Resonate

Sydney Biomedical Accelerator

Construction Noise and Vibration Management Plan

S240427RP1 Revision D

Thursday, 19 June 2025

Resonate

Document Information

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Revision Table

Report revision	Date	Description	Author	Reviewer
0	14 April 2025	Draft Construction Noise and Vibration Management Plan	Cameron Heggie	Raymond Sim
A	13 May 2025	Updated to include revised monitoring campaign and indicative monitoring locations	Cameron Heggie	Raymond Sim
B	22 May 2025	Updated to include comments from RCC review	Cameron Heggie	Raymond Sim
C	28 May 2025	Updated to include CVs	Cameron Heggie	Raymond Sim
D	19 June 2025	Updated to address comments from client	Justin Hauswirth	Raymond Sim

Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to approximate human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
BS 7385	British Standard BS 7385 Part 2-1993 *Evaluation and Measurement for Vibration in Buildings.*
Characteristic	Associated with a noise source, means a tonal, impulsive, low frequency or modulating characteristic of the noise that is determined in accordance with the NPfI.
CNVMP	Construction Noise and Vibration Management Plan
Day	The period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays in accordance with the NPfI.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. People typically perceive a 10 dB increase in sound as a doubling of that sound level.
dB(A)	Units of the A-weighted sound level.
DIN 4150-3	German Standard DIN 4150-3 *Structural Vibration, Part 3 – Effects of Vibration on Structures*
EPA	NSW Environment Protection Authority
Evening	the period from 6 pm to 10 pm in accordance with the NPfI.
Frequency (Hz)	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second.
ICNG	Department of Environment & Climate Change NSW's *Interim Construction Noise Guideline* (July 2009).
$L_{A1\ (1min)}$	The A-weighted sound pressure level that is exceeded for 1% of the 1-minute measurement period.
$L_{A90\ (15min)}$	The A-weighted sound pressure level that is exceeded for 90% of the 15-minute measurement period, when measured in the absence of the construction works under consideration and excluding extraneous noise. This is considered to represent the background noise.
$L_{Aeq\ (15min)}$	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community. Other descriptors may be used providing they can be justified as representing the characteristics of the construction noise.
L_{Amax}	The A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
mm/s	Millimetres per second, unit of vibration velocity

Night	The period before 7 am Mondays to Saturdays, 8 am on Sundays and Public Holidays, or after 10pm on any day in accordance with the NPfI.
NPfI	NSW EPA's *Noise Policy for Industry* (October 2017).
NML	Airborne noise management levels – to be measured and assessed at the residential property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the residential property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most affected point within 30 m of the residence.
OOHW	Out of Hours Work – works conducted outside of standard hours of work.
PPV	Peak Particle Velocity. The maximum speed of a particle in a particular component direction due to vibration during a measurement.
Rating background noise level (RBL)	The overall, single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). This is the level used for assessment purposes. See NPfI Fact Sheets A & B.
Standard hours of work	Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays
Vibration	Human comfort vibration to be measured and assessed in accordance with Assessing vibration – a technical guideline (DEC 2006).

Table of Contents

1 Introduction

This Construction Noise and Vibration Management Plan (CNVMP) outlines the planned noise and vibration management approach to be undertaken by Richard Crookes Constructions (RCC) for the Sydney Biomedical Accelerator project. Management and mitigation practices within this CNVMP are designed to support the achievement of the Conditions of Approval item B21.

1.1 Project description

The proposed Sydney Biomedical Accelerator (SBA) is a co-funded partnership project between the NSW Government (NSW Health), Sydney Local Health District (SLHD) and the University of Sydney (the University), comprising a state-of-the-art biomedical research complex spanning SLHD's Royal Prince Alfred Hospital (RPAH) campus and University of Sydney's Camperdown Campus Health Precinct.

The SBA complex is made up of two wings. Within the University of Sydney campus, the proposed development comprises the Isaac Wakil Biomedical Building (IWBB); approximately 29,000sqm gross floor area (GFA) over 8 floors for physical containment level 2 (PC2) wet lab research, mortuary and advanced anatomy teaching, clinical research facilities, and core research facilities. On the RPAH site the proposed development comprises Building B; approximately 8,200sqm GFA over 8 floors of primarily PC2 laboratories with a specialist PC3 laboratory and biobank facility.

1.2 Purpose and objectives of the CNVMP

This CNVMP forms part of the Construction Environmental Management Plan (CEMP) for the project. It has been prepared to ensure noise generating activities are appropriately managed and nearby sensitive receivers protected.

This CNVMP is intended to cover works that will occur over three phases of the project:

- Phase 1: Groundworks and excavation
- Phase 2: General construction
- Phase 3: Landscaping

The CNVMP includes the following:

- Identification of background noise levels and construction noise and vibration management criteria.
- Evaluation and assessment of potential noise and vibration impacts on receptors.
- Description of environmental management controls to mitigate potential noise and vibration impacts on receptors.
- Procedures for monitoring and auditing of noise and vibration impacts against noise and vibration goals.
- Procedures for the management of complaints and non-compliances.

The key objective of the CNVMP is to ensure that project impacts on noise and vibration sensitive receivers are minimised and within the scope permitted by the planning approval. This includes a target to minimise complaints from the community and stakeholders relating to noise and vibration.

To achieve this objective, Richard Crookes Constructions will undertake the following:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise noise and vibration impacts and potential adverse impacts to neighbouring sensitive receivers.
- Ensure appropriate measures are implemented to address Condition B21 and other guidance for construction noise and vibration management relevant to building works in NSW.

This CNVMP may be updated throughout the works to reflect changes to anticipated works, plant and schedule.

1.3 Review and ongoing development

The CNVMP will be reviewed annually and/or under the following conditions:

- Significant change to the Scope of Works.
- If required as a result of an audit or incident.
- If the Project Manager determines that it is appropriate.
- If project stakeholders formally request an update.

1.4 Guidelines and standards

Additional guidelines and standards relating to the management of noise and vibration that are applicable for the project include:

- Interim Construction Noise Guideline (DECC, 2009);
- Assessing Vibration: a technical guideline (NSW OEH, 2006);
- Australian Standard AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites;
- Australian Standard AS1055:2018 Acoustics - Description and Measurement of Environmental Noise;
- German Standard DIN 4150-Part 3:1999 Structural vibration - Effects of vibration on structures;
- British Standard 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings, 1993;
- British Standard 6472: Evaluation of human exposure to vibration in buildings(1-80 Hz), 1992;
- Noise Policy for Industry (EPA, 2017);
- NSW Road Noise Policy (DECCW, 2011); and
- Noise Guide for Local Government (EPA, 2013).

2 Approval condition requirements

2.1 Condition B21

This CNVMP is to satisfy the meeting of the requirements of Condition B21 of the projects Planning Approval. Table 1 outlines the Development Consent conditions that are relevant to management of noise impacts associated with the construction of the development and where these have been addressed within this CNVMP. Should any development modifications trigger an update of these requirements, this section will be amended as needed and the revised CNVMP distributed as required. Noting, works related to SSD-7974 (Mod 3 Susan Wakil Health Building) will prompt an update of the CNVMP for Crown Works Verification Certificate (CWVC) 3.

Table 1 Condition B21 requirements

Condition no.	Reference	Where is the condition addressed
B21	The Construction Noise and Vibration Management Sub-plan must address, but not be limited to, the following	This CNVMP
B21 (a)	be prepared by a suitably qualified and experienced noise expert;	The author, reviewer and contributors to this report have significant experience in the assessment of construction noise and vibration, and are Members of the Australian Acoustical Society. CVs are included in Appendix B.
B21 (b)	describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009), including correction of noise management levels to 57dB(A) $L_{eq(15min)}$ for St Andrews College and 59dB(A) $L_{eq(15min)}$ for Wesley College and identification of noise management levels for works outside of standard construction hours pursuant to this guideline for all sensitive receivers.	Section 8.2
B21 (c)	describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;	Section 8.2
B21 (d)	include strategies that have been developed with the community for managing high noise generating works;	Section 10
B21 (e)	describe the community consultation undertaken to develop the strategies in condition B21(d);	Section 10
B21 (f)	include a complaints management system that would be implemented for the duration of the construction; and	Section 8.3

Condition no.	Reference	Where is the condition addressed
B21 (g)	include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B18.	Section 11
C12	The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures identified in the approved Construction Noise and Vibration Management Plan.	Sections 6.1.4 & 8
C13	The Applicant must ensure construction vehicles (including concrete agitator trucks) do not arrive at the site or surrounding residential colleges outside of the construction hours of work outlined under condition	Section 8.2
C14	The Applicant must implement, where practicable and without compromising the safety of construction staff or members of the public, the use of 'quackers' to ensure noise impacts on surrounding noise sensitive receivers are minimised.	Section 8.2 *(note that within this document, 'quackers' are referred to as 'broadband alarms'.)*
C15	Vibration caused by construction at any residence or structure outside the site must be limited to:	-
C15 (a)	for structural damage, the latest version of DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures (German Institute for Standardisation, 1999); and	Table 8
C15 (b)	for human exposure, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: a technical guideline (DEC, 2006) (as may be updated or replaced from time to time).	Table 9
C16	Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition C15.	Table 12
C17	The limits in conditions C15 and C16 apply unless otherwise outlined in a Construction Noise and Vibration Management Plan, approved as part of the CEMP required by condition B21 of this consent.	-

3 Site description

The site is located on the corner of Western Avenue and Cadigal Lane in Camperdown. The University of Sydney (Lot 1 DP1171804) and Royal Prince Alfred Hospital (Lot 1000 DP1159799).

The overall site has an area of 8,600 sqm and is bound by existing Royal Prince Alfred Hospital and the Susan Wakil Health Building to North, Western Avenue & Wesley College to the East, Cadigal Lane and St. Andrews College to the South and Gloucester House to the West. An aerial photograph of the site detailing the development footprint is provided in Figure 1.

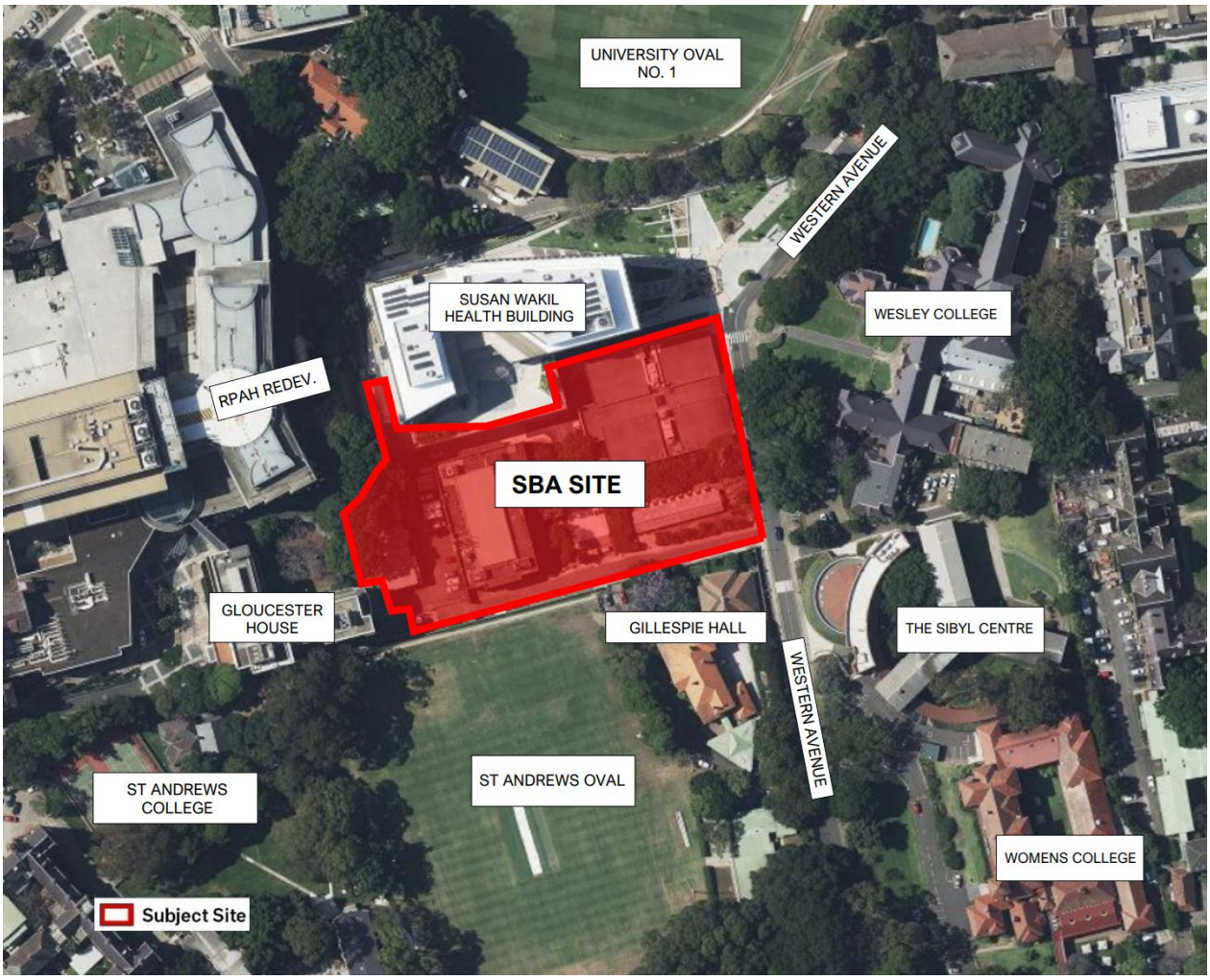


Figure 1 SBA site footprint. *Source: Acoustic Logic- SSDA Noise & Vibration Impact Assessment 20221419.4*

3.1 Nearest sensitive receivers

Table 2 below lists the nearest noise and vibration sensitive receivers identified within the projects Noise & Vibration Impact Assessment, developed by Acoustic Logic, dated 28 August 2023. An aerial photo of the site indicating nearby noise sensitive receivers and measurement locations is presented in Figure 2.

A land use survey of the buildings in the area has been conducted and is presented in Appendix D. Heritage listed buildings are indicated in the land use survey.

Table 2 Nearest noise and vibration sensitive receivers as identified by Acoustic Logic

Receiver	Land use	Comment
SWHB	Educational	Susan Wakil Health Building to the north of the subject site
StAC	Student Accommodation	St Andrew's College to the south of the subject site. Noted to be used for student accommodation purposes for around 350 students throughout the year.
H1	Hospital	Royal Prince Alfred Hospital to the west of the subject site.
WC	Student Accommodation	Wesley College located to the east of the subject site
TWC	Student Accommodation	The Women's College located to the south east of the site
R1	Residential	We note that the nearest residential receiver is located along Campbell Street approximately 270 metres from the development site and largely shielded from the development by other buildings

Source: Acoustic Logic- SSDA Noise & Vibration Impact Assessment 20221419.4

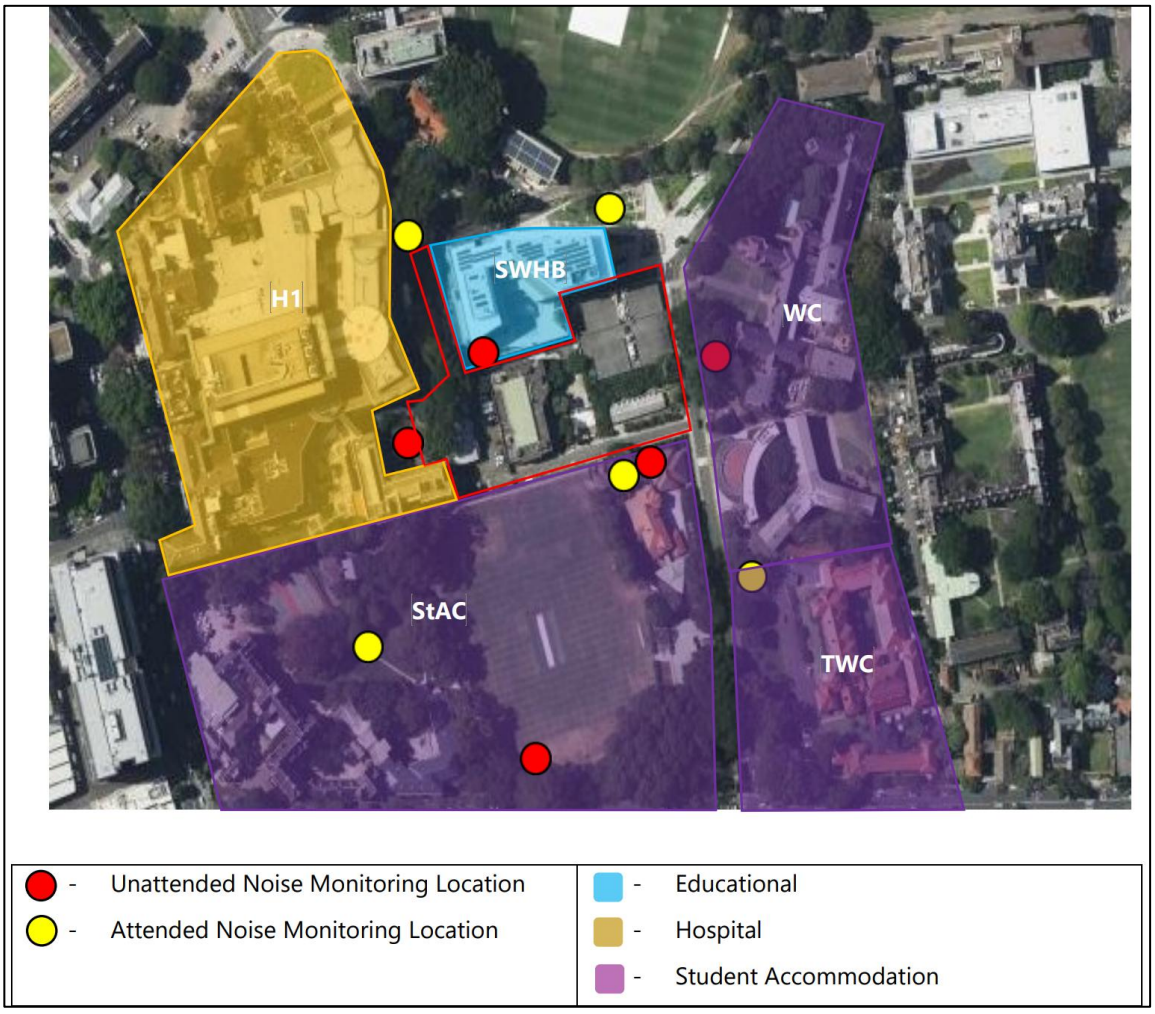


Figure 2 Site plan showing surrounding land uses and sensitive receivers

Source: Acoustic Logic- SSDA Noise & Vibration Impact Assessment 20221419.4

4 Existing acoustic environment

4.1 Rating background level

Table 3 summarises the rating background noise levels (RBL) for the day, evening and night periods as defined in the NPfI for each location extracted from the projects Noise & Vibration Impact Assessment, developed by Acoustic Logic. Refer to the Noise & Vibration Impact Assessment for a full description of the existing acoustic environment.

Table 3 Rating background levels

Location	Rating Background Noise Level (dB(A) L_{90})		
	Day	Evening	Night
Wesley College	49	48	47
Royal Prince Alfred Hospital	50	49	49
St Andrew's College, Cadigal Lane	47	45	43
St Andrew's College, Carillon Ave	47	47	43

4.2 Site observations

The Noise & Vibration Impact Assessment has included the following site observations for the measurement locations are indicated in Figure 2:

- Location 1: Susan Wakil Health Building – largely general ambient noise and campus activity noise.
- Location 2: Royal Prince Alfred Hospital Loading Dock – loading dock activity noise, patron noise and minor mechanical plant noise.
- Location 3: St Andrew's College – largely general ambient noise.
- Location 4: Wesley College – largely general ambient noise.
- Location 5: St Andrew's College Main Building – largely general ambient noise.

5 Proposed works

5.1 Construction plant

Based on the project's Construction Noise and Vibration Impact Assessment, we understand that the plant outlined in Table 4 is expected to be used during the works.

Table 4 Phases of work and corresponding construction plant

Phase of Work	Work Package	Construction Plant
Groundworks and excavation	Piling	CFA Piling Rig
		Dynamic Pile Testing
	Earthworks	Excavators W/ Bucket Attachment
		Ground Anchor Drilling Rig
		Skid Steer
		Pad Foot Roller
		Forklift
		Bin Lifter
		Mobile Concrete Pump W/ Boom
		Trucks
Construction Phase	Tower Crane	Tower Crane
	Mobile Crane	Mobile Crane
	Facade	Crawler Crane
	Hoist	Man and Materials Hoists
	Concrete Placement	Static Concrete Pump W/ Boom
		Mobile Concrete Pump W/ Boom
	Facade	Articulating Boom Lift
	Structure, Facade and Finishes	Scissor and Single Man Lift
		Duct Lifter
		Air Compressor
		Forklift
		Bin Lifter
	All	Trucks
General and landscaping	All	Bobcat
		Excavators W/ Bucket Attachment

Phase of Work	Work Package	Construction Plant
		Hand tools
		Mobile Crane

This list has been provided as a guide to assist with the preparation with this CNVMP. The list in Table 4 and this CNVMP may be updated during the detailed planning stage of the project where required.

5.2 Hours of work

5.2.1 Approved hours of work

The works will occur in accordance with the Approved Development Consent, being:

- Monday to Friday: 7:00am – 6:00pm
- Saturday: 8:00am – 1:00pm
- Sunday & Public Holidays: No construction works permitted

Excavations within rock, sawing of rock, use of jack hammers, driven-type piling and the like are limited to:

- Monday to Friday: 9:00am – 12:00pm and 2:00pm – 5:00pm
- Saturday: 9:00am – 12:00pm
- Sunday & Public Holidays: No construction works permitted

Any work outside these hours will require prior approval from Sydney City Council.

5.2.2 Out of hours work

Out of hours work is managed through the implementation of the Out of Hours Work (OOHW) Protocol. This sets out the process for the preparation, consideration, assessment, management and approval of OOHW. A draft preliminary OOHW Protocol is located in Appendix C of this document. All construction activities must be undertaken within the standard construction hours specified in Section 5.2.1, except under the following circumstances:

- The works generate airborne noise that is:
  - No more than 5 dB(A) above the RBL at any residence, in accordance with the *Interim Construction Noise Guideline* (ICNG); and
  - No more than the noise management levels specified in Table 3 of the ICNG at other sensitive receivers.
- The delivery of materials is required outside standard hours by the NSW Police Force or other authorities for safety or traffic management reasons.
- Works are necessary in an emergency to prevent loss of life, protect property, or mitigate environmental harm.
- Works are approved under an Environment Protection Licence (EPL).
- Where OOHW are proposed, a Construction Noise and Vibration Impact Statement (CNVIS) will be prepared to assess and document the potential impacts.

Any requirements for night-works outside of these times are to be determined during the detailed planning phase. If night-works are required, the CNVMP will be reviewed and updated as required.

5.2.3 Out of hours delivery

Most deliveries of plant and equipment will be scheduled during standard construction hours. However, oversized deliveries may occasionally be required outside these hours. Where practicable, such deliveries will be scheduled during off-peak periods when traffic volumes are lower. This approach is intended to maximise public and road user safety while minimising disruption to the road network.

6 Construction noise and vibration criteria

6.1 Construction noise criteria

Construction noise in New South Wales is assessed using the Department of Environment & Climate Change (now Environment Protection Authority) *Interim Construction Noise Guideline* (ICNG).

The ICNG aims to manage noise from construction works regulated by the EPA. It is also intended to provide guidance to other interested parties in the management of construction noise, and has therefore been adopted for this construction noise assessment.

The ICNG prescribes $L_{eq,15min}$ Noise Management Levels (NML) for sensitive receivers as part of a quantitative construction noise assessment. Where the predicted or measured construction noise level exceeds these management levels, then all feasible and reasonable work practices should be implemented to reduce construction noise, and community consultation regarding construction noise is required to be undertaken.

Any noise generated during construction of the development must not be offensive noise within the meaning of the Protection of the Environment Operations Act 1997 or exceed approved noise limits for the site. Noise limits for the site are the NMLs set out in Table 7 below.

6.1.1 Standard working hours

To encourage work during the Standard Working Hours, and to reflect the lower impact of work at these times, the ICNG prescribes less stringent Standard Working Hours NMLs.

It should be noted that the Standard Working Hours are only applicable to residential (or similar) land uses. At non-residential land uses such as educational or commercial land uses, where evening and night-time amenities, and sleeping is not a concern, the impact of construction noise is assessed based on the times that the land use operates.

6.1.2 Residential land uses

The NMLs prescribed for residential land uses by the ICNG are presented in Table 5. The levels apply at the most exposed property boundary of the noise sensitive receiver at a height of 1.5 metres above ground level.

Table 5 Noise management levels for residential land uses

Time of day	NML, $L_{Aeq,15min}$	Application notes
Recommended Standard Working Hours	Noise affected: RBL + 10 dB(A)	May be some community reaction to noise. • Where the predicted or measured construction noise level exceeds the noise affected level, all feasible and reasonable work practices should be applied to meet the noise affected level. • All residents potentially impacted by the works should be informed of the nature of the works, the expected noise levels and duration, and provided with site contact details.

Time of day	NML, $L_{Aeq,15min}$	Application notes
	Highly noise affected: 75 dB(A)	May be strong community reaction to noise. • Where construction noise is predicted or measured to be above this level, the relevant authority may require respite periods that restrict the hours that the very noisy activities can occur. • Respite activities would be determined considering times identified by the community when they are less sensitive to noise, and if the community is prepared to accept a longer period of construction to accommodate respite periods.
Outside recommended Standard Working Hours	Noise affected: RBL + 5 dB(A)	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the affected noise level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the affected noise level, the proponent should negotiate with the affected community.

6.1.3 Other sensitive land uses

The ICNG also prescribes NMLs for other sensitive land uses, including educational buildings and offices. The NMLs for relevant land uses are summarised in Table 6 and apply only when those land uses are in use.

For those receivers where an internal NML applies, it is common to assume an outdoor-to-indoor noise reduction of 10 dB(A). This is based on a standard residential building facade with windows kept partially open.

Table 6 ICNG noise management levels for other sensitive land uses

Land use	NML $L_{Aeq,15min}$ (applies when property in use)
Classrooms at schools and other educational institutions	Internal noise level of 45 dB
Hospital wards and operating theatre	Internal noise level of 45 dB
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation).	External noise level of 60 dB
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion).	External noise level of 65 dB
Offices, retail outlets	External noise level of 70 dB

6.1.4 Project specific noise management levels

The NSW EPA's ICNG assessment requires:

- Determination of noise management levels (based on ambient noise monitoring).
- Review of generated noise levels at nearby development.

- Recommendation of noise control strategies when noise management levels are exceeded.

The ICNG adopts differing strategies for noise management depending on the predicted noise level at the nearest sensitive land uses. These are summarised in Table 3 of the guideline.

Table 7 summarises the NMLs applicable to sensitive land uses around the site during the construction phase. The NMLs are based on the background noise levels from unattended monitoring conducted by Acoustic Logic.

Table 7 Noise management levels

Receiver	Land use	NML for time period, dB(A)			
		Standard Working Hours	Out of Hours Day(1) (Saturday afternoon & Sundays)	Out of Hours Evening(2)	Out of Hours Night(3)
SWHB Susan Wakil Health Building to the north of the subject site	Educational	45(4)	45(4)	45(4)	45(4)
StAC St Andrew's College to the south of the subject site	Student accommodation(5)	57	52	50	48
H1 Royal Prince Alfred Hospital to the west of the subject site.	Hospital	45(4)	45(4)	45(4)	45(4)
WC Wesley College located to the east of the subject site	Student accommodation(5)	59	54	53	52

(1) Any out of hours work occurring between 7 am and 6 pm.

(2) Any out of hours work occurring between 6 pm and 10 pm.

(3) Any out of hours work occurring between 10 pm and 7 am.

(4) Internally - applies when property in use.

(5) Residential land use has been applied to student accommodation

6.1.5 Commercial and industrial premises

The ICNG recommends NMLs for commercial and industrial land uses that are applicable during the time of day for which they are occupied. The external NMLs recommended are:

- industrial premises – external $L_{Aeq(15\text{-}minute)}$ 75 dB.
- commercial premises – external $L_{Aeq(15\text{-}minute)}$ 70 dB.
- other businesses that may be very sensitive to noise where the noise level is project specific.

Other noise sensitive commercial premises, such as cafes and restaurants, should be assessed on a project-by-project basis in consideration of the recommended maximum internal noise levels provided by AS 2107 *Acoustics – Recommended design sound levels and reverberation times for building interiors.*

6.1.6 Bio-resources

Bio-resources are understood to be located at various locations distributed across the university campus. Bio-resources are not addressed by the ICNG and therefore criteria have been developed from other guidance.

NMLs for bio-resources have been based on the Code of Practice for the Housing and Care of Laboratory, Mice and Rats – Department of Primary Industries, Victoria, 2004. The Code of Practice recommends noise limits of:

- 50 dB L_{eq} for steady continuous noise, that is to be free of distinct tones
- 85 dB L_{max} for short-term events.

The targets applied to a particular facility should be considerate of the frequency range associated with the bio-resources. For example, mice are typically considered sensitive across the range of 1,000 Hz and above, while for rats it is typically 200 Hz and above.

6.1.7 Ground-borne noise

Ground-borne noise is unlikely to be a controlling factor with respect to construction noise impacts as air-borne noise levels are likely to exceed the ground-borne noise levels. As such criteria for ground-borne noise have not been included in this CNVMP.

6.2 Construction vibration criteria

Ground vibration generated by construction can have a range of effects on buildings and building occupants, with the main effects generally classified as:

- Human disturbance – disturbance to building occupants: vibration which inconveniences or interferes with the activities of the occupants or users of the building.
- Effects on building structures – vibration that may compromise the condition of the building structure itself.

In general, vibration criteria for human disturbance are more stringent than vibration criteria for effects on building contents and structural damage. Building occupants will normally feel vibration readily at levels well below those that may cause a risk of cosmetic or structural damage to a structure. However, it may not always be practical to achieve the human comfort criteria. Furthermore, unnecessary restriction of construction activities can prolong construction works longer than necessary, potentially resulting in other undesirable effects for the local community.

Construction vibration criteria have been adopted from the following sources:

- Cosmetic and structural damage to buildings: German Standard DIN 4150-3[1].
- Cosmetic damage: British Standard BS 7385 Part 2-1993 *Evaluation and Measurement for Vibration in Buildings.*
- Human comfort: NSW EPA's Assessing Vibration – a technical guideline.

6.2.1 Cosmetic and structural damage

The DIN 4150-3 structural and cosmetic damage assessment criteria for different types of buildings are presented in Table 8. The criteria are specified as Peak Particle Velocity (PPV) levels measured in any direction at or adjacent to the building foundation.

[1] German Standard DIN 4150-3, 1999, *Structural Vibration – Part 3: Effects of vibration on structures*.

DIN 4150-3 states that exposing buildings to vibration levels higher than that recommended in Table 8 would not necessarily result in damage. Rather it recommends these values as maximum levels of short-term construction vibration at which experience has shown that damage that reduces the serviceability of structures will not occur due to vibration effects. DIN 4150-3 is considered to be suitable for the assessment of both structural and cosmetic damage as the standard considers a reduction in serviceability of the structure is deemed to have occurred if:

- Cracks form in plastered surfaces of walls.
- Existing cracks in the building are enlarged.
- Partitions become detached from loadbearing walls or floors.

Table 8 DIN 4150-3 vibration cosmetic and structural damage criteria

Structure type	Peak Particle Velocity (PPV) mm/s			
	Foundation of structure			Vibration at horizontal plane of highest floor at all frequencies
	< 10 Hz	10-50 Hz	50-100 Hz	
Buildings used for commercial, industrial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwelling and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in rows 1 and 2, and are of great intrinsic value (e.g. heritage-listed buildings)[1].	3	3 to 8	8 to 10	8

The guideline values from BS7385 relating to cosmetic damage from transient vibration are reproduced in Table 9.

Table 9 Transient vibration guide values for cosmetic damage (BS7385)

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		Frequency range	
		4-15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
(1) Values referred to are at the base of the building. (2) For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.			

DIN4150 and BS7385 state that exceedances of the guidance values do not necessarily mean that damage will occur, but that more detailed analysis may be required in order to quantify the site-specific relationship between vibration levels, strain and the potential for damage. If required, the additional analysis may include more detailed vibration, strain or displacement measurements combined with engineering analysis.

BS7385 also states that *a building of historical value should not (unless it is structural unsound) be assumed to be more vibration sensitive*.

6.2.2 Human comfort

The ICNG recommends that vibration from construction works be assessed under the EPA's *Assessing Vibration – a technical guideline* (the Vibration Guideline). The vibration assessment criteria defined in this guideline are for human comfort and represent goals that, where predicted or measured to be exceeded, require the application of all feasible and reasonable mitigation measures. Where the maximum value cannot be feasibly and reasonably achieved, the operator would need to negotiate directly with the affected community.

The Vibration Guideline defines vibration assessment criteria for continuous, impulsive and intermittent vibration. Vibration can be classified according to the following definitions:

- Continuous vibration: continues uninterrupted for a defined period. Applies to continuous construction activity such as tunnel boring machinery.
- Impulsive vibration: rapid build-up to a vibration peak followed by a damped decay or the sudden application of several cycles of vibration at approximately the same magnitude providing that the duration is short. Applies to very occasional construction activities that create distinct events such as the occasional dropping of heavy equipment.
- Intermittent vibration: interrupted periods of continuous vibration (such as a drill) or repeated periods of impulsive vibration (such as a pile driver).
- The majority of construction works as part of the proposal would be expected to be intermittent in nature with the potential for some impulsive activities (e.g. demolition works).

Table 10 presents the management levels for continuous and impulsive vibration at different land uses. The management levels specified are as overall unweighted Root-Mean-Square vibration velocity levels (V_{rms}). The Vibration Guideline specifies the management levels as suitable for vibration sources predominantly in the frequency range 8-80 Hz as would be expected for construction vibration.

Table 10 Daytime V_{rms} management levels for continuous and impulsive vibration

Receiver	Continuous vibration V_{rms}, mm/s		Impulsive vibration V_{rms}, mm/s	
	Preferred	Maximum	Preferred	Maximum
Critical areas(1)	0.1	0.2	0.1	0.2
Residences – daytime(2)	0.2	0.4	6	12
Residences – night-time(3)	0.14	0.28	2	4
Offices, schools, place of worship	0.4	0.8	13	26
Workshops	0.8	1.6	13	26

(1) Critical operating areas include hospital operating theatres and precision laboratories where sensitive operations are occurring.

(2) Daytime is defined by the Vibration Guideline to be 7 am to 10 pm.

(3) Night time is defined by the Vibration Guideline to be 10 pm to 7 am.

For intermittent vibration, the Vibration Dose Value (VDV) is used as the metric for assessment as it accounts for the duration of the source, which will occur intermittently over the assessment period. The VDV management levels at different land uses for intermittent vibration sources are presented in Table 11.

Table 11 VDV management levels for intermittent vibration

Receiver	VDV – Intermittent vibration, m/s$^{1.75}$	
	Preferred	Maximum
Critical areas(1)	0.1	0.2
Residences – daytime	0.2	0.4
Residences – night-time	0.13	0.26
Offices, schools, places of worship	0.4	0.8
Workshops	0.8	1.6

(1) Critical operating areas include hospital operating theatres and precision laboratories where sensitive operations are occurring.

(2) Daytime is defined by the Vibration Guideline to be 7 am to 10 pm.

(3) Night time is defined by the Vibration Guideline to be 10 pm to 7 am.

6.2.3 Sensitive Scientific and Medical Equipment

Certain scientific equipment such as electron microscopes, medical diagnostic equipment and microelectronics manufacturing tools may require more stringent vibration limits than those typically applicable for human comfort. Where vibration-sensitive scientific or medical instruments are known or expected to be in use within the premises of an identified vibration-sensitive receiver, performance objectives will be based on the equipment manufacturer's specifications.

In the absence of manufacturer specifications, the Vibration Criterion (VC) curves (as per ANSI S2.71/ISO 2631) will be used to define default vibration goals these are shown in Figure 3. These curves provide conservative RMS vibration limits, ranging from VC-A (0.050 mm/s) suitable for general labs to VC-E (0.003 mm/s) for ultra-sensitive instruments such as atomic force microscopes (AFMs).

It is important to note that the VC curves are conservative by design. Accordingly, baseline vibration monitoring is recommended to be conducted at locations identified as containing sensitive scientific or medical equipment prior to the commencement of construction activities. This baseline data, together with the VC criteria, will be used to establish site-specific vibration goals appropriate to the equipment in question.

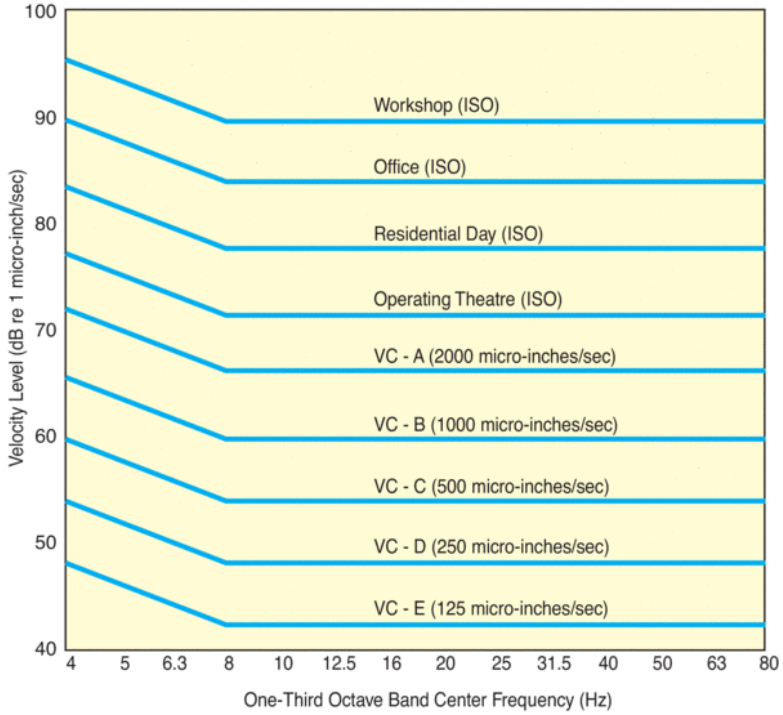


Figure 3 VC curves

6.2.4 Minimum working distances

The *Construction Noise and Vibration Guideline (CNVG)* (NSW Government, 2006) provides guidelines for minimum working distances for vibration-intensive activities with respect to the stated standards and guidelines. The minimum working distances for building damage should be complied with at all times. The distances are noted as being indicative and are likely to vary depending on the particular item of plant and local geotechnical conditions. The minimum working distances apply to addressing the risk of cosmetic (minor – easily reparable) damage of typical buildings under typical geotechnical conditions.

Where vibration intensive works are required to be undertaken within the specified minimum working distances, vibration monitoring should be undertaken to ensure acceptable levels of vibration are satisfied.

In relation to human comfort, the minimum working distances relate to continuous vibration. For most construction activities, vibration emissions would be intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods may be allowed.

Table 12 presents the recommended minimum working distances for vibration intensive plant.

Table 12 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Minimum Working Distance – Cosmetic Damage (BS7385)	Minimum Working Distance – Human Response (OH&E Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 metres	15 metres to 20 metres
	< 100 kN (Typically 2-4 tonnes)	6 metres	20 metres
	< 200 kN (Typically 4-6 tonnes)	12 metres	40 metres

Plant Item	Rating/Description	Minimum Working Distance – Cosmetic Damage (BS7385)	Minimum Working Distance – Human Response (OH&E Guideline)
	< 300 kN (Typically 7-13 tonnes)	15 metres	100 metres
	> 300 kN (Typically 13-18 tonnes)	20 metres	100 metres
	> 300 kN (> 18 tonnes)	25 metres	100 metres
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 metres	7 metres
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 metres	23 metres
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 metres	73 metres
Vibratory Pile Driver	Sheet piles	2 metres to 20 metres	20 metres
Pile Boring	≤ 800 mm	2 metres (nominal)	4 metres
Jackhammer	Hand held	1 metres (nominal)	2 metres

Figure 4 presents the safe working distances for a 4-tonne vibratory roller. It is noted that any vibratory roller greater than 4 tonnes will exceed the minimum working distance for the human response at any location within the site boundary and thus it is recommended that vibratory rollers of 4 tonnes and under should only be used for construction.

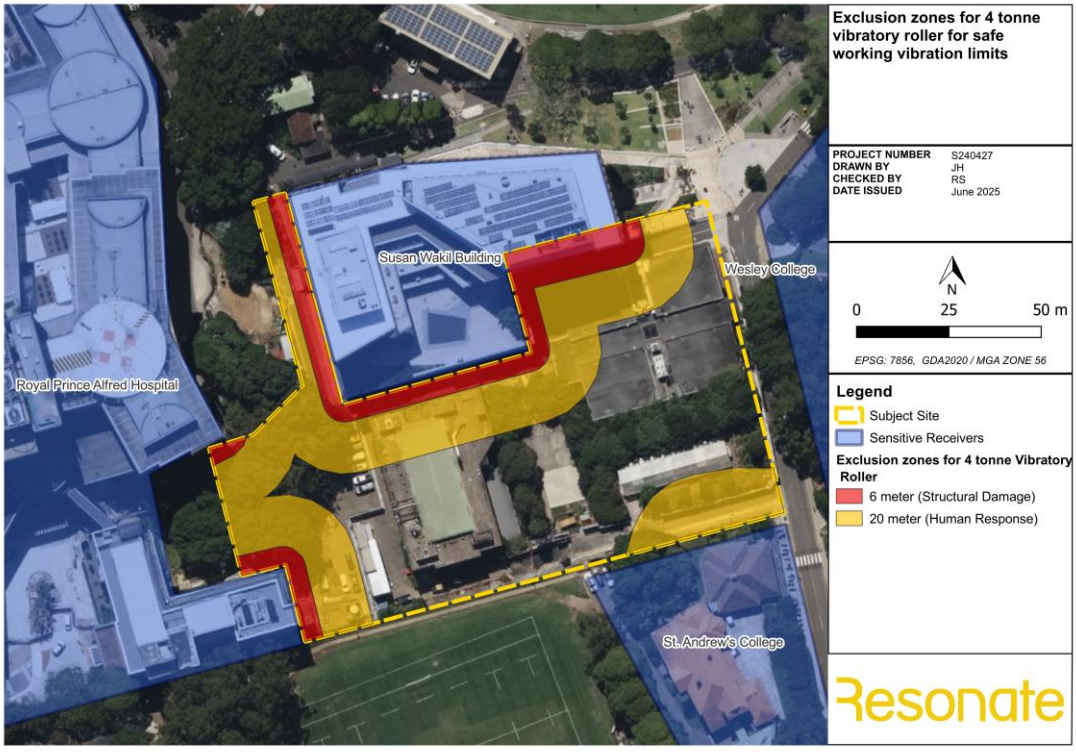


Figure 4 Exclusion zones for 4 tonne vibratory roller for safe working distances

6.3 Construction road noise criteria

The NSW Road Noise Policy (RNP) provides guidance, criteria and procedures for assessing noise impacts from existing, new and redeveloped roads and traffic generating developments. The assessment of road traffic noise impacts on public roads is assessed under the RNP.

The construction of the project will generate additional traffic on surrounding public roads, such as construction worker car movements and delivery and construction vehicle movements. Once construction is complete, project traffic is expected to return to levels similar to the current situation.

The RNP details a number of noise assessment criteria for various road categories and land uses.

The Application Notes for the RNP state that;

> *'for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.'*

If road traffic noise during the project construction is within 2 dB(A) of current levels then the objectives of the RNP are met and no specific mitigation measures are required. Where the project road traffic noise levels exceed 2 dB(A) of current levels than the consideration should be given to the actual noise levels associated with construction traffic and whether or not these levels comply with the RNP criteria as presented in Table 13.

Table 13 RNP Residential Road Traffic Noise Criteria

Road Category	Type of Project/Land Use	Assessment Criteria – dB(A)	
		Day 7am to 10pm	Night 10pm to 7am
Local roads	Existing residences affected by additional traffic on existing local roads by land use developments.	$L_{Aeq,15hr}$ 55(external)[1]	$L_{Aeq,9hr}$ 50 (external)[1]

(1) The assessment criteria for external noise levels apply at 1 metre from the facade of any affected residential receiver

An estimation of the anticipated noise level contribution of construction traffic on local roads has been conducted using the TfNSW Construction Noise Estimator Tool. The following indicative construction road traffic volumes have been assumed for the site:

- 30 two-way light vehicle movements per hour.
- 2 two-way heavy vehicle movements per hour.

The following has been determined:

- A typical $L_{Aeq(1\ hour)}$ noise level contribution of 52 dB(A) has been predicted for construction scenarios.
- A total combined noise level of 57 dB(A) is predicted with a noise level increase of 2 dB or less, noting that the existing daytime L_{Aeq} noise level is approximately 55 dB(A) outside of peak times.

Therefore, per the NSW RNP, no further assessment of construction road traffic is required.

7 Construction noise and vibration assessment

Construction noise and vibration impacts, as well as road traffic noise impacts associated with the construction of the project have been assessed within the CNVIA prepared by Acoustic Logic - *Appendix U – Noise and Vibration Assessment.* The following sections provides a summary of the noise and vibration impact assessments presented in the CNVIA report.

7.1 Construction Noise

The noise assessment was undertaken in accordance with the NSW Environment Protection Authority's Interim Construction Noise Guideline (ICNG, DECC 2009). Construction activities are expected to occur within standard daytime hours (Monday to Friday: 7 am–6 pm; Saturday: 8 am–1 pm), consistent with regulatory guidance.

As outlined in Appendix U, several sensitive receivers were identified in proximity to the site, including adjacent university buildings, hospitals, and student accommodation. Predicted external noise levels associated with typical construction plant (e.g. concrete pumps, vibrators, trucks, and cranes) range from 48 to 67 dB(A). These levels are anticipated to exceed relevant Noise Management Levels (NMLs) at some nearby receivers during certain phases of work, particularly structure erection and high-activity stages adjacent to boundaries. However, internal noise levels considering typical façade attenuation are generally expected to remain within acceptable limits.

The report recommends the implementation of feasible and reasonable mitigation measures, such as appropriate equipment selection, scheduling of high-noise works, and temporary acoustic shielding where practicable.

Notwithstanding, noise mitigation measures and application of good practice noise management have been considered. Noise mitigation and management measures are discussed in Section 8 of this plan.

7.2 Construction Vibration

The vibration assessment was conducted with reference to the EPA's Assessing Vibration: A Technical Guideline and German Standard DIN 4150-3 (2016) for structural damage risk. Based on the construction methodology and separation distances to nearby buildings, vibration impacts are predicted to remain below thresholds for both cosmetic and structural damage.

Safe working distances for vibration-generating plant, such as vibratory rollers and hydraulic hammers, have been established. The report recommends monitoring and mitigation protocols in the event of complaints or elevated risk, including real-time attended vibration monitoring and engagement with affected stakeholders. These measures are further detailed in Sections 8 and 10 of this plan.

7.3 Road Traffic Noise

Construction-related traffic is expected to utilise existing road infrastructure. Appendix U concludes that vehicle movements associated with the proposed works are unlikely to result in exceedances of applicable criteria outlined in the EPA's Road Noise Policy (2011), given the temporary and low-volume nature of these activities. Ongoing monitoring and management will be undertaken to ensure compliance and respond to any community concerns, in accordance with the recommendations of Appendix U – Noise and Vibration Assessment.

8 Construction noise and vibration mitigation and management measures

This section outlines noise management measures that will be implemented as part of the construction works, including consultation and complaint handling procedures.

It may not be feasible to adopt all management measures at all times during construction, and identification of all reasonable and feasible mitigation methods will be conducted by the Site Manager and/or environmental representative on a regular basis during noisy works near sensitive land uses.

In relation to the implementation of mitigation measures, feasibility addresses engineering consideration regarding what is practical to build. Reasonableness relates to the application of judgment in arriving at a decision, taking into account the following factors:

- noise reduction achieved
- number of people or other uses benefited
- cost of the measure
- delay to schedule and whether the measure will prolong exposure to noise
- community views
- pre-construction noise levels at receivers.

While the management measures presented will not necessarily result in mitigating all noise impacts at all times, they are expected to reduce impacts to levels most stakeholders should find acceptable considering the anticipated benefits of the completed project as a whole.

8.1 Reasonable and practicable

During works where the noise or vibration limit is predicted or measured to be exceeded at the relevant receiver or structure the Site Manager will implement all reasonable and practicable mitigation measures in accordance with this Plan. The assessment of reasonable and practicable mitigation will be based upon the following factors:

- Reasonableness:
  - Noise or vibration reduction achieved
  - cost of the mitigation measure
  - delay to schedule.
- Practicability:
  - consideration regarding the feasibility of implementing the mitigation measure.

8.2 Mitigation and management measures

Table 14 summarises potential noise and vibration mitigation and management measures to be implemented on site where possible to help reduce impacts where required.

Table 14 Noise and vibration management measures

Reference	Details of management measures	Responsibility
Implemented throughout external works		
NVMM01	Stakeholder engagement & communication during construction works to keep stakeholders informed.	Stakeholder & Workforce Development Manager

Reference	Details of management measures	Responsibility
Implemented throughout external works		
NVMM02	Site induction will cover noise and vibration management and complaints, which will be reiterated through onsite training such as toolbox talks or pre-starts.	Site Manager
NVMM03	Effective stakeholder communication is a key mitigation measure.	Stakeholder & Workforce Development Manager
NVMM04	The potential shielding provided by site topography and intervening buildings will be taken into account in locating equipment.	Site Manager
NVMM05	Processes and equipment that generate lower noise levels will be selected.	Project Manager
NVMM06	Noisy plant, site access roads and site compounds will be located as far away from occupied premises as is practical to allow efficient and safe completion of the task.	Project Manager
NVMM07	Equipment that emits noise predominantly in a particular direction will be sited such that noise is directed away from occupied premises.	Site Manager
NVMM08	Works planning will consider minimising vehicles and equipment queuing, idling or reversing near occupied premises.	Site Manager
NVMM09	Truck movements on local roads will be limited as much as possible.	Site Manager
NVMM10	Plan material haulage routes to minimise impacts to the community.	Project Manager
NVMM11	Equipment that is used intermittently will be shut down or throttled down to a minimum during periods where it is not in use.	Site Manager
NVMM12	Where noisy plant is to be fixed in a stationary location such that it may impact on sensitive receivers for a significant length of time (i.e. generator located in a stockpile site for the duration of the project), noise mitigation (such as an acoustic screening, silenced generator or lighting tower) will be installed.	Site Manager
NVMM13	For the compound site, where possible ensure a break in line-of-site / reduction in sight lines to ground level receivers by ensuring the surrounding boundary fence is solid in nature with no gaps and minimum 2.1m high. We note it will be impractical to break sight lines to multi-storey building's overlooking the site.	Site Manager

Reference	Details of management measures	Responsibility
Implemented throughout external works		
NVMM14	Low vibration alternatives for plant will be implemented where feasible, such as the smallest vibratory compactor practically capable of completing the task.	Project Manager
NVMM15	Broadband (rather than tonal) alarms will be fitted to regularly reversing vehicles where possible in accordance with site safety protocols. Broadband alarms should be installed on vehicles prior to entering project construction site. Evidence of the installation of broadband alarms should be provided to the project manager.	Project Manager
NVMM16	Where there is risk of vibration goals being exceeded by plant that has high and low vibration operation settings, this plant will be run on the lowest effective vibration setting.	Site Manager
NVMM17	Where vibration compaction works are occurring near to sensitive receivers or structures, the smallest size roller capable of completing the works will be used where this is practical.	Site Manager
NVMM18	Where vibratory compaction works are occurring within the safe working distances for building damage, static rolling will be used where feasible. This is to be informed by the vibration testing during works.	Project Manager
NVMM19	For all works, adaptive management techniques are to be implemented. Noting that criteria in this report are guidelines, and therefore continual assessment/review of works and the building's structural response should be noted throughout the project. These observations will inform ongoing decisions – to this end, a logbook shall be maintained for the duration of the project.	Project Manager
NVMM20	Works to be undertaken during Standard Working Hours where possible.	Construction Manager
NVMM21	The induction of site staff will include a reference to potential noise impacts and the identification of noise-sensitive land uses.	Site Manager & WH&S Manager
NVMM22	'Toolbox talks' will include a reference to any noise management measures being implemented on site at the time.	Site Manager
NVMM23	Where possible, schedule work breaks at same time as sensitive times for receivers. For example, break for lunch between 12 pm and 2 pm when catering usage is busy.	Site Manager

Reference	Details of management measures	Responsibility
Implemented throughout external works		
NVMM24	Implement complaint response procedures as detailed in Section 8.3	Stakeholder & Workforce Development Manager
NVMM25	Vehicle warning devices, such as horns, are not to be used as signalling devices.	Site Manager Operators
NVMM26	No swearing or unnecessary shouting or loud stereos/radios on site. No radios or speakers are allowed on University projects.	Site Manager
NVMM27	No unnecessary dropping of materials from height, throwing of metal items and slamming of doors.	Site Manager
NVMM28	Truck movements will use arterial roads and be diverted away from residential streets where feasible.	Construction Manager
NVMM29	Traffic flow, parking and loading/unloading areas will be planned to avoid the need for reversing near sensitive receivers.	Site Manager
NVMM30	Two-way radios will be used at the minimum effective volume.	Site Manager Operators
NVMM31	Quieter construction methods will be used where feasible and reasonable.	Construction Manager
NVMM32	Noise levels of plant and equipment will be considered in rental decisions and all plant and equipment will be selected and operated to be compliant with the sound power levels by referring to the SSDA noise and vibration impact assessment report wherever possible.	Construction Manager
NVMM33	Simultaneous operation of noisy plant close together and near the sensitive receivers will be avoided.	Site Manager
NVMM34	The offset distance between plant and sensitive uses will be maximised.	Site Manager
NVMM35	Plant emitting noise in a particular direction will be directed away from sensitive receivers.	Site Manager
NVMM36	Locate plant and equipment to take advantage of barriers provided by existing site features and structures.	Site Manager Operators
NVMM37	Implement mufflers/silencers on plant and equipment. Undertake regular maintenance of plant and equipment, including silencers, to ensure that noise emissions do not increase over time. Servicing, refuelling and warm-up to be undertaken during standard construction hours.	Site Manager Operators

Reference	Details of management measures	Responsibility
Implemented throughout external works		
NVMM38	Noise associated with packing up plant and equipment at the end of works will be minimised.	Site Manager Operators
NVMM39	Construction vehicles (including concrete agitator trucks) are not to arrive at the site or surrounding residential colleges outside of the construction hours of work defined in Section 5.2.	Site Manager Operators

8.3 Complaint handling

The person receiving complaints will have the ability to implement reasonable and feasible measures to action the complaint. These measures may include modification of the work site or work practices, or a review of night activities.

The following complaint management procedure will be implemented during all works:

1) Assess whether the issue can be resolved easily and take immediate action if possible.
2) If not, assess the construction site and activities and determine whether there is any reason to believe noise levels are higher than anticipated.
3) Undertake monitoring of noise (where this is an appropriate response).
4) Ensure all planned management measures have been appropriately implemented.
5) If steps 3 and 4 are correct, no further site actions are required (proceed to step 8).
6) If steps 3 and 4 are incorrect, implement all reasonable and practicable mitigation measures where possible and implement correct engagement procedures.
7) Ensure person receiving complaints is well briefed on the existing mitigation measures in place during the activity and the justification for the activity and understands the details of any night works approvals (if applicable).
8) Advise complainant of actions undertaken.

Records of any noise and vibration complaint received during the works, and the action taken in response to the complaint, will be maintained throughout the works. Complaints received will be issue to Principal to be uploaded onto the project website as per SSDA condition.

9 Compliance management

9.1 Roles and responsibilities

Complaints and enquiries from the public are to be directed in the first instance to the Stakeholder & Workforce Development Manager. All complaints shall be logged in the Project Complaints Register which records the following information:

- date and time of complaint;
- name and contact details of complainant;
- nature of complaint;
- number of people in the household affected in relation to a complaint, if relevant;
- method by which the complaint was made;
- action taken and by whom;
- means by which the complaint was addressed and whether resolution was reached, with or without mediation;
- if no action was taken, the reason(s) why no action was taken.

The main points of public contact will be displayed on project signage and on public facing project information:

- Project email address: sydneybiomedicalaccelerator@richardcrookes.com.au
- Website: https://www.sydney.edu.au/about-us/campuses/transforming-our-campus.html

In addition to the above, Richard Crookes Constructions will be submitting the Communications Consultation & Engagement Plan which will outline and align to all of the above.

Richard Crookes Constructions Project Team's organisational structure and overall roles and responsibilities are to be outlined in the Project Management Plan. Responsibilities for the implementation of specific mitigation measures for noise and vibration management are detailed in Section 8.2.

9.2 Training

All employees, sub-contractors, and utility staff working on site shall be provided with relevant environmental and sustainability information and training, as applicable, to ensure they understand their responsibilities and are competent to perform their duties in a compliant, environmentally responsible, and sustainable manner.

These responsibilities and requirements will be communicated at multiple stages, beginning during the tender process and continuing through the development of construction methodologies, to ensure that environmental and sustainability considerations are embedded in the planning of works. This communication will be reinforced during site inductions and maintained through ongoing training, including toolbox talks, briefings, notifications, and other appropriate communication forums.

At minimum, the training shall include the following:

- Existence and requirements of this CNVMP.
- Standard Working Hours.
- OOHW.
- Location of noise sensitive areas and receivers.
- General noise and vibration management measures, including monitoring procedures.
- Areas predicted to exceed noise and vibration criteria.
- Complaints reporting.

Richard Crookes Construction's Health Safety and Environment Site Induction documentation should be updated to adopt all noise and vibration related requirements.

10 Communication and consultation

This section outlines the community consultation and engagement measures undertaken to inform the construction noise and vibration management strategies, in accordance with the requirements of Condition B21.

Richard Crookes Constructions has prepared the Community Consultation & Engagement Plan (CCEP) which forms part of the RCC Project Management Plan (PMP) for the Sydney Biomedical Accelerator (SBA). This Plan has been prepared to outline the procedures and mechanisms to facilitate communication between Richard Crookes Constructions and interested and engaged stakeholders and community members.
This plan also acts as a sub-plan to support the existing Community Engagement and Consultation Plan (CECP) created by The University of Sydney and Sydney Local Heath District.

Communication with the relevant community groups and stakeholders, including noise and vibration complaints shall be managed collectively in accordance with this CNVMP, CECP and the CCP. Key risk areas should also be

communicated to all project staff and subcontractors to ensure that sensitive receivers are managed appropriately during construction.

B21(d) – Community-Informed Strategies for High Noise Generating Works

High noise generating activities, including rock excavation, hammering and driven piling, have been planned with specific regard to nearby sensitive receivers. Noise management strategies were developed in consultation with key stakeholders including St Andrews College, Wesley College, Sydney Local Health District (SLHD), and the University of Sydney.

These strategies include:

- Restricting high noise works to the hours of 9:00 am–12:00 pm and 2:00 pm–5:00 pm on weekdays, and 9:00 am–12:00 pm on Saturdays;
- Provision of respite periods during times identified by stakeholders as sensitive;
- Advance notification to affected stakeholders detailing the nature, timing, and duration of high-noise activities;
- Application of alternative, lower-impact construction methods where feasible (e.g., non-percussive techniques).

B21(e) – Community Consultation Undertaken

Consultation was undertaken in accordance with the University of Sydney's *Community Engagement and Consultation Plan* (Version 4.0, July 2023). Engagement activities conducted between February and June 2023 included:

- Direct engagement with nearby stakeholders, including residential colleges;
- Distribution of newsletters and letterbox drops to approximately 150 local residences and businesses;
- Establishment of a dedicated email address and telephone line for project enquiries;
- Publication of project updates via University staff communications and online platforms;
- Ongoing liaison with SLHD and briefings with relevant authorities.

Stakeholder feedback will be used to refine the work schedules and subsequent mitigation measures.

B21(f) – Complaints Management System

As defined in Section 8.3, a complaints management system will be implemented throughout the construction period, including:

- A dedicated project contact (sydneybiomedicalaccelerator@richardcrookes.com.au) for community enquiries;
- A formal complaints register to document, track, and respond to all issues raised;
- Response timeframes targeting acknowledgment within 24 hours and resolution within five business days;
- Documentation of actions taken in response to each complaint.

Complaints will be reviewed regularly to identify trends and inform ongoing management practices.

B21(g) – Monitoring and Reporting Program

A monitoring and reporting framework will be implemented to evaluate environmental performance and compliance with noise and vibration management objectives. This will include:

- Routine noise and vibration monitoring at representative sensitive receiver locations;
- Weekly reporting during periods of high-impact construction, and monthly summaries during standard works;
- Ongoing assessment against predicted impact levels and effectiveness of mitigation measures;
- Annual review and update of the CNVMP, or earlier where required due to audit outcomes, incidents or stakeholder feedback.

Noise and vibration monitoring results as detailed in Section 11 below will be reported to key stakeholders upon request to ensure accountability and compliance with approval conditions.

11 Monitoring

Additional management actions are proposed as alternative measures to support the practical management of noise and vibration impacts. These actions are effective in identifying specific sources of noise and vibration during construction and can inform the development of appropriate community-focused mitigation measures.

The table below identifies the noise monitoring that will be carried out for the project, including the personnel requirements for carrying out the monitoring.

Table 15 Noise and vibration monitoring plan

Situation	Monitoring requirements	Frequency, reporting and responsibility
Noise monitoring		
Monitoring to assess typical construction noise levels at noise sensitive receivers.	If monitoring cannot be undertaken at the nearest relevant sensitive receiver, a suitable representative location will be selected. Indicative locations for attended and unattended noise monitoring are presented in Appendix A. The testing method includes: • Sound level meter configured for "Fast" time weighting and "A" frequency weighting. • Test environment free from reflecting objects where possible. Where noise monitoring is conducted within 3.5 metres of large walls or a building facade, then a reflection correction of up to -2.5 dB(A) will be applied to remove of increased noise due to sound reflections. • Tests will not be carried out during rain or when wind speed exceeds 5m/s. • Conditions such as wind velocity and direction, temperature, relative humidity and cloud cover will be recorded from the nearest Bureau of Meteorology station or on-site weather station/observations. • The monitoring period should be sufficient such that measured noise levels are representative of noise over a 15-minute period. • At a minimum L_{Aeq}, $L_{AF,max}$, L_{A10} and L_{A90} levels will be measured and reported. • For noise-sensitive receivers located within the SWHB, vibration criteria shall be determined in consultation with the stakeholders responsible for the affected spaces. The observations of the person undertaking the measurements will be reported including audibility of construction noise, other noise in the environment and any discernible construction activities contributing to the noise at the receiver.	<u>Frequency</u> Either; On a minimum bi-monthly basis for attended monitoring **or** Permanent unattended noise loggers located at the locations defined in Appendix A. **or** A combination of the above. <u>Reporting</u> Written reports for all bi-monthly noise monitoring will be maintained by Richard Crookes Constructions staff and made available to key stakeholders upon request. In the case of unattended monitoring, noise data must be continuously recorded and retained as part of the ongoing monitoring process. <u>Responsibility</u> Monitoring to be undertaken by a suitably qualified acoustic consultant.

Situation	Monitoring requirements	Frequency, reporting and responsibility
Where complaint is received and monitoring is considered an appropriate response to determine if noise levels exceed predicted construction noise levels documented in this CNVMP.	If monitoring cannot be undertaken at the nearest relevant sensitive receiver, a suitable representative location will be selected. Indicative locations for attended and unattended noise monitoring are presented in Appendix A. The testing method includes: • Sound level meter configured for "Fast" time weighting and "A" frequency weighting. • Test environment free from reflecting objects where possible. Where noise monitoring is conducted within 3.5 metres of large walls or a building facade, then a reflection correction of up to -2.5 dB(A) will be applied to remove of increased noise due to sound reflections. • Tests will not be carried out during rain or when wind speed exceeds 5m/s. • Conditions such as wind velocity and direction, temperature, relative humidity and cloud cover will be recorded from the nearest Bureau of Meteorology station or on-site weather station/observations. • The monitoring period should be sufficient such that measured noise levels are representative of noise over a 15-minute period. • At a minimum L_{Aeq}, $L_{AF,max}$, L_{A10} and L_{A90} levels will be measured and reported. • For vibration-sensitive receivers located within the SWHB, vibration criteria shall be determined in consultation with the stakeholders responsible for the affected spaces. The observations of the person undertaking the measurements will be reported including audibility of construction noise, other noise in the environment and any discernible construction activities contributing to the noise at the receiver.	<u>Frequency</u> As required for complaints. <u>Reporting</u> Report detailing measurement results and any corrective actions to be provided to the complainant and relevant stakeholders. <u>Responsibility</u> A suitably qualified acoustic consultant will undertake monitoring to resolve complaints.

Situation	Monitoring requirements	Frequency, reporting and responsibility
Spot checks of noisy plant to determine noise emission levels for: • assessing compliance against manufacturer specifications • assisting to assess accuracy of predictions • assessing quieter construction techniques where required.	Stationary test procedures according to AS 2012.1:1990 *Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition*. The testing method includes: • Sound level meter configured for "Fast" time weighting and "A" frequency weighting. • The test environment will be free from reflecting objects. • Tests will not be carried out during rain or when wind speed exceeds 5 m/s. • In accordance with *AS 2012.1*, a minimum of three measurement points will be defined at locations on the hemispherical surface around the plant with the radius determined by the basic length of the machine. • The L_{A90} background noise level at the measurement locations will be at least 6 dB and preferably 10 dB below the level with plant operating. • L_{Aeq} and L_{A10} levels will be measured and reported.	Frequency On an as required basis during main works. Reporting Records of spot checks of noisy plant will be maintained by Richard Crookes Constructions. Responsibility Monitoring to be undertaken by Richard Crookes Constructions staff suitably experienced in carrying out noise monitoring or by a suitably qualified acoustic consultant.
Vibration monitoring		
If any works occur within safe working distances for damage to buildings, detailed in Section 6.2.	Continuous vibration monitoring conducted throughout works as follows: • Geophone installed at ground adjacent to building foundations or equivalent (or nearer) location if access not provided to the outside of the building. • Monitor to continuously record PPV vibration level in 15-minute (or shorter) intervals. • If PPV level exceeds 75% of the minimum DIN 4150-3 building damage limit, an alert will be sent to nominated site staff via email/SMS. This will include a Site Supervisor with suitable authority to stop work. • Upon receipt of an alert, work will STOP. • Necessary modifications will be made to work practices to reduce the vibration level and the works will continue as long as further alerts are not received. • Note that if the frequency of the vibration event is such that 75% of the DIN 4150-3 limit was not exceeded, then works will proceed with caution, and the alert level adjusted as appropriate.	Frequency If required if works change such that works may occur in safe working distances for buildings. Reporting Records of logged vibration levels will be maintained by Richard Crookes Constructions. Responsibility Monitoring to be undertaken by a suitably qualified acoustic consultant.

Situation	Monitoring requirements	Frequency, reporting and responsibility
Vibration monitoring in response to a complaint, where this is considered an appropriate response.	Attended vibration monitoring will be conducted of the relevant activities as follows: • Geophone installed at ground adjacent to building foundations or equivalent (or nearer) location if access not provided to the outside of the building. • Monitor to continuously record PPV and/or VDV vibration levels generated by the activity. • Measured levels to be compared to human disturbance vibration goals and/or building damage limits as appropriate. • For vibration-sensitive receivers located within the SWHB, vibration criteria shall be determined in consultation with the stakeholders responsible for the affected spaces. If necessary following the vibration measurements: • Appropriate vibration management measures will be implemented. Continuous vibration monitoring will be considered if this is considered of benefit to address the complaint.	<u>Frequency</u> As required for complaints. <u>Reporting</u> Report detailing measurement results and any corrective actions to be provided to the complainant and relevant stakeholders. <u>Responsibility</u> A suitably qualified acoustic consultant will undertake monitoring to resolve complaints.

Situation	Monitoring requirements	Frequency, reporting and responsibility
Monitoring to assess typical construction vibration levels at noise sensitive receivers.	Vibration monitoring will be conducted of the relevant activities as follows: • Geophone installed at ground adjacent to building foundations or equivalent (or nearer) representative location. • Monitor to continuously record PPV and/or VDV vibration levels generated by the activity. • Measured levels to be compared to human disturbance vibration goals and/or building damage limits as appropriate. • For vibration-sensitive receivers located within the SWHB, vibration criteria shall be determined in consultation with the stakeholders responsible for the affected spaces. If necessary following the vibration measurements: • Appropriate vibration management measures will be implemented. Continuous vibration monitoring will be considered if this is considered of benefit to address the complaint.	<u>Frequency</u> Either; On a minimum bi-monthly basis for attended monitoring **or** Permanent unattended vibration loggers located at the locations defined in Appendix A. **or** A combination of the above <u>Reporting</u> Written reports for all bi-monthly vibration monitoring will be maintained by Richard Crookes Constructions staff and made available to key stakeholders upon request. In the case of unattended monitoring, vibration data must be continuously recorded and retained as part of the ongoing monitoring process. <u>Responsibility</u> Vibration monitoring shall be undertaken by Richard Crookes Constructions staff with appropriate experience or by a suitably qualified acoustic consultant. In the event of a complaint, monitoring must be conducted by a suitably qualified acoustic consultant.

12 Conclusion

Resonate Consultants have been engaged by Richard Crookes Constructions to develop a Construction Noise and Vibration Management Plan for the Sydney Biomedical Accelerator, located within the University of Sydney Camperdown Campus.

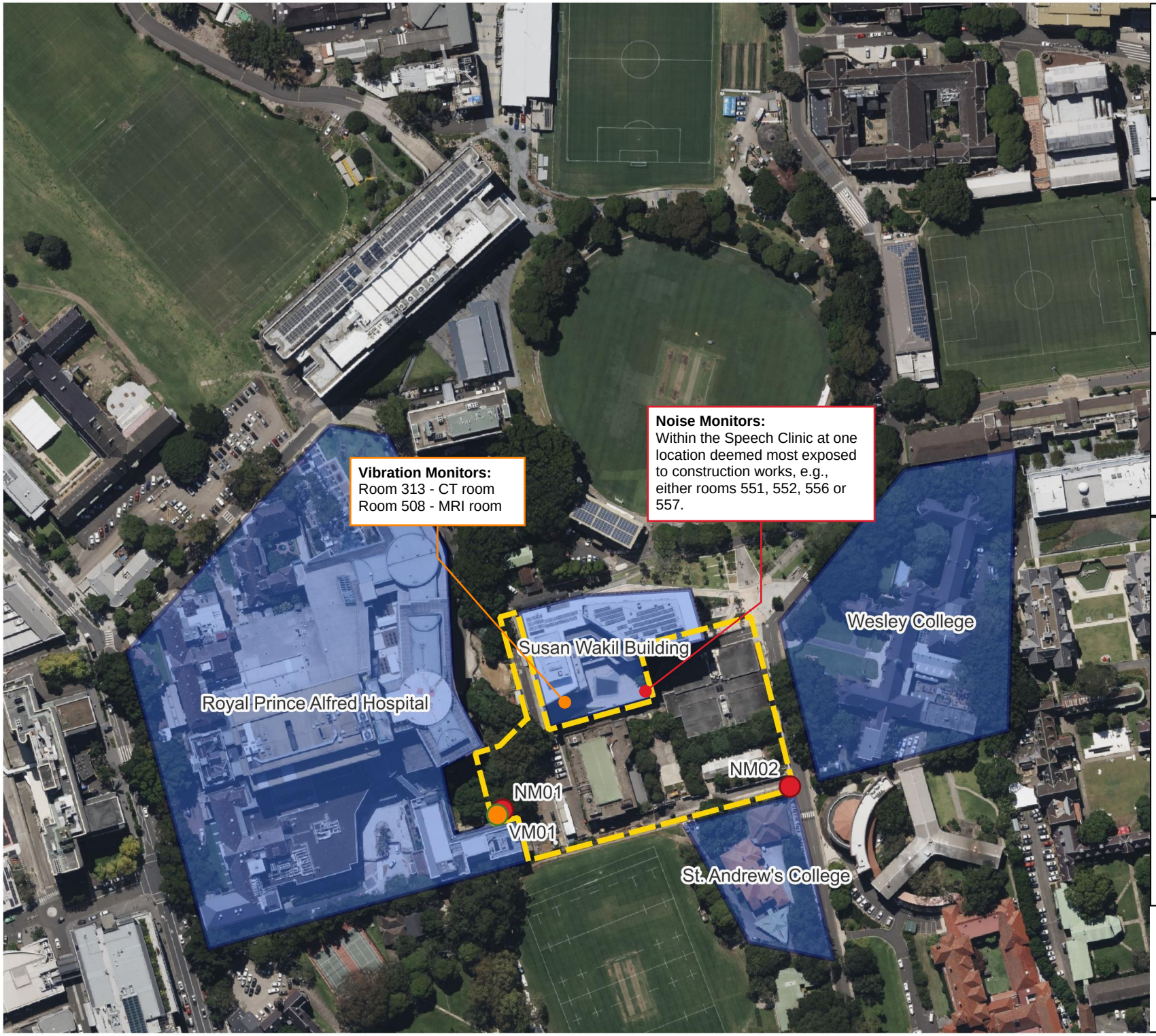
This Construction Noise and Vibration Management Plan outlines the framework for identifying, assessing, and managing potential noise and vibration impacts. It has been developed to ensure compliance with relevant planning conditions, including DA Condition B21, and to support the principles of reasonable and feasible mitigation in accordance with applicable guidelines and legislation.

The assessment has considered construction methodologies and their potential impacts on nearby sensitive receivers. Appropriate noise and vibration criteria have been adopted, and risk management strategies, including mitigation, monitoring, and community consultation protocols have been developed to minimise potential adverse impacts throughout the ground works, construction and landscaping phases.

Mitigation strategies are tailored to the site-specific context and include both proactive planning measures and responsive adaptive management practices.

Monitoring procedures will be implemented to verify compliance, respond to complaints, and inform continuous improvement of mitigation practices. Any changes to the construction methodology or project schedule will trigger a review of this CNVMP to ensure continued relevance and effectiveness.

Appendix A – Noise and vibration monitoring locations.



Site Overview

Proposed locations for noise and vibration monitoring

PROJECT NUMBER	S240427
DRAWN BY	SF
CHECKED BY	CH
DATE ISSUED	May 2025

N

0 50 100 m

EPSG: 7856, GDA2020 / MGA ZONE 56

Legend

- Subject Site
- Vibration Monitor
- Noise Monitor
- Sensitive Receivers

Resonate

Appendix B – Author and reviewer CVs.

Cameron Heggie

Principal Consultant

Qualifications

- Master of Design Science (Acoustics)
- Bachelor of Environmental Science

Affiliations

- Member of the Australian Acoustical Society
- Member of the Institute of Acoustics

Career history

Cameron Heggie graduated with an MDSc in Architectural Design Science (Acoustics) in 2011 from the University of Sydney. By completing research and design projects in the fields of room acoustics qualification, electro-acoustics, loudspeaker design and project management, he has developed a passion for creating a balance between acoustic functionality and aesthetics in the built environment.
During his 12-year career in acoustics, Cameron has led numerous projects across a broad range of industries, including, education, arts and culture facilities, commercial developments, performance spaces, transport infrastructure and laboratories. Cameron has endeavoured to maintain a broad skill base over his career and has worked in various capacities, including project management, acoustic design lead, technical reviewer and post-construction compliance.

Cameron also has a strong interest in inclusive, sustainable and low environmental impact design and looks to include this in his work where possible.
He was awarded the Australian Acoustical Society 'Education in Acoustics' prize for his research on room diffusion and has authored research papers on Higher Order Ambisonics and Aural Diversity in educational settings.

Contact details

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e cameron.heggie@resonate-consultants.com

Project Experience

Arts & Culture

- Australian Museum, vibration monitoring and assessment for various exhibitions, Sydney
- Powerhouse Ultimo Redevelopment, Sydney, Australia
- Stedelijk Museum, Amsterdam, The Netherlands
- Theatre Zuidplein, Rotterdam, The Netherlands
- Biotopia Naturkundemuseum Auditorium, Bayern, Germany
- Tambillo Cultural Centre, Ecuador
- Bahrain International Circuit Amphitheatre, Kingdom of Bahrain
- Şişli Harbiye Open-Air Theatre, Istanbul, Turkey
- Sydney Opera House, Sydney, Australia
- State Theatre and Gowings Building, Sydney, Australia

Public Sector

- LocHal, Tilburg, Netherlands
- OBA Public Library, Amsterdam, The Netherlands
- Breda Law Courts, Breda, The Netherlands
- New Ethiopian Parliament Building, Ethiopia
- dlr Lexicon Library and Cultural Centre, Dún Laoghaire, Ireland
- Parnell Square Cultural Quarter, Dublin, Ireland
- Marrickville Library, Sydney, Australia

Health

- Manly Health & Wellbeing Precinct, Sydney, Australia
- National Paediatric Hospital, Dublin, Ireland
- Bispebjerg Somatic Hospital, Copenhagen, Denmark
- Children's Medical Research Institute, Westmead Hospital, Australia

Education

- CB04a sensitive laboratory, University of Technology Sydney, Australia

- St. Edwards College, Gosford, Australia
- UTS Block 15, Sydney, Australia
- Urban Schools Technical Brief, Schools Infrastructure New South Wales, Australia
- Physics, Astronomy & Electrical Engineering Faculty, Macquarie University, Sydney, Australia.
- J03 Electrical Engineering Faculty, Sydney University, Australia
- Hawkesbury Institute for Environment, Western Sydney University, Australia
- Wolfert Dalton & De Brug Mytylschool, Rotterdam, the Netherlands
- Sint Lucas High School, Eindhoven, Netherlands
- National Automotive Innovation Centre, Warwick, UK
- Sandwell 6th form college, Birmingham, UK
- Warwick Independent Schools Foundation, Warwick
- Creative Industries Precinct II, Queensland University of Technology, Brisbane, Australia

Science & Industry

- Irish Cement Ltd, Platin and Limerick Plants, Ireland
- Origio & CooperSurgical, Hilvarenbeek, The Netherlands
- Mars Petcare Factory, Rostov-on-Don, Russia
- Schüco acoustic testing facility, Germany
- Jaguar and Land Rover Engine Manufacturing Centre Mod 4, Wolverhampton, UK
- Thames Tideway Tunnel, Thames Water, UK
- Datacenters for confidential clients, various locations, The Netherlands, Germany & Italy

Road

- Coffs Harbour Bypass, Coffs Harbour, Australia
- Highway 2000 Jamaica, Section 1B, Jamaica
- MR83 Summerland Way, Grafton, Australia
- A120 Little Hadham Bypass, Little Hadham, UK
- Widening of A14, Cambridgeshire, UK

Rail

- Western Sydney Airport Metro, Sydney, Australia
- Cross Island Line, Singapore
- Thomson-East Coast Line, Singapore
- Crossrail Elizabeth Line, London, UK
- Croxley Rail Link, Croxley, UK
- Flackarp-Arlov Rail expansion tender design, Malmo, Sweden
- Birmingham to Derby vibration testing, Birmingham, UK

Aviation

- Dublin Airport Authority PBZ, Dublin, Ireland
- Schiphol Airport, Amsterdam, The Netherlands

Sport

- Derby Multi Sport Arena, Derby, UK
- Randwick Racecourse, Sydney, Australia
- Perry Park, Alexandria, Sydney, Australia

Commercial

- Master Builders Association of SA – CLT base build and fitout, Adeliade, Australia
- Allens fitout, Sydney, Australia
- Central Place Sydney, Australia
- Royal Bank of Australia, head office renovation. Sydney, Australia
- Salesforce; Sydney, Dublin, Paris, London, Amsterdam & Munich
- Starbucks Roastery, Milan, Italy
- GoPro Studios, San Francisco, America
- Amore Pacific Headquarters, Seoul, Korea
- BBC Cardiff, Cardiff, Wales
- Paradise Circus Buildings D & E, Birmingham, UK
- Paradise Circus Master plan EIA, Birmingham, UK
- Barangaroo South C3, C4, C5, Sydney, Australia
- MLC Office Fit-out, Sydney, Australia
- 100 Mount St, Sydney, Australia
- 1 Bligh St, Sydney, Australia
- 48 Martin Place, Sydney, Australia
- 1 Eden Park, Sydney, Australia

Residential & Hotels

- HAUT, Amsterdam, The Netherlands
- Smaakkelaarspark, Utrecht, The Netherlands
- The Grace, Den Haag, The Netherlands
- Hilton Hotel and Congress Centre, Tashkent, Uzbekistan
- Chelsea Barracks, London, UK
- The Ritz Hotel, Madrid, Spain
- Various Luxury Villas, Barcelona, Spain

Defence

- HMAS Harman Buildings 132 & 133, Canberra, Australia
- HMAS Creswell, Jervis Bay, Australia

Raymond Sim

Principal Acoustic Consultant

Qualifications

Bachelor of Mechanical Engineering (Honours)

Affiliations

Australian Acoustical Society: Member.
Engineers Australia: Member.

Career history

Raymond has over 15 years of consulting experience in environmental, transportation and architectural acoustics. Raymond is passionate about acoustics and consulting. He has demonstrated ability to provide, lead and deliver high quality noise and vibration consulting services to clients on small scale developments and major infrastructure projects. His desire to be challenged and innovate often allows him to deliver exceptional outcomes and results for his clients.

Contact details

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e raymond.sim@resonate-consultants.com

Project experience

Raymond has been involved in a wide range of projects as an acoustic consultant, some of which include:

Transportation

- Sydney Gateway Road Project Detailed Design
- Newcastle Inner City Bypass EIS
- Garfield Road East REF
- Princes Highway and Jervis Bay Road Intersection Upgrade REF
- Wahroonga Estate Intersection Upgrade REF
- Alexandria to Moore Park Connectivity Upgrade REF
- Great Western Highway & Reservoir Road Intersection Upgrade REF
- Showground Road & Carrington Road Intersection Upgrade REF
- Hunter Expressway
- M7 Westlink Motorway

Power

- Ragland BESS (QLD)
- Kojonup BESS (WA)
- Rollingstone Solar Farm and BESS (QLD)
- Ausgrid Community BESS projects (NSW)
- Armidale BESS (NSW)
- Gin Gin BESS (QLD)
- Runchs Creek BESS (QLD)
- Mica Creek Gas Turbine Power Station (QLD)
- Billilingra Solar Farm (NSW)
- Hunter Power Gas Turbine Project (NSW)
- Merriwa Solar Farm and BESS Project (NSW)
- Peninsula Solar Farm (NSW)
- Tamworth BESS (NSW)
- New England Solar Farm (NSW)
- Daroobalgie Solar Farm in Parkes (NSW)
- Georgina Gas Turbine Power Station (QLD)
- Thomson Gas Turbine Power Station (QLD)
- Whittingham Solar Farm (NSW)
- AGL Newcastle Power Station (NSW)
- Ben Tre Wind Farm Project (Vietnam)
- Ausgrid Substation Projects (NSW)
- Vales Point Solar Farm (NSW)

Industry

- Austrak Minto Cold Storage Facility
- Dnata Catering Facility Mascot
- Parramatta Light Rail Maintenance Facility
- Mirani Water Recycling Facility (QLD)
- Broken Hill Water Pipeline Project

Construction

- Heathcote Road Intersection Upgrade
- Mascot Station Vertical Upgrade
- Sydney Metro Crows Nest Station
- Berry to Bomaderry
- Scots College Stevenson Library
- Commercial development at 15 Bourke Street, Alexandria
- Glenfield Transport Interchange
- Transport for NSW Easy Access Upgrade (various projects)
- Ausgrid Sydney CBD Cabling Project
- Ausgrid Transmission Cabling Project (from Surry Hills to Rose Bay; from Mason Park to Rozelle; from Willoughby/Artarmon to Crows Nest & North Sydney)
- Wynyard Walk

Appendix C – Out of Hours Work Protocol

Resonate

Sydney Biomedical Accelerator

Out of Hours Work Protocol

S240427RP2 Revision 0

Thursday, 19 June 2025

Resonate

Document Information

Project	Sydney Biomedical Accelerator
Client	Richard Crookes Constructions Pty Limited
Report title	Out of Hours Work Protocol
Project Number	S240427

Revision Table

Report revision	Date	Description	Author	Reviewer
0	19 June 2025	First Issue	Justin Hauswirth	Raymond Sim

Table of Contents

Project Name:	Sydney Biomedical Accelerator
Location:	Camperdown, New South Wales, Australia
Principle Contractor:	Richard Crookes Construction Pty Limited
Version:	1
Effective Date:	19 June 2025

1 Purpose of this document

This protocol establishes the procedures and controls for undertaking construction activities outside standard working hours, ensuring compliance with NSW regulatory frameworks and minimising disruption to the local community for the duration of construction of the Sydney Biomedical Accelerator.

2 Applicable legislation & guidelines

The following relevant legislation and guidelines have been considered in the creation of this protocol:

- Protection of the Environment Operations Act 1997 (NSW)
- Interim Construction Noise Guideline
- NSW EPA Noise Guide for Local Government
- NSW Environment Protection Licence
- Local Council development consent conditions
- Construction Environmental Management Plan (CEMP)
- NSW Work Health and Safety Regulation 2017

The EPA lists the following times as standard construction times:

- Monday to Friday: 7:00 am – 6:00 pm
- Saturday: 8:00 am – 1:00 pm
- No work on Sundays or public holidays

Out of Hours Work (OOHW) is any work conducted outside these times.

Out of Hours Work may be required due to the following circumstances:

- Safety-critical activities
- Time-sensitive concrete pours
- Utility shutdowns
- Traffic management constraints (e.g. night works on roads)
- Weather-dependent activities
- Emergency works

3 Approvals process

3.1 Internal approval

The primary contractor must submit an **OOHW Request Form** at least **5 working days** before planned work. The request form must contain at least the following information: scope, justification, timings, plant/equipment, mitigation strategies.

3.2 Regulatory approval

Seek approval from the *consent authority* (e.g. Council or Department of Planning) as per DA/Consent Approval conditions. If an Environment Protection Licence (EPL) applies, notify or obtain permission from NSW EPA as required. Include noise predictions, community consultation outcomes, and risk assessments where applicable.

3.3 Community notification

Notify all potentially affected stakeholders **at least 48 hours in advance** via letterbox drop, email, or SMS or as per any other requirement of the CNVMP.
OOHW notification must include:

- Description of works
- Expected duration
- Contact details for enquiries/complaints
- Mitigation measures

4 Noise and vibration management

4.1 Noise assessment

The *Interim Construction Noise Guideline* requires that a predictive noise assessment must be carried out prior to and works likely to generate significant noise during non-standard construction periods to determine the extent of potential noise impact.
The assessment must consider:

- Existing background noise levels
- Proximity and sensitivity of surrounding receivers
- Type and duration of activities
- Equipment noise levels

This informs whether the activity is feasible, what controls are needed, and what restrictions (if any) must be imposed.

4.2 Control measures

All OOHW must implement noise and vibration controls that are reasonable and feasible, including but not limited to:

- Using low-noise or electrically powered equipment
- Locating noisy plant away from sensitive boundaries
- Using portable noise barriers, screens, or enclosures
- Limiting high-noise activities to the early part of OOHW windows (e.g. before 10 pm)
- Implementing respite periods for long-duration work
- Any other control measure specified in the CNVMP

These measures should be tailored based on site-specific risk and community proximity.

4.3 Monitoring

Attended noise or vibration monitoring is required:

- When predicted noise or vibration exceeds ICNG or EPL limits
- During high noise or vibration impact activities (e.g. demolition, rock breaking, piling)
- In response to noise or vibration complaints
- As required by planning or licence conditions

Attended monitoring must be undertaken at locations representative of noise affected receivers. Monitoring must record $L_{Aeq\ (15\ minute)}$ and L_{Amax} sound levels and relevant vibration levels.

5 Complaints handling

A 24/7 Community Contact Line must be available during all OOHW periods.

All complaints must be logged with:

- Time and nature of complaint.
- Complainant details (if provided).
- Action taken and timeframe for response.
- Review root causes of complaints and implement further mitigation if required.
- Any other action as specified within the CNVMP

Complaints trends must be reviewed weekly and reported in project environmental reporting.

6 Record keeping

The principle contractor must maintain a register of all OOHW activities, including:

- Date, time, and location
- Nature of work
- Equipment used
- Approvals obtained
- Community notifications
- Monitoring results
- Complaints received

Records must be retained for the duration of the project and made available upon request to regulatory authorities.

7 Non-compliance

Any non-compliant OOHW will be reported to:

- The Principal Contractor
- The Environmental Manager
- Consent Authority and/or EPA
- Community (as appropriate)

All incidents must be recorded in the project's non-conformance register and reviewed in regular compliance audits.

Appendix D – Land Use Survey