

18221 – HEXAGON STUDIO ENVIRONMENTAL NOISE ASSESSMENT

The Hexagon/Hexagon Studio, Reading, UK

Report
October 2024

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Executive Summary

Charcoalblue have been appointed to provide acoustic design services for the proposed expansion to the existing Hexagon Theatre. The expansion includes alterations to some existing layouts and usage types of the site, including moving of the existing Get-In, as well as the construction of a new secondary building. The secondary building will contain an auditorium, rehearsal spaces, front of house spaces, and back of house spaces, including changing areas and workshops.

This report presents an overview of acoustic aspects of the site, in regards to noise impact on nearby noise-sensitive receivers. Charcoalblue have undertaken attended and unattended surveys on site, with the results of these measurements presented here. Initial noise impact target criteria are also presented in this report; These targets will be used to inform the design of plant noise mitigation measures as well as building sound insulation.

1. INTRODUCTION

SITE DESCRIPTION

The Hexagon, and proposed ancillary Hexagon Studio site, are located in the centre of Reading. To the West of the site is the dual carriageway Inner Distribution Road (IDR), to the East are partially-covered service roads alongside public raised walkways/shops, to the North a high-rise student housing block (regarded as the nearest residential noise-sensitive receivers), and to the South is open park space.

The noise climate around the proposed site is dominated by traffic noise from the IDR. Additional noise sources include existing plant associated with the Hexagon and with the adjacent student housing, alongside traffic noise from the service road (refuse lorries, coaches, and cars), and noise from general public at the nearby podium level.

Key locations are noted in the adjacent maps: Hexagon site buildings are highlighted in blue (existing Main Building in light blue, including plant room to the North-West, and the new Studio site in darker blue to the North), primary external noise sources are highlighted in yellow/orange (Inner Distribution Road and service roads), alongside nearby noise-sensitive receivers in red. The unattended survey location is shown in pink and spot measurement locations in green. The numbered survey locations are later used as references for tabulated measurement results.

SUMMARY OF PROPOSED WORKS

The Hexagon Studio project looks to build a secondary, adjoining building to the existing Hexagon, in place of the current Get-In/Office building to the North of the site.

The new space will incorporate a secondary auditorium, multipurpose rehearsal/foyer space, a shared Get-In with the main house, and dressing rooms.

The construction of the new building has an environmentally sustainable focus; To achieve this the use of timber and natural ventilation are proposed. Some areas of the building are still to be mechanically ventilated. All aspects of the ventilation strategy will be attenuated so as to not exceed environmental noise impact targets set out in this report.

Get-In will be to the West of the site, near to the IDR and existing external plant.

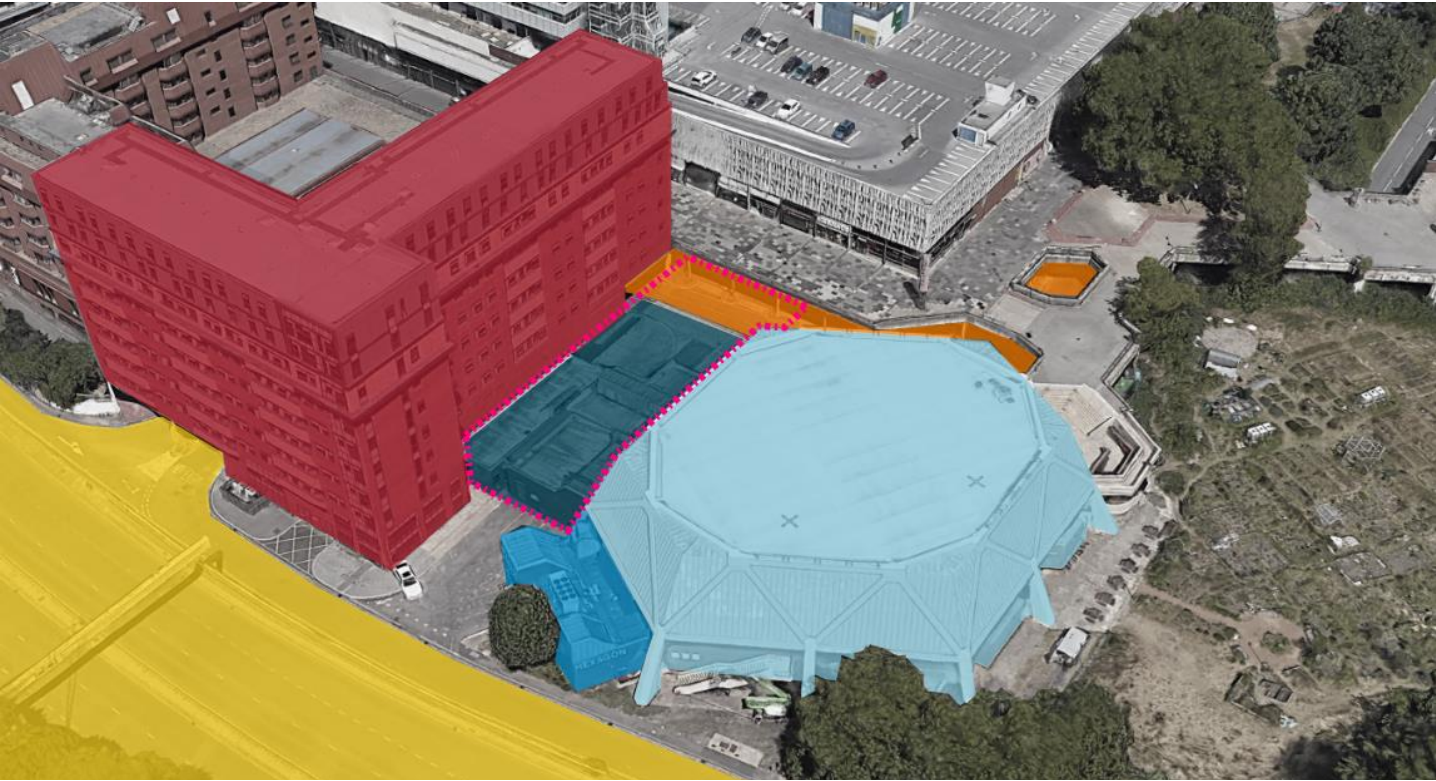
USAGE AND OPENING HOURS

It is expected that the programming of the new auditorium will largely consist of theatre, as well as amplified music concerts.

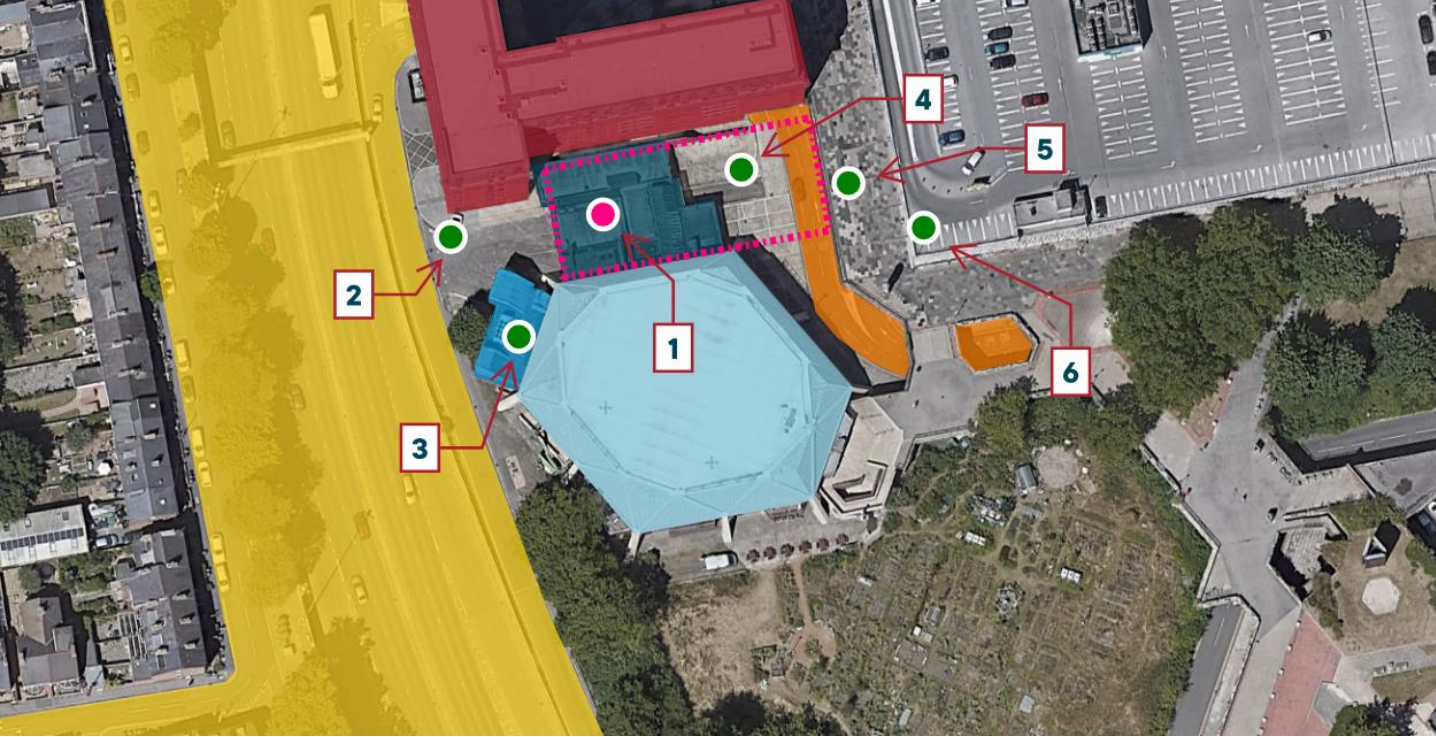
It is understood that opening hours will not go beyond 23:30 at night, referred to as “evening” for the purposes of this report.

Permissible maximum internal noise levels are to be further developed in the following design stages, depending on the sound separation performance of the coordinated building envelope.

Project Site Context Map: Hexagon site buildings are marked in **BLUE**, nearest noise-sensitive receivers in **RED**, and nearby roads in **YELLOW/ORANGE**. New Hexagon Studio extents are outlined in **PINK**.



Project Site Context Map: Unattended survey location in **PINK** and spot measurements in **GREEN** (numbered).



2. ENVIRONMENTAL NOISE SURVEY

OVERVIEW

An extended unattended survey was set up on site to establish existing ambient noise levels.

Measurements were taken over the period 9th August to 16th August 2023.

Measurements were recorded every 15 minutes, and were undertaken following the methodology and recommendations defined in ISO 1996:2 – 2017 “Description, measurement, and assessment of environmental noise – Part 2: Determination of sound pressure levels”.

5 minute attended spot measurements were also taken at the locations marked in green on the Project Site Context Map during typical operational hours of the daytime.

MEASUREMENT PROCEDURE

For all measurements, an NTi Audio XL2-TA Class 1 Sound Level Meter was used. The sound level meter had the serial number AZA-12886-E0, calibrated in December 2021. The Sound Level Meter was field calibrated at the beginning and end of the measurements using an LD CAL200 calibrator with serial number 14035, calibrated in December 2021.

2.1. UNATTENDED NOISE MEASUREMENTS

MEASUREMENT PROCEDURE

The measurement location chosen was on the roof of the existing ancillary building to the North of the Hexagon, indicated as Location 1 in pink in the image on the previous page.

Location 1 has been used for the unattended noise measurements since it is considered representative of the noise levels experienced at nearest residential receivers to the North of the site (student accommodation).

The microphone was mounted on a tripod at approximately 1.6m, a minimum of 3m from any other nearby sound reflecting surfaces. This test location is shown in the image to the right.

No significant deviation in calibration of the sound level meter occurred over the measurement period (≤0.2dB).

An NTi WP30 environmental housing was used to minimise turbulence due to wind at the microphone.

OPERATING CONDITIONS AND NOISE ENVIRONMENT

Meteorological data recorded at Bracknell/Beaufort Park over the survey period indicated some elevated windspeeds (over 5m/s) and light rainfall. Reviewing these periods against measured data and audio recordings, there was minor impact on measured levels in the early hours of 14th August 2023, but not any other period. No other reasons were observed for occluding measurement data.

Comparison of spot measurements taken at the existing rooftop plant location against the unattended survey data indicated no adverse contribution from this existing plant.

MEASURED RESULTS

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements is provided at the end of this report. The minimum values of ambient noise levels during each of the daytime, evening, and night-time periods of the unattended survey are presented below:

1. Unattended Survey Results: LAeq,15mins – Minimum

Date	Daytime (07:00 - 19:00) LAeq, 15min (dB)	Evening (19:00 - 23:30) LAeq, 15min (dB)	Night (23:30 - 07:00) LAeq, 15min (dB)
Wednesday 9 August 2023	65*	61	53
Thursday 10 August 2023	65	62	54
Friday 11 August 2023	66	62	56
Saturday 12 August 2023	62	63	56
Sunday 13 August 2023	60	60	55
Monday 14 August 2023	66	61	53
Tuesday 15 August 2023	65	62	53
Wednesday 16 August 2023	64*	-	-
* Measurement not made over full daytime period due to logger start and end time			

Background noise levels measured during the periods of the unattended survey are presented below:

2. Unattended Survey Results: LA90,15mins – Arithmetic Average

Date	Daytime (07:00 - 19:00) LA90, 15min (dB)	Evening (19:00 - 23:30) LA90, 15min (dB)	Night (23:30 - 07:00) LA90, 15min (dB)
Wednesday 9 August 2023	62*	57	47
Thursday 10 August 2023	62	58	47
Friday 11 August 2023	62	58	47
Saturday 12 August 2023	61	59	48
Sunday 13 August 2023	59	56	48
Monday 14 August 2023	63	56	46
Tuesday 15 August 2023	62	58	46
Wednesday 16 August 2023	61*	-	-
* Measurement not made over full daytime period due to logger start and end time			

The average measured noise level of the period of minimum background noise outside of the night period was 56dBA (linear average of L90 measurements over 19:00-23:30 Sunday 13th August and 19:00-23:30 Monday 14th August 2023).

Unattended Survey Location



View to nearest noise-sensitive receivers (left)



Existing plant location



View of raised measurement locations (walkway & carpark)



2.2. ATTENDED NOISE MEASUREMENTS

MEASUREMENT PROCEDURE

Daytime spot measurements of 5 minutes were taken at multiple locations to identify current contributions from nearby noise sources. These included the primary nearby noise source, the Inner Distribution Road, as well as existing external plant associate with the Hexagon.

Each measurement was taken at a height of ~1.6m (unless otherwise noted) using the previously noted Class 1 sound level meter.

OPERATING CONDITIONS AND NOISE ENVIRONMENT

Weather was clear for all spot measurements. A windshield was utilised to minimise impact from any potential air turbulence.

Measured noise was primarily associated with traffic on the IDR. Some traffic was also observed along the Easterly service road/into the adjacent car park.

MEASURED RESULTS

Supplementary data from the various spot measurements, is presented in the following table, all taken during daytime hours:

3. Spot measurement results

Spot Measurement	Location		dBA
LAMax,5mins	Near Inner Distribution Road (1.4m height)	2	77
LAeq,5mins			72
LA90,5mins			68
LAMax,5mins	Near Inner Distribution Road (1.8m height)	2	78
LAeq,5mins			73
LA90,5mins			69
LAMax,30sec	Existing Hexagon Plant Roof	3	73
LAeq,30sec			69
LA90,30sec			65
LAMax,5mins	In Front of Get-In (Street Level)	4	67
LAeq,5mins			60
LA90,5mins			55
LAMax,5mins	Pedestrian Walkway	5	74
LAeq,5mins			61
LA90,5mins			57
LAMax,5mins	Roof of Carpark	6	69
LAeq,5mins			62
LA90,5mins			57

3. NOISE EMISSIONS CRITERIA

LOCAL AUTHORITY CRITERIA

Guidance provided by Rebecca Moon, Environmental Health Officer for Reading Borough Council, indicates that an acoustic assessment carried out in accordance with BS4142:2014+A1:2019 should be provided prior to commencement of construction both for noise due to mechanical services and noise due to internal operations of the proposed site.

Specific noise levels from cumulative plant/equipment at 1 metre from the façade of the nearest noise sensitive receiver should not exceed 10dB below measured background noise levels.

Specific noise levels from internal operations at 1 metre from the façade of the nearest noise sensitive receiver should not exceed 10dB below measured background noise levels, less any adjustments for characteristic features of the sound (such as tonality or intermittency).

4. DESIGN CRITERIA

Current measured ambient noise levels during the unattended survey period indicate a lowest level during the evenings of Sunday 13th and Monday 14th August (occluding measurements during non-opening hours) of 56dBA LA90,15mins. Following Reading Borough Council guidance, contributions from noise sources associated with the new development at 1m from the façade/windows of the nearest residential property (student accommodation to the North of site) should not exceed 10dB below the measured background level; As such, target criterion contribution level at 1m from the nearby residential façade is **46dBA** LAeq.

Additional penalties shall be included in all calculations to account for potential characteristics of any noise sources, such as tonality, intermittency, or impulsivity.

5. PROPOSED DESIGN

The design of the new building incorporates a combination of internal and external plant, with some atmospheric connections of the internal plant terminating at the envelope of the building.

All units/connections to be considered as potential noise sources that could affect the nearest noise-sensitive receptors to the site have been indicated in Table 4 alongside the layout drawing on the following page.

Choice of unit type, operational duties/hours, location, and attenuation methods (such as attenuators and lined ducts) have been developed to ensure that combined impact at the nearest noise sensitive receivers does not exceed the target levels set out in this report.

The envelope of the building has been developed so as to ensure internal performance and rehearsal activities can be undertaken without adverse impact on nearby noise sensitive receivers. This includes a full resilient box-in-box design of the main auditorium to provide high levels of sound separation during performances and development of high-performance sound attenuating natural ventilation paths (with the extract chimney to the Studio Theatre).

6. NEXT STEPS

As the design of the mechanical services and building envelope are further developed, finalised acoustic assessments (in accordance with BS4142:2014+A1:2019) for both noise from mechanical services and noise from internal operations shall be produced. These assessments will highlight compliance of the building design with Reading Borough Council requirements, including the design elements considered so as to achieve this.

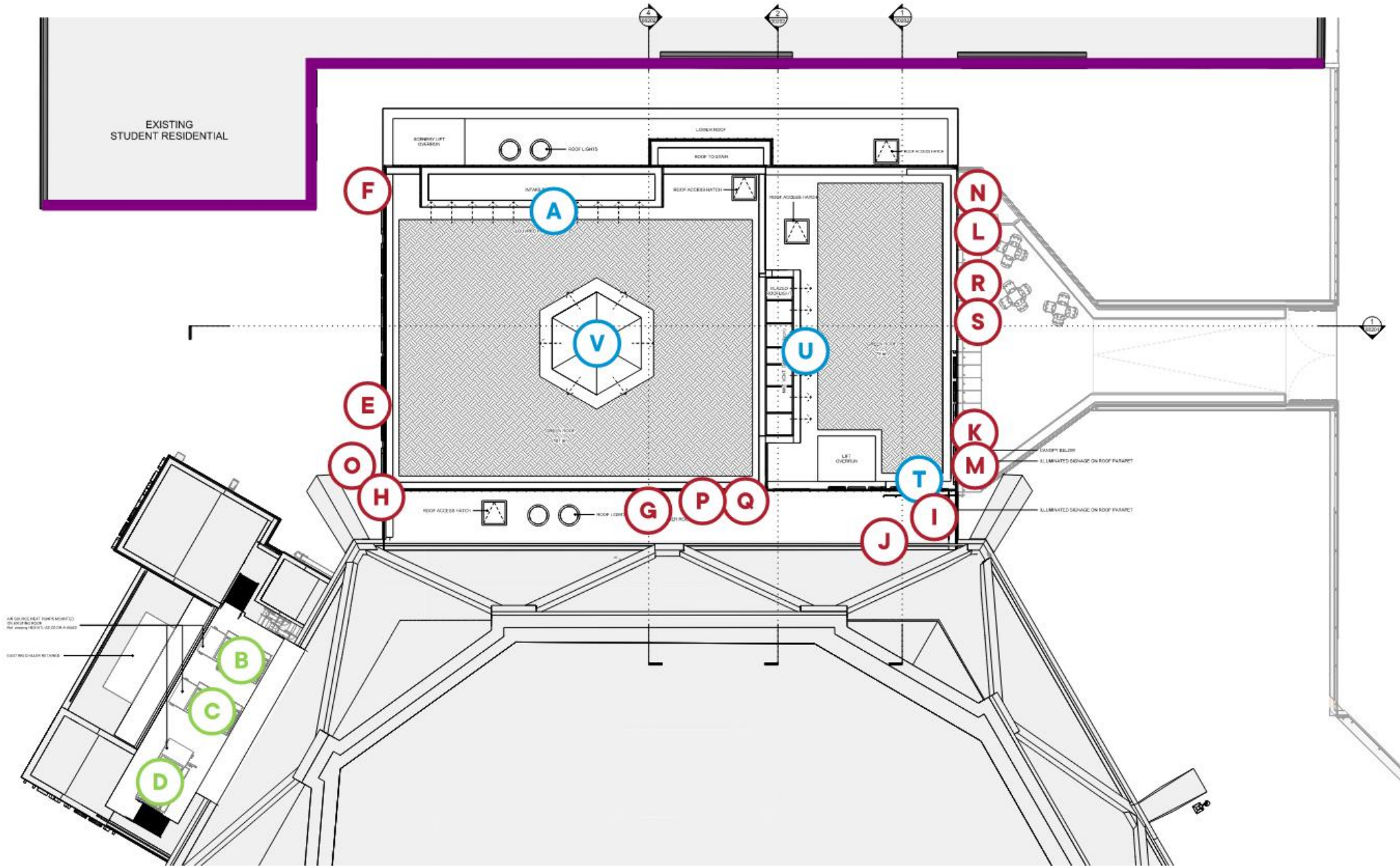
7. CONCLUSION

This Environmental Noise Assessment demonstrates that the site is suitable for the proposed theatre extension, subject to the recommendations and design criteria set out in the report.

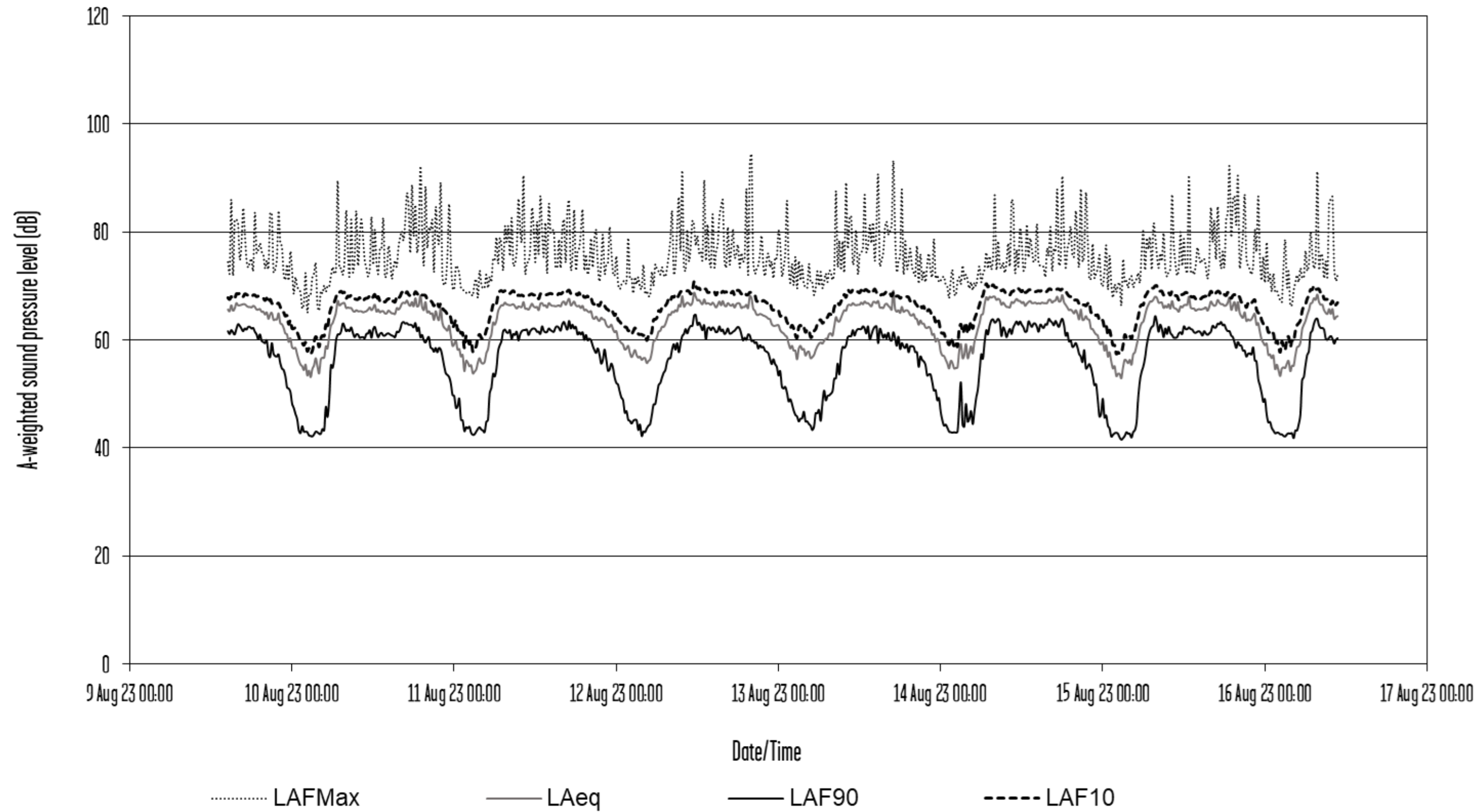
4. Proposed plant and locations.

Description	Location	
	Key	Level
AHU1: Fresh Air	A	RF
ASHP (1, 2, 3)	B, C, D	2FL
MVHR 2: Fresh Air	E	GFL
MVHR 2: Exhaust	F	GFL
AHU2: Fresh Air	G	2FL
AHU2: Exhaust	H	2FL
AHU3: Fresh Air	I	2FL
AHU3: Exhaust	J	GFL
MVHR 3: Fresh Air	K	2FL
MVHR 3: Exhaust	L	2FL
MVHR 6: Fresh Air	M	2FL
MVHR 6: Exhaust	N	GFL
Heat Pump 1	O	GFL
Heat Pump 2	P	2FL
Heat Pump 3	Q	2FL
Heat Pump 4	R	GFL
Heat Pump 5	S	GFL
FCU1	T	2FL
Foyer Natural Vent Extract	U	RF
Studio Natural Vent Chimney	V	RF

Proposed plant locations. Large plenum connections are indicated in **BLUE**, external units in **GREEN**, and ducted atmospheric connections in **RED**. Nearest noise-sensitive receptors are highlighted in **PURPLE**.



18221 - HexBox, Reading - Results of 7 day noise logging survey - 9th-16th August 2023



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