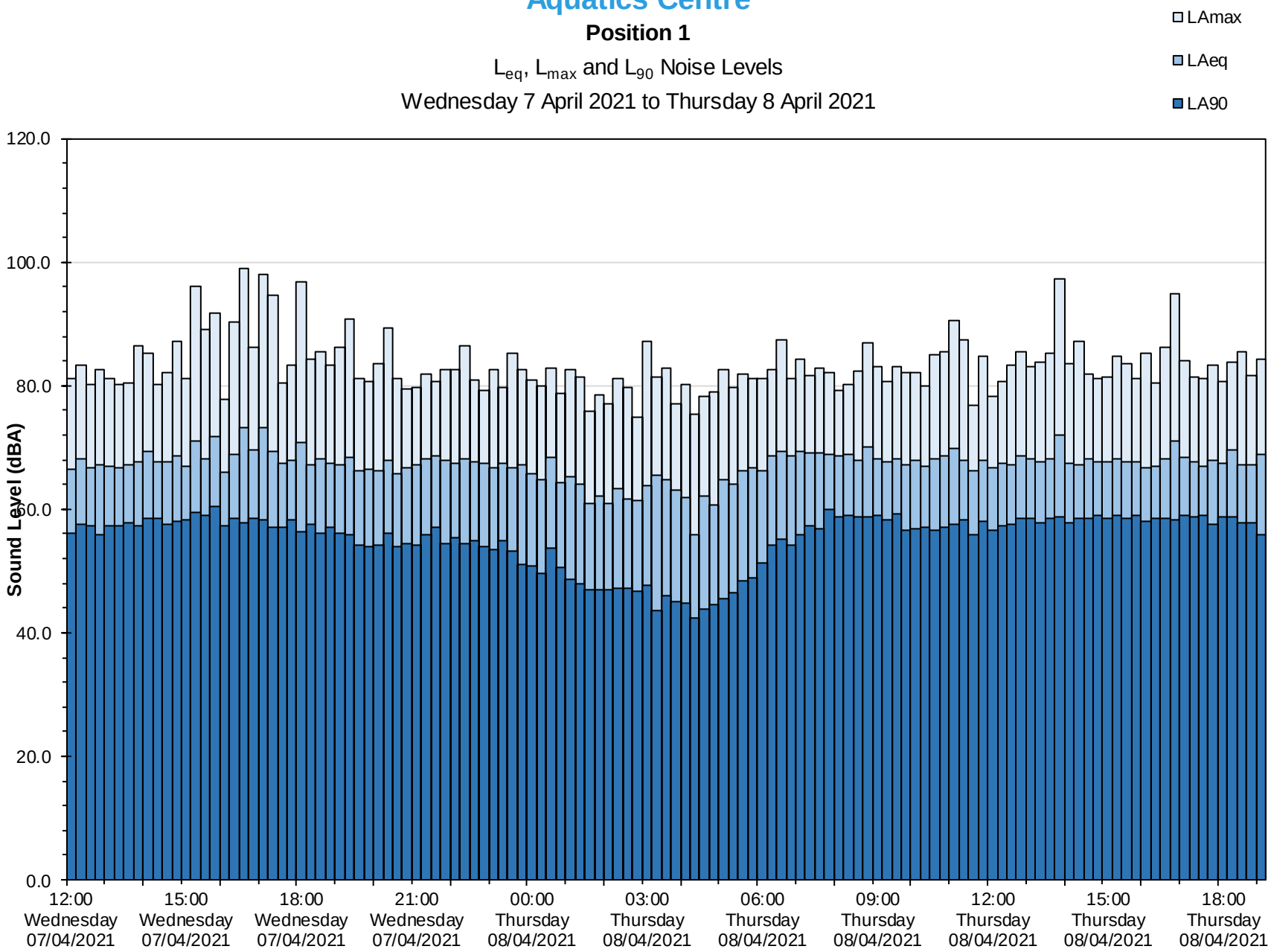
Position 1

L_{eq}, L_{max} and L_{90} Noise Levels

Wednesday 7 April 2021 to Thursday 8 April 2021



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Position 3

L_{eq}, L_{max} and L_{90} Noise Levels

Wednesday 12 May 2021 to Friday 14 May 2021

