Moore Park Precinct Village and Carpark

Construction Noise and Vibration Management Sub Plan (CNVMSP)

SSD-9835

BESIX Watpac

Report number: 240131-MPVC-CNVMSP-R4
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PULSE WHITE NOISE ACOUSTICS Suite 601, L6, 32 Walker St, North Sydney NSW 2060
P 1800 4 PULSE (1800 478 573) **E** info@pwna.com.au **pwna.com.au** ABN 95 642 886 306

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PREPARED BY:

Pulse White Noise Acoustics Pty Ltd
ABN 95 642 886 306
Suite 601, level 6 32 Walker Street, North Sydney, 2060
1800 4 PULSE

TABLE OF CONTENTS

TABLES

FIGURES

1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) has been engaged to prepare a Construction Noise and Vibration Management Sub Plan (CNVMSP) for the construction works associated with the Moore Park Precinct Village and Carpark project which includes part of the Sydney Football Stadium redevelopment site.

As part of the projects SSD approvals background noise surveys have been undertaken at the which have established relevant project requirements. Details of the relevant background noise levels and established criteria which are included as part of the SSD approvals of the project have been used in this assessment and include the following:

1. The Stage *2 SSDA - Noise and Vibration Impact Assessment* prepared by ARUP and dated 30 August 2019 which is included in the project SSD application and Consolidated Consent.

2. The *Stadium Fitness Facilities Noise and Vibration Impact Assessment* prepared by ARUP and dated 11 November 2020 and includes a revised assessment of construction noise and vibration impacts from the Stadium Fitness Facilities.

3. The *Precinct Village and Carpark Noise and Vibration Impact Assessment* prepared by ARUP and dated 6 September 2021 which includes revised acoustic assessment of construction noise and vibration impacts from the Precinct Village and Car Park.

The SSD DA approval has been informed by the findings of both Noise and Vibration Impact Assessments and this Construction Noise and Vibration Sub Plan has been undertaken in accordance with the project Consolidated Consent including the SSD-9835 requirements dated 15/12/2023.

A glossary of acoustic terminology used throughout this report is included in Appendix A.

The author of this report is Ben White who is a director of Pulse White Noise Acoustics who is a member of the Australian Acoustic Society with over 20 years' experience as an acoustic consultant, details including Ben's CV and membership of the AAS are included in Appendix B.

1.1 Project Overview and Report Purpose

Stage 2 of the Sydney Football Stadium (SFS) Redevelopment (SSD 9835) was approved by the Minister for Planning and Public Spaces on 6 December 2019. SSD 9835 has been modified on eight previous occasions.

SSD 9835 MOD 10 was submitted to the Department of Planning, Housing and Infrastructure on 17 march 2025 which provided approval to:

- Reconfigure the basement car park structure by increasing the depth of excavation on the western side and constructing an additional level on the eastern side of the car park, resulting in an increase in the depth of excavation by 3m from existing level
- Revise Level B4 of the basement to partially accommodate retention of the rock section of the shaft
- Remove car parking spaces from the mezzanine level on the east to provide a double height 'boneyard' space to facilitate on site bump in and bump out requirements for events
- Reconfigure the Plaza to facilitate interpretation of the newly discovered shaft
- Reconfigure the Plaza to satisfy conditions of consent requiring compliance with the Everyone Can Play Guidelines and approved tree retention and planting regime

Incorporate a suite of detailed design refinements across the site reflecting the design development process. such as fire stair and plant room rationalisation.

Project Description

BESIXWatpac has been appointed by Venues NSW as Principal Contractor for the Precinct Village and Car Park (PV&C) which represents the next stage of development. The PV&C was approved via modification to SSD 9835 on 18 July 2022 by the Minister for Planning and Public Spaces' delegate. In approving the modification, approval was granted for:

- Up to a maximum of 1,340 space multilevel carpark below ground level with the following access arrangements:
    - 1 x egress point onto Moore Park Road to be used on event days only;
    - 1 x two-lane access point from Driver Ave to be used on event and non-event days; and
    - dedicated area within the car park for operation/servicing vehicles.
- Reconfiguration of the currently approved drop off requirements for the elderly and mobility impaired;
- Free flow level pedestrian access to and from the SFS concourse from Driver Ave and Moore Park Road;
- Electric car charging provision;
- A versatile and community public domain, comprising:
    - provision for 4 x north-south orientated tennis courts on non-event days with the potential to become an event platform on event days;
    - children's playground;
    - 1,500 m2 cafe / retail / restaurants with associated amenities in a single storey pavilion (6 metre) low level;
    - customer service office and ticket window; and
    - vertical transport provisions.
- Utilities provision augmentation.

Purpose of this CNVMSP

The Precinct Village and Car Park is proposed to be constructed in four (4) stages to respond to the proposed design milestones, construction program and the conditions of approval, and as set out in the Staging Report that has been submitted to the Department of Planning, Housing and Industry.

The purpose of this document is to address the requirements of Conditions, including those detailed in Table 1.

Further reviews of this CNVMSP may be undertaken through the construction period, as required, in response to revised methods and equipment, as well as in response to the monitoring and evaluation of actual impacts. Subsequent updates will accordingly only will need to be made only if the construction methodology, impacts or mitigation strategies are required to adopt a different approach. Should updates be required, the CNVMSP will be submitted to the Planning Secretary/Certifier for approval.

Qualifications

This CNVMSP was prepared by Ben White and reviewed by Matthew Furlon, both suitably qualified and experienced acoustic engineers from Pulse White Noise Acoustics, who hold good working knowledge of the relevant standards, specifications and conditions applicable to this project. The CV's of both Ben and Matthew are included in Appendix B.

1.2 Site Layout and Development Overview

This report has been prepared on behalf of BESIX Watpac as part of the required construction works to undertaken to deliver the Moore Park Precinct Village and Carpark project and required as part of the SSD-9835 Consolidated Consent.

The project includes the delivery of the Moore Park Precinct Village and Carpark project which includes the carparking and associated precinct village which is to include retail, commercial, place of recreation and associated amenities.

The project site is located within the Sydney Football Stadium redevelopment and includes the site to the west of the completed football stadium with Moore Park Road to the north and Diver Avenue to the west and south.

As part of the redevelopment of the Sydney Football Stadium the construction of the main stadium has been completed.

Details of the proposed Moore Park Precinct Village and Carpark project are included in Figure 1 below.

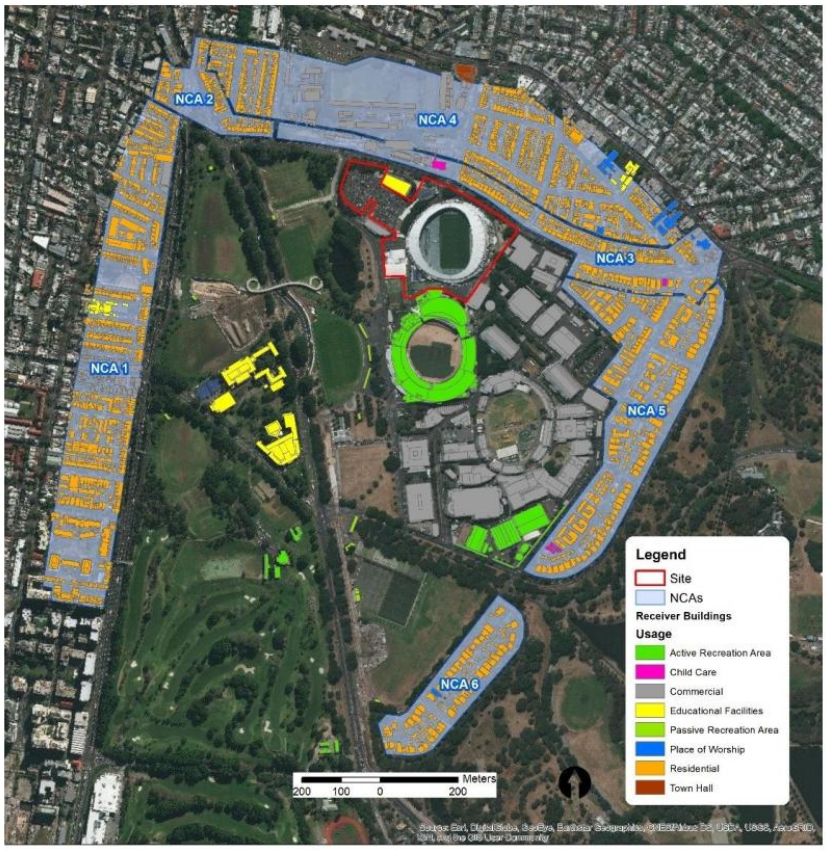
Figure 1 Site Plan including the Moore Park Precinct Village and Carpark project

The required construction works to be completed as part of the project includes the following:

- Demolition of existing structures on the site.
- Ground works including excavation and pilling for the proposed in ground basement levels of the project.
- Construction of the new building on the site including the carpark and associated retail, commercial, place of recreation and associated amenities.

Noise catchment areas within the vicinity of the Sydney Football Stadium have been detailed in the projects acoustic reports , including the those completed by ARUP and included the SSD approvals. Details of the noise catchment areas are included in the Stage *2 SSDA - Noise and Vibration Impact Assessment* prepared by ARUP and dated 30 August 2019 which is included in the project SSD application and Consolidated Consent which are detailed in the figure below:

Figure 2 Noise Catchment Areas included in the SSD *Noise and Vibration Impact Assessment*



Based on the acoustic characteristics of areas, the uses in each catchment area and the land zonings the classification of each catchment is detailed below:

1. NCA 1 – Surry Hills and Redfern (along South Dowling Street) – Urban area

    a. Based on the location of these receivers and the proximity to the works required to be completed as part of the Moore Park Precinct Village and Carpark project, as well as the exiting ambient noise levels including those resulting from traffic movements on surrounding roadways including South Dowling Street and Anzac Parade, construction noise and vibration will not result in impacts to these receivers and therefore detailed assessment not required to be undertaken at these locations.

2. NCA 2 – Surry Hills (intersection between Anzac Parade and Flinders Street) – Urban area

    a. These locations are impacted from noise levels resulting from traffic noise on Anzac Parade and Moore Park Road. An assessment of construction noise impacts has been undertaken in this report including the residential receivers .

3. NCA 3 – Paddington, Moore Park Road - Urban area

    a. These locations are impacted from noise levels resulting from traffic noise on Moore Park Road. An assessment of construction noise impacts has been undertaken in this report including both residential receivers located on More Park road, the childcare centre and commercial receivers which are located to the north of the Moore Park Precinct Village and Carpark project.

4. NCA 4 – Paddington local roads - Urban area

    a. These locations are impacted from noise levels resulting from traffic noise on surrounding roadways including Moore Park Road. All locations within the catchment area include an additional separation to those within the NCA catchment area. An assessment of construction noise impacts has been undertaken to the receivers within the closest proximity of this catchments area.

5. NCA 5 – Centennial Park Land Road and local roads – Suburban area

    a. These locations are impacted from noise levels resulting from traffic noise on surrounding roadways. All locations within the catchment area include significant distance separation from the Moore Park Precinct Village and Carpark project (not less than 450m) as well as being screed by the now completed Sydnye Football Stadium.

    Based on the location of this catchment area, including the distance separation and screening, construction noise and vibration will not result in impacts to these receivers and therefore detailed assessment not required to be undertaken at these locations.

6. NCA 6 – Centennial Park Roberston Road and local roads – Suburban area

    a. These locations are impacted from noise levels resulting from traffic noise on surrounding roadways. All locations within the catchment area include significant distance separation from the Moore Park Precinct Village and Carpark project (not less than 1000m) as well as being screed by the now completed Sydnye Football Stadium and other exiting building.

    Based on the location of this catchment area, including the distance separation and screening, construction noise and vibration will not result in impacts to these receivers and therefore detailed assessment not required to be undertaken at these locations.

The nearest sensitive receivers to the site have been identified below.

Receiver 1: Residential receivers located to the west of the site including those on Moore Park Road and located to the west of Greens Road.

Receiver 2: Residential receivers located to the north east of the site including those on Moore Park Road and located to the east of Oatley Road.

Receiver 3: Residential receivers located to the north of the site including those on Leinster Street and located to the east Oatley Road.

Receiver 4: Commercial and educational receivers including within the University of Technology building (including Rugby Australia) of Moore Park Road and located to the north of the site.

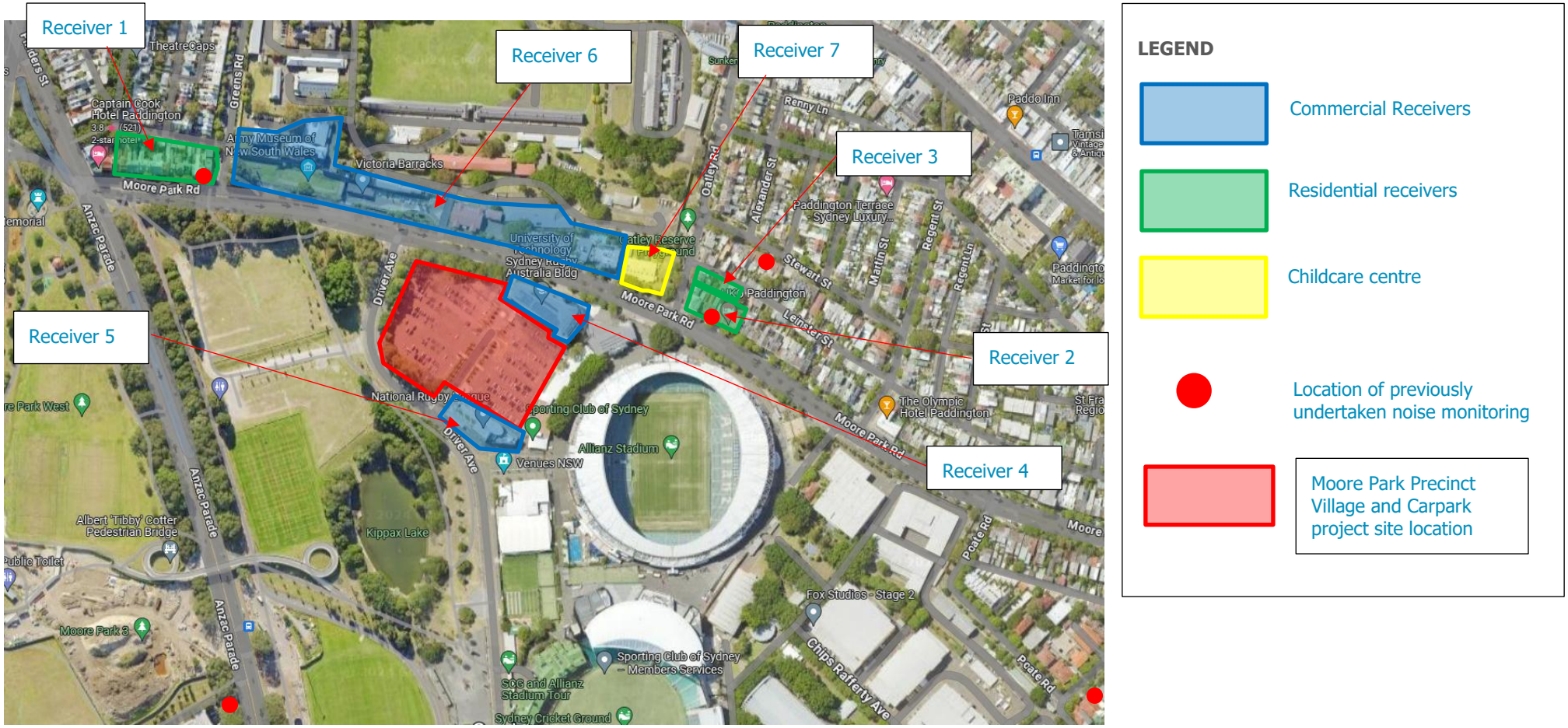
Receiver 5: Commercial receivers including those within the National Rugby Leage building of Driver Avenue and located to the south of the site.

Receiver 6: Commercial receivers including those located to the north of the site opposite on Moore Park Road.

Receiver 7: The Childcare centre located to the north of the site and opposite on Moore Park Road.

Details of the site location and the receivers included in the points above are detailed in the following figure.

Figure 3 Site Map, Measurement Locations and Surrounding Receivers



2 SSD COMPLIANCE

This report has been undertaken in accordance with the requirements of the project approvals including the SSD-9835, which includes a number of requirements regarding the assessment of construction noise and vibration.

Details of SSD consent and sections of the report which include the required items required by the consent are included in the table below.

Table 1 SSD Compliance Table

SSD Condition number	Requirement	Report Reference for Satisfaction
B28	*B28. Prior to the commencement of construction, the Applicant must prepare a Construction Noise and Vibration Management Sub-Plan (CNVMP). The plan must address, but not be limited to, the following:*	Report in Total
(a)	*be prepared by a suitably qualified and experienced noise expert and in consultation with the EPA;*	Ben white is a director of Pulse White Noise Acoustics, Ben's CV and membership of the Australian Acoustic Society is included in Appendix B. Details of Consultation included in Section 2.1.
(b)	*provide details of all the residential and non-residential receivers including the Kira Child Care Centre, University of Technology Sport Sciences Faculty Building (UTS) and Fox Studios, identified in Stage 2 SSDA – Noise and Vibration Assessment prepared by ARUP dated 30 August 2019;*	Section 1.2

(c)	*provide details of the project specific construction noise management levels (NMLs) at all the identified receivers (B28(b)) considering the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009) (ICNG) and the relevant provisions of Australian Standard 2436 - 2010 Guide to Noise Control on Construction and Maintenance and Sites, at all identified receivers;*	Section 4.1 and 4.1.1
(d)	*identify the 'High Noise Impact works' with the associated predicted construction noise levels that would exceed the NMLs and reach or exceed the Highly Affected Noise Level of 75dB(A) LAeq(15min), at the identified the residential and non-residential receivers; Note: High noise impact works mean:* *o jack hammering, rock breaking or hammering, pile driving, vibratory rolling, cutting of pavement, concrete or steel or other work occurring on the surface that generates noise with impulsive, intermittent, tonal or low frequency characteristics that exceed the NML; or* *o continuous noisy activities where 'continuous' includes any period during which there is less than a 1-hour respite between ceasing and recommencing any of the work that is the subject of this condition.*	Section 4.1 and 6.2

(e)	*describe all reasonable and feasible management and mitigation measures to be implemented when the predicted construction noise levels exceed the NMLs LAeq(15min) at the identified residential and non-residential receivers, including (but not limited to) the recommendations in the draft Construction Noise and Vibration Management Plan (Appendix E) of the Stage 2 SSDA – Noise and Vibration Assessment prepared by ARUP dated 30 August 2019) and recommendations of the Noise and Vibration Impact Assessment (Issue 2), prepared by Arup, dated 6 September 2021 for the Precinct Village and multi-level carpark stages and the following:* *(i) "Stop-work" procedures* *(ii) proposing specific plant and equipment to ensure lower noise generation;* *(iii) proposing suitable location of the noise generating equipment so that the predicted construction noise levels at the residential and non-residential receivers is lowered;* *(iv) the following intra-day respite periods (as defined by ICNG) for works exceeding 75dB(A) LAeq(15 mins), unless otherwise agreed with the identified sensitive receivers such as UTS, Kira Child Care Centre and / or Fox Studios and evidence of the agreement provided to the Planning Secretary, prior to the commencement of the works:* *- in continuous blocks not exceeding 3 hours each with one hour of respite every three hours block;* *- scheduling of works outside of the examination time for educational establishments; and* *- noise intrusive works commencing after 8am and be undertaken within the approved standard construction hours.* *(v) proposing where practicable and without compromising the safety of construction staff or members of the public, the use of quackers';*	Section 6

	(vi) 'Toolbox talks' at regular intervals with contractors' and other staff training methods; *(Vii) use of broadband, non-tonal reversing alarms where possible and ensure that warning devices are no more than 5dB above the relevant Australian Standard level;* *(viii) proposing appropriate material handling methods (avoid dropping from a height);* *(iX) use of noise shields (such as hoardings where applicable and possible) along the specific boundaries facing the identified sensitive receivers.*	
(f)	*describe the measures to be implemented to monitor and manage high noise generating works in close proximity to sensitive receivers including the location of noise loggers associated with the noise monitoring;*	Section 6.5
(g)	*include strategies that have been developed in consultation with the community (especially all identified residential and non-residential receivers in condition B28(b) including UTS, Kira Child Care Centre and Fox studios), for managing high noise generating works, including any alternate intra-day respite periods that suit the sensitive receivers;*	Section 6.8
(h)	*include details of management measures to avoid any adverse vibration impacts on the nearby following heritage items during construction:* *(i) Member's stand, SCG; and* *(ii) Lady's Member Stand, SCG*	Section 0
(i)	*include details of management measures to protect the archaeological heritage items including Busby's Bore in accordance with the requirements of the Methodology Statement – Working Near Busby's Bore prepared by Artefact, dated February 2025 as updated by condition B22;*	Section 6.6

(j)	*describe the community consultation undertaken to develop the strategies in condition B28(g), including but not limited to:* *(i) evidence regarding agreed (if any) intra-day respite periods with Kira Child Care Centre, UTS and Fox Studios (where applicable) as an alternate measure to B28(e); and* *(ii) evidence of agreed scheduling of construction work activities outside of sensitive times of the day or specific times of the year (where applicable) with UTS and Fox Studios.*	Section 6.8
(k)	*include a complaints management system that would be implemented for the duration of the construction including a chain of responsibilities for dealing with and responding to noise complaints and noise management*	Section 6.8.2
B29	*The Applicant must not commence any works until:* *(a) evidence of consultation with the EPA in the preparation and finalisation of the Construction Noise and Vibration Management Plan (CNVMP) is provided to the Planning Secretary;* *(b) the CNVMP is approved by the Planning Secretary; and* *(c) a copy submitted to Council and the Certifying Authority*	Report in total
B 30	*Prior to commencement of works on the site, all mitigation and management measures identified in the CNVMP, must be installed or implemented on the site*	BESIX Watpac to implement
B32 (h)	*detail the mitigation measures that are to be implemented to ensure road safety and network efficiency during construction in consideration of potential impacts on general traffic, cyclists and pedestrians and bus services; and* *(iii) minimise road traffic noise;*	Section 5.4

C7	*All works that generate noise exceeding 75dB(A) LAeq (15mins) are subject to the intra-day respite periods, as approved by the Planning Secretary in the CNVMP in Condition B28*	Section 6.2
C15	*The noise generated by construction activities must be managed in accordance with the CNVMP (condition B28).*	Section 6.1
C17	*The Applicant must undertake short term attended noise monitoring for all 'High Noise Impact Works' that predicted to exceed the NMLs, identified in the CNVMP (B28). and any other works that generate NSW Government 40 Sydney Football Stadium Stage 2 Department of Planning, Industry and Environment noise exceeding 75dB(A) LAeq (15mins) and a noise monitoring report must be produced and submitted to the Planning Secretary every three months following commencement of the construction to verify that:* *(a) construction noise levels do not exceed the recommended NMLs identified in the Stage 2 SSDA – Noise and Vibration Assessment prepared by ARUP dated 30 August 2019; and* *(b) Noise management and mitigation measures have been implemented where the NMLs are exceeded.*	Section 6.3.3 and 6.5
C18	*The intra-day respite periods, required by condition B28 of this development consent must be reviewed on a monthly basis (or another timescale as agreed with the child care centre, UTS or Fox Studios) in consultation with Kira Child Care Centre, UTS and Fox Studios. The respite periods are to be maintained / or amended as agreed with the sensitive noise receivers. The details of any amendments to the intra-day respite periods due to agreement with the sensitive receivers, must be provided to the CCC and the Planning Secretary for information at least seven days prior to the implementation*	Section 6.2 and 6.8.4

C19	*Vibration caused by construction activities at any residence or adjoining structure including all surrounding heritage items within or outside the boundary of the site must be limited to:* *(a) the latest version of DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures (German Institute for Standardisation) for structural damage;* *(b) 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), for human exposure; and* *(c) The vibration requirement of the Methodology statement -Working Near Busby Bore prepared by Infrastructure NSW dated September 2018 as updated by condition B22 (being part of the CNVMP in condition B28).* *(d) a maximum peak particle velocity of 5 mm/second in the vicinity of Shafts 8, 9 and 10 of the Busby's Bore.*	Sections 4.2, 4.3and 6.6
C20	*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 C19*	Section 5.5
C21	*Vibration during the construction works must comply with the limits specified in conditions C19 and C20, unless otherwise agreed in the CNVMP as required by condition B28 and forming a part of the CEMP*	Section 5.5
C22	*Ongoing vibration monitoring must be conducted during the excavation works in the vicinity of Shafts 8, 9 and 10 of the Busby's Bore.*	Section 6.6

2.1 Consultation with the EPA

Consultation with the EPA has been undertaken, including the following:

1. Correspondence on the 12th June 2025 regarding the CNVSP.

2. The EPA have been consulted regarding the CNVSP and comments are included in their letter with reference DOC25/383007-1 which has identified that the EPA has no comment regarding the report.

3 EXISTING ACOUSTIC ENVIRONMENT

As part of the projects SSD approvals background noise surveys have been undertaken at the which have established relevant project requirements. Details of the relevant background noise levels and established criteria which are included as part of the SSD approvals of the project have been used in this assessment and include the following:

1. The Stage *2 SSDA - Noise and Vibration Impact Assessment* prepared by ARUP and dated 30 August 2019 which is included in the project SSD application and Consolidated Consent.

2. The *Stadium Fitness Facilities Noise and Vibration Impact Assessment* prepared by ARUP and dated 11 November 2020 and includes a revised assessment of construction noise and vibration impacts from the Stadium Fitness Facilities.

3. The *Precinct Village and Carpark Noise and Vibration Impact Assessment* prepared by ARUP and dated 6 September 2021 which includes revised acoustic assessment of construction noise and vibration impacts from the Precinct Village and Car Park.

The SSD DA approval has been informed by the findings of both Noise and Vibration Impact Assessments and this Construction Noise and Vibration Sub Plan has been undertaken in accordance with the project Consolidated Consent including the SSD-9835 requirements.

Based on the SSD reporting project construction noise management levels have been developed which are based on the recorded background noise levels and are detailed in Section 0 of this report.

4 NOISE AND VIBRATION CRITERIA

Relevant noise and vibration criteria for construction activities are detailed below.

4.1 Construction Noise Objectives

Relevant construction noise objectives applicable to this project are outlined below.

4.1.1 NSW EPA Interim Construction Noise Guideline (ICNG) 2009

Noise objective for construction and demolition activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in the table below.

Table 2 NMLs for quantitative assessment at residences

Time of Day	Noise Management Level $L_{Aeq(15minute)}$ [1,2]	How to Apply
During approved working hours	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside the approved working hours	Noise affected RBL + 5 dB	• 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 noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should notify the community.

Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Note 2 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).

Construction noise levels at other noise receivers are outlined below:

- Construction noise levels within classrooms other educational institutions is not recommended to exceed 45dBA $L_{Aeq,15minute}$, when measured internally.
- Construction noise levels at offices and retail outlets are not recommended to exceed 70dBA LAeq,15minute, when measured externally.

As part of the SSD approvals, including the project acoustic reports construction management noise levels have been determined based on noise surveys within the vicinity of the site.

Based on the project SSD approvals a summary of the construction noise management levels are detailed in Table 3 below.

Table 3 Noise Management Levels based on SSD Approvals

Receiver Location		Noise Management Levels, dB $L_{Aeq(15minute)}$		
		During approved working hours		Outside of approved working hours
Location 1 – Residential Receivers		Noise Management Level - Externally 56	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)
Location 2 – Residential Receivers		Noise Management Level - Externally 52	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)
Location 3 – Residential Receivers		Noise Management Level - Externally 43	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)
Location 4	Commercial Receivers	Noise Management Level – Externally 70	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)
	Educational Receivers	Noise Management Level – Internally 45	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)
Location 5 – Commercial Receivers		Noise Management Level – Externally 70	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)
Location 6 – Commercial Receivers		Noise Management Level – Externally 70	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)
Location 7 – Childcare centre		Noise Management Level – Internally 45	High Noise Affected Level- Externally 75	Background noise levels + 5 dB(A)

Details of the project construction noise management levels are based on the details include in project SSD approvals including the following reports and including the SSD-9835 requirements:

1. The Stage *2 SSDA - Noise and Vibration Impact Assessment* prepared by ARUP and dated 30 August 2019 which is included in the project SSD application and Consolidated Consent.

2. The *Stadium Fitness Facilities Noise and Vibration Impact Assessment* prepared by ARUP and dated 11 November 2020 and includes a revised assessment of construction noise and vibration impacts from the Stadium Fitness Facilities.

3. The *Precinct Village and Carpark Noise and Vibration Impact Assessment* prepared by ARUP and dated 6 September 2021 which includes revised acoustic assessment of construction noise and vibration impacts from the Precinct Village and Car Park.

4.2 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself.

4.2.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from AV-TG. This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources.
- Impulsive vibration – up to three instances of sudden impact e.g., dropping heavy items, per monitoring period.
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously.

Table 4 Continuous vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day or night-time	0.0050	0.010	0.10	0.20
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 5 Impulsive vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day or night-time	0.0050	0.010	0.10	0.20
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 6 Intermittent vibration impacts criteria (m/s$^{1.75}$) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Critical working areas (e.g. hospital operating theatres, precision laboratories)	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

4.2.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration"* (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 *"Effects of Vibration on Structure"* (DIN 1999).

4.2.3 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised below.

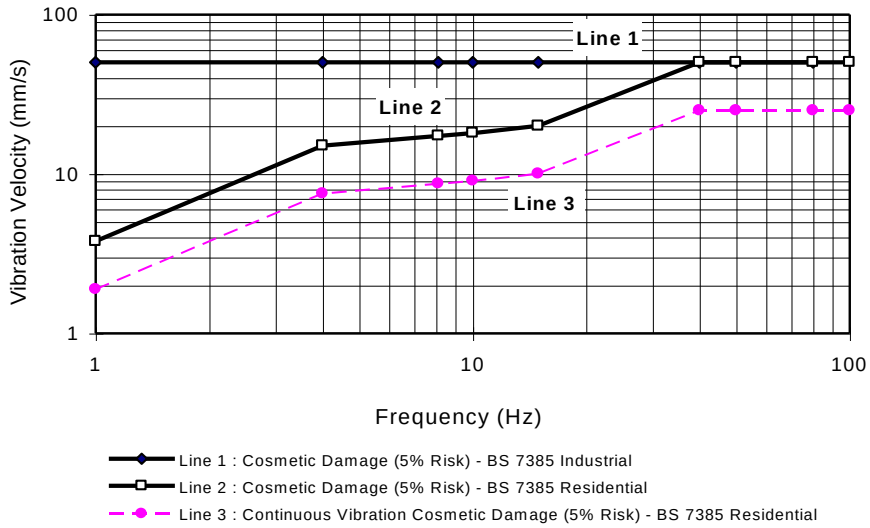
Table 7 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in ~~Figure 4~~Figure 4	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 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

Standard BS 7385 Part 2 – 1993 states that the values in Table 7 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such that it results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 7 may need to be reduced by up to 50% (refer to Line 3 in Figure 4).

Figure 4 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 7, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless the calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 7 should not be reduced for fatigue considerations.

4.2.4 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 8. The criteria are frequency dependent and specific to particular categories of structures.

Table 8 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.

4.3 Busby Bore

Vibration limits regarding the busby bore include those included in the SSD conditions of consent including item C19, which includes the following;

Vibration Criteria

C19. Vibration caused by construction activities at any residence or adjoining structure including all surrounding heritage items within or outside the boundary of the site must be limited to:

(a) the latest version of *DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures* (German Institute for Standardisation) for structural damage;

(b) 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), for human exposure; and

(c) the vibration requirements of the *Methodology Statement – Working Near Busby's Bore* prepared by Infrastructure NSW dated September 2018 as updated by condition B22 (being part of the CNVMP in condition B28).

(d) a maximum peak particle velocity of 5 mm/second in the vicinity of Shafts **8,** 9 and 10 of the Busby's Bore.

4.4 Project Vibration Criteria

Based on the details included in the sections above the project specific vibration criteria to protect the surrounding residential receivers from structural or architectural damage includes the following:

1. Project construction vibration management level at all surrounding building structures – 8 mm/s.

2. Busby bore including Shafts 8, 9 and 10 – 5mm/s

4.5 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW *Road Noise Policy (RNP)* states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

Based on the location of the site and the proximity to roadways including Moore Park Road the proposed construction traffic.

5 NOISE AND VIBRATION ASSESSMENT

5.1 Approved Hours of Work

Construction works on the site will be undertaken in accordance with the requirements of the project SSD approval including SSD-9835 including item C3 to C7 which will include the following:

Construction Hours

C3. Construction works, including the delivery of materials to and from the site, may only be carried out between the following hours:

(a) between 7am and 6pm, Mondays to Fridays inclusive;

(b) between 8am and 1pm, Saturdays; and

(c) No construction work may be carried out on Sundays or public holidays.

C4. Construction works on the days when events occur at SCG land must be undertaken in accordance with the following requirements unless prior approval for alternative arrangements is granted by Sydney Coordination Office and Transport Management Centre within TfNSW with respect to vehicle movements and SCSGT with respect to event noise and impacts:

(a) construction or associated works must cease at least two hours prior to an event;

(b) no construction works are to be undertaken during an event; and

(c) no construction works are to be undertaken for at least two hours after the completion of an event.

C5. Activities may be undertaken outside of the hours in condition C3:

(a) if the delivery of oversized plant or structures has been determined by the police or other public authorities to require special arrangements to transport along public roads; or

(b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm; or

(c) where the works and activities do not cause, when measured at the boundary of the most affected noise sensitive receiver:

(i) Leq (15 minute) dB(A) noise levels greater than 5dB above the day, evening and night rating background level (RBL) as applicable; and

(ii) L1(1 minute) dB(A) or L_{Fmax} dB(A) noise levels greater than 15dB above the night RBL for night works;

(iii) continuous or impulsive vibration values greater than those for human exposure to vibration, set out for residences in Table 2.2 in "Environmental noise management - Assessing Vibration: a technical guideline" (Department of Environment and Conservation, February 2006); and

(iv) intermittent vibration values greater than those for human exposure to vibration, set out for residences in Table 2.4 in "Environmental noise management - Assessing Vibration: a technical guideline" (Department of Environment and Conservation, February 2006); or

Note: *For the purpose of this condition, the RBLs are those contained in an environmental assessment for the scheduled activity subject to this licence prepared under the Environmental Planning and Assessment Act 1979. Alternatively, the licensee may use another RBL determined in accordance with the NSW Noise Policy for Industry (EPA, 2017) and provided to the EPA prior to carrying out any works or activities under this condition.*

C6. The variation to the works hours in condition C5 must be approved in advance in writing by the Planning Secretary or her nominee if appropriate justification is provided for the works.

Notification of the activities in condition C5 must be given to affected residents before undertaking the activities or as soon as is practical afterwards.

C7. All works that generate noise exceeding 75dB(A) $L_{Aeq\ (15mins)}$ are subject to the intra-day respite periods, as approved by the Planning Secretary in the CNVMP in condition B28.

5.2 Construction Noise Assessment

Sound power levels have been predicted for the construction tasks identified in the project program. The equipment anticipated for use in each task is based on previous project experience. The sound power levels for the equipment likely to be used for each of the listed tasks are provided in Table 9 below.

Table 9 Summary of predicted sound power levels

Tasks	Equipment	Sound Power Levels (dBA re 1pW)	Aggregate Sound Power Level per Task (dBA re 1pW)
Site Establishment, Ground Works and Demolition	Mobile crane	113	122
	Power hand tools	109	
	Semi Rigid Vehicle [1]	105	
	Excavators	112	
	Hydraulic Hammering	113	
	Bulldozers	108	
	Hand held jack hammers [1]	111	
	Dump trucks [1]	104	
	Truck Movements	98	
	Concrete saw [1]	114	
	Water Carts	107	
	Skid steer	110	
	Bobcats	104	
	Rollers	107	
	Pilling	110	
	Power hand tools	109	
Construction of the Structure	Hand held jack hammer [1]	106	118
	Concrete saw [1]	114	
	Power hand tools	109	
	Welder	101	
	Truck Movements	98	
	Forklifts	106	
	Rollers	107	
	Concrete pump truck	110	
	Concrete agitator truck	108	
Internal Works	Power hand tools	109	109
Common and External Works	Concrete agitator truck	108	117
	Saw cutter [1]	104	
	Dump truck [1]	104	
	Concrete saw [1]	114	
	Power hand tools	109	

Note 1: An assumed time correction has been applied, this being 5 minutes of operation in any 15-minute interval.

5.3 Predicted Construction Noise Levels

Predicted construction noise levels are presented below for each of the surrounding receivers in accordance with the NSW EPA ICNG.

Note:

- Predicted noise levels presented below are given in a range, this includes the expected minimums as well as the maximums.
- With regards to the maximum noise levels in the range, these are typically experienced when plant/works are within close proximity to a boundary. In our experience whilst these levels above NML's and considered intrusive they will only occur for a short time and is not a representation of noise levels during the entire construction period.

Table 10 Receiver 1 – Summary of preliminary predicted construction noise levels – Residential Receivers

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	53 to 59	61 to 67	Standard Construction Hours 56 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Generally, construction noise expected to be within noise management levels and below the high noise affected levels, Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		49 to 55			
	Semi Rigid Vehicle [1]		45 to 51			
	Excavators		52 to 58			
	Hydraulic Hammering		53 to 59			
	Bulldozers		48 to 54			
	Hand held jack hammers [1]		51 to 57			
	Dump trucks [1]		44 to 50			
	Truck Movements		38 to 44			
	Concrete saw [1]		54 to 60			
	Water Carts		47 to 53			
	Skid steer		50 to 56			
	Bobcats		44 to 50			
	Rollers		47 to 53			
	Piling		49 to 55			
	Power hand tools		49 to 55			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	46 to 52	58 to 64	Standard Construction Hours 56 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Generally, construction noise expected to be within noise management levels and below the high noise affected levels, Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Concrete saw [1]		54 to 50			
	Power hand tools		49 to 55			
	Welder		41 to 47			
	Truck Movements		38 to 44			
	Forklifts		46 to 52			
	Rollers		47 to 53			
	Concrete pump truck		50 to 56			
	Concrete agitator truck		48 to 54			
Internal Works	Power hand tools	109	49 to 55	49 to 55		
Common and External Works	Concrete agitator truck	117	48 to 54	56 to 62		
	Saw cutter [1]		44 to 50			
	Dump truck [1]		44 to 50			
	Concrete saw [1]		54 to 60			
	Power hand tools		49 to 55			

Table 11 Receiver 2 – Summary of predicted construction noise levels – Residential Receiver

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	57 to 65	65 to 73	Standard Construction Hours 52 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Generally, construction noise expected to be within noise management levels and below the high noise affected levels, Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		53 to 61			
	Semi Rigid Vehicle [1]		49 to 57			
	Excavators		56 to 64			
	Hydraulic Hammering		57 to 65			
	Bulldozers		52 to 60			
	Hand held jack hammers [1]		55 to 63			
	Dump trucks [1]		48 to 56			
	Truck Movements		42 to 50			
	Concrete saw [1]		58 to 66			
	Water Carts		51 to 59			
	Skid steer		54 to 62			
	Bobcats		48 to 56			
	Rollers		51 to 59			
	Pilling		54 to 62			
	Power hand tools		53 to 61			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	50 to 58	62 to 70	Standard Construction Hours 52 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Generally, construction noise expected to be within noise management levels and below the high noise affected levels, Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Concrete saw [1]		58 to 66			
	Power hand tools		53 to 61			
	Welder		45 to 53			
	Truck Movements		42 to 50			
	Forklifts		50 to 58			
	Rollers		51 to 59			
	Concrete pump truck		54 to 62			
	Concrete agitator truck		52 to 60			
Internal Works	Power hand tools	109	53 to 61	53 to 61		
Common and External Works	Concrete agitator truck	117	52 to 60	60 to 68		
	Saw cutter [1]		48 to 56			
	Dump truck [1]		48 to 56			
	Concrete saw [1]		58 to 66			
	Power hand tools		53 to 61			

Table 12 Receiver 3 – Summary of predicted construction noise levels – Residential Receiver

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	56 to 63	63 to 71	Standard Construction Hours 43 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Generally, construction noise expected to be within noise management levels and below the high noise affected levels, Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		52 to 59			
	Semi Rigid Vehicle [1]		48 to 55			
	Excavators		55 to 62			
	Hydraulic Hammering		56 to 63			
	Bulldozers		51 to 58			
	Hand held jack hammers [1]		54 to 61			
	Dump trucks [1]		47 to 54			
	Truck Movements		41 to 58			
	Concrete saw [1]		57 to 64			
	Water Carts		50 to 57			
	Skid steer		53 to 60			
	Bobcats		47 to 54			
	Rollers		50 to 57			
	Pilling		53 to 60			
	Power hand tools		52 to 59			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	49 to 56	60 to 68	Standard Construction Hours 43 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Generally, construction noise expected to be within noise management levels and below the high noise affected levels, Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Concrete saw [1]		57 to 64			
	Power hand tools		52 to 59			
	Welder		44 to 51			
	Truck Movements		41 to 48			
	Forklifts		49 to 56			
	Rollers		50 to 57			
	Concrete pump truck		53 to 60			
	Concrete agitator truck		51 to 58			
Internal Works	Power hand tools	109	52 to 59	51 to 59		
Common and External Works	Concrete agitator truck	117	51 to 58	58 to 66		
	Saw cutter [1]		47 to 54			
	Dump truck [1]		47 to 54			
	Concrete saw [1]		57 to 64			
	Power hand tools		52 to 59			

Table 13 Receiver 4 - Summary of predicted construction noise levels – Commercial Receiver

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	65 to 83	73 to 90	Standard Construction Hours 70 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Power hand tools		61 to 79			
	Semi Rigid Vehicle [1]		57 to 75			
	Excavators		64 to 82			
	Hydraulic Hammering		65 to 83			
	Bulldozers		60 to 78			
	Hand held jack hammers [1]		63 to 81			
	Dump trucks [1]		56 to 74			
	Truck Movements		50 to 68			
	Concrete saw [1]		66 to 84			
	Water Carts		59 to 77			
	Skid steer		62 to 80			
	Bobcats		56 to 74			
	Rollers		59 to 77			
	Pilling		62 to 80			
	Power hand tools		61 to 80			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	58 to 76	60 to 68		
	Concrete saw [1]		66 to 84			
	Power hand tools		61 to 79			
	Welder		53 to 71			
	Truck Movements		50 to 68			
	Forklifts		58 to 76			
	Rollers		59 to 77			
	Concrete pump truck		62 to 80			
	Concrete agitator truck		60 to 78			
Internal Works	Power hand tools	109	61 to 79	61 to 79		
Common and External Works	Concrete agitator truck	117	60 to 78	68 to 86		
	Saw cutter [1]		56 to 74			
	Dump truck [1]		56 to 74			
	Concrete saw [1]		66 to 84			
	Power hand tools		61 to 79			

Table 14 Receiver 4 - Summary of predicted construction noise levels – Educational Receiver (internally)

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	35 to 53	43 to 60	Standard Construction Hours 45 dB(A) $L_{Aeq\ (15\ min)}$ internally Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$ externally	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Power hand tools		31 to 49			
	Semi Rigid Vehicle [1]		27 to 45			
	Excavators		34 to 52			
	Hydraulic Hammering		35 to 53			
	Bulldozers		30 to 48			
	Hand held jack hammers [1]		33 to 51			
	Dump trucks [1]		26 to 44			
	Truck Movements		20 to 38			
	Concrete saw [1]		36 to 54			
	Water Carts		29 to 47			
	Skid steer		32 to 50			
	Bobcats		26 to 44			
	Rollers		29 to 47			
	Pilling		32 to 50			
	Power hand tools		31 to 50			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	28 to 46	30 to 58	Standard Construction Hours 45 dB(A) $L_{Aeq\ (15\ min)}$ internally Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$ externally	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Concrete saw [1]		36 to 54			
	Power hand tools		31 to 49			
	Welder		23 to 41			
	Truck Movements		30 to 38			
	Forklifts		28 to 46			
	Rollers		29 to 47			
	Concrete pump truck		32 to 50			
	Concrete agitator truck		30 to 48			
Internal Works	Power hand tools	109	31 to 49	31 to 49		
Common and External Works	Concrete agitator truck	117	30 to 48	38 to 56		
	Saw cutter [1]		26 to 44			
	Dump truck [1]		26 to 44			
	Concrete saw [1]		36 to 54			
	Power hand tools		31 to 49			

Table 15 Receiver 5 - Summary of predicted construction noise levels – Commercial Receiver

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	65 to 83	73 to 90	Standard Construction Hours 70 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Power hand tools		61 to 79			
	Semi Rigid Vehicle [1]		57 to 75			
	Excavators		64 to 82			
	Hydraulic Hammering		65 to 83			
	Bulldozers		60 to 78			
	Hand held jack hammers [1]		63 to 81			
	Dump trucks [1]		56 to 74			
	Truck Movements		50 to 68			
	Concrete saw [1]		66 to 84			
	Water Carts		59 to 77			
	Skid steer		62 to 80			
	Bobcats		56 to 74			
	Rollers		59 to 77			
	Pilling		62 to 80			
	Power hand tools		61 to 80			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	58 to 76	60 to 68	Standard Construction Hours 70 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Concrete saw [1]		66 to 84			
	Power hand tools		61 to 79			
	Welder		53 to 71			
	Truck Movements		50 to 68			
	Forklifts		58 to 76			
	Rollers		59 to 77			
	Concrete pump truck		62 to 80			
	Concrete agitator truck		60 to 78			
Internal Works	Power hand tools	109	61 to 79	61 to 79		
Common and External Works	Concrete agitator truck	117	60 to 78	68 to 86		
	Saw cutter [1]		56 to 74			
	Dump truck [1]		56 to 74			
	Concrete saw [1]		66 to 84			
	Power hand tools		61 to 79			

Table 16 Receiver 6 - Summary of predicted construction noise levels – Commercial Receiver

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	61 to 79	69 to 86	Standard Construction Hours 70 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Power hand tools		67 to 75			
	Semi Rigid Vehicle [1]		53 to 71			
	Excavators		60 to 78			
	Hydraulic Hammering		61 to 79			
	Bulldozers		56 to 76			
	Hand held jack hammers [1]		59 to 77			
	Dump trucks [1]		52 to 70			
	Truck Movements		46 to 64			
	Concrete saw [1]		62 to 80			
	Water Carts		55 to 69			
	Skid steer		58 to 76			
	Bobcats		52 to 70			
	Rollers		55 to 73			
	Pilling		58 to 76			
	Power hand tools		57 to 76			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	54 to 72	56 to 64	Standard Construction Hours 70 dB(A) $L_{Aeq\ (15\ min)}$ Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Concrete saw [1]		62 to 80			
	Power hand tools		57 to 75			
	Welder		49 to 67			
	Truck Movements		46 to 64			
	Forklifts		52 to 72			
	Rollers		55 to 73			
	Concrete pump truck		58 to 76			
	Concrete agitator truck		56 to 74			
Internal Works	Power hand tools	109	57 to 75	57 to 75		
Common and External Works	Concrete agitator truck	117	56 to 74	64 to 84		
	Saw cutter [1]		52 to 70			
	Dump truck [1]		52 to 70			
	Concrete saw [1]		62 to 80			
	Power hand tools		57 to 75			

Table 17 Receiver 7 - Summary of predicted construction noise levels – Childcare Centre (internally)

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Site Establishment, Ground Works and Demolition	Mobile crane	122	32 to 50	40 to 57	Standard Construction Hours 45 dB(A) $L_{Aeq\ (15\ min)}$ internally Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$ externally	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Power hand tools		28 to 46			
	Semi Rigid Vehicle [1]		24 to 42			
	Excavators		31 to 49			
	Hydraulic Hammering		32 to 50			
	Bulldozers		27 to 45			
	Hand held jack hammers [1]		30 to 47			
	Dump trucks [1]		23 to 41			
	Truck Movements		17 to 35			
	Concrete saw [1]		33 to 51			
	Water Carts		26 to 44			
	Skid steer		29 to 47			
	Bobcats		23 to 41			
	Rollers		26 to 44			
	Pilling		29 to 47			
	Power hand tools		27 to 47			

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Noise Management Levels	Summary of Result
Construction of the Structure	Hand held jack hammer [1]	117	25 to 43	27 to 55	Standard Construction Hours 45 dB(A) $L_{Aeq\ (15\ min)}$ internally Highly Noise Affected Level Standard Construction Hours 75 dB(A) $L_{Aeq\ (15\ min)}$ externally	Works undertaken within proximity of the receiver have the potential to be greater than the noise management levels and high noise affected noise levels. Mitigation and management controls including communication with the receiver and periods of respite are required to be included as part of the construction works as detailed in this report.
	Concrete saw [1]		33 to 51			
	Power hand tools		28 to 46			
	Welder		20 to 38			
	Truck Movements		27 to 36			
	Forklifts		25 to 43			
	Rollers		26 to 44			
	Concrete pump truck		29 to 47			
	Concrete agitator truck		27 to 45			
Internal Works	Power hand tools	109	28 to 46	28 to 46		
Common and External Works	Concrete agitator truck	117	27 to 45	35 to 53		
	Saw cutter [1]		23 to 41			
	Dump truck [1]		23 to 41			
	Concrete saw [1]		33 to 51			
	Power hand tools		28 to 46			

5.4 Construction Traffic Noise Assessment

It is proposed that the construction traffic would access the site via Moore Park Road and Driver Avenue. All construction traffic will access the site and use the surrounding roadways in accordance with the site Construction Traffic and Pedestrian Management Plan.

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW *Road Noise Policy (RNP)* states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

It is proposed that the construction traffic would access the site via Moore Park Road which includes exiting traffic movements (including heavy viceless). Based on the exiting noise levels resulting from the use of the surrounding roadways compliance with the required traffic noise levels will be achieved.

All drivers of trucks and construction vehicles are required to be trained in the sites requirements for the operation of equipment and routes to be used to access the site. The driver code is required to be developed in accordance with the project SSD Conditions including Item B32(h) (iii) which includes the following.

(h) detail the mitigation measures that are to be implemented to ensure road safety and network efficiency during construction in consideration of potential impacts on general traffic, cyclists and pedestrians and bus services; and
   (i) include a Driver Code of Conduct to: minimise the impacts of construction on the local and regional road network;
   (ii) minimise conflicts with other road users;
   (iii) minimise road traffic noise;
   (iv) ensure truck drivers use specified routes;
   (v) include a program to monitor the effectiveness of these measures; and
   (vi) if necessary, detail procedures for notifying residents and the community (including local schools), of any potential disruptions to routes.

Truck drivers are to be instructed to mitigate noise impacts including the following:

1. Mitigate engine braking from truck when possible, including deactivating breaks within the vicinity of residential receivers.
2. Reduce aggressive acceleration from the site.
3. Ensure all trucks and equipment are well maintained.
4. Other relevant noise reducing operations where possible.

Details of the required driver codes are include in the projects *Construction Management Plan.*

5.5 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 0, it is recommended that the indicative safe distances listed in table below should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site.

Since the criteria for scientific or medical equipment (should any of these exist close to the site) can be more stringent than those required for human comfort, vibration validating measurements should be conducted at each site to determine the vibration level and potential impact onto this sensitive equipment.

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 4.2.

Table 18 Recommended indicative safe working distances for vibration intensive plant

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically more than 13 tonnes)	20	100
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

Any vibration rolling, including Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in Section 4.2 of this report.

6 NOISE AND VIBRATION MANAGEMENT PLAN

6.1 Acoustic Management Procedures

Table 19~~Table 19~~ below summarises the management procedures recommended for airborne noise and vibration impact. These procedures are also further discussed in the report. Hence, where applicable, links to further references are provided in Table 19~~Table 19~~.

Table 19 Summary of mitigation procedures

Procedure	Abbreviation	Description	Further Reference
General Management Measures	GMM	Introduce best-practice general mitigation measures in the workplace which are aimed at reducing the acoustic impact onto the nearest affected receivers.	Refer to Section 5 For noise impact, also refer to Section 0 For vibration impact, also refer to Section 6.4.1
Project Notification	PN	Issue project updates to stakeholders, discussing overviews of current and upcoming works. Advanced warning of potential disruptions can be included. Content and length to be determined on a project-by-project basis.	Refer to Section 6.8.3 and 6.8.4
Verification Monitoring	V	Monitoring to comprise attended or unattended acoustic surveys. The purpose of the monitoring is to confirm measured levels are consistent with the predictions in the acoustic assessment, and to verify that the mitigation procedures are appropriate for the affected receivers. If the measured levels are higher than those predicted, then the measures will need to be reviewed and the management plan will need to be amended.	For noise impact, refer to Section 6.3.3. For vibration impact, refer to Section 6.4.2
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders	Refer to Section 6.6
Specific Notification	SN	Individual letters or phone calls to notify stakeholders that noise levels are likely to exceed noise objectives. Alternatively, contractor could visit stakeholders individually in order to brief them in regards to the noise impact and the mitigation measures that will be implemented.	Refer to Section 6.8.3 and 6.8.4
Respite Offer	RO	Offer provided to stakeholders subjected to an ongoing impact.	-
Alternative Construction Methodology	AC	Contractor to consider alternative construction options that achieve compliance with relevant criteria. Alternative option to be determined on a case-by-case basis.	-

The application of these procedures is in relation to the exceedances over the relevant criteria. For airborne noise, the criteria are based on NMLs. The allocation of these procedures is discussed in Section 6.1.1

For vibration, the criteria either correspond to human comfort, building damage or scientific and medical equipment. The application of these procedures is discussed in Section 6.1.2.

6.1.1 Allocation of Noise Management Procedures

For residences, the management procedures have been allocated based on noise level exceedances at the affected properties, which occur over the designated NMLs (refer to section 4.1). The allocation of these procedures is summarised in Table 20~~Table 20~~ below.

Table 20 Allocation of noise management procedures – residential receivers

Construction Hours	Exceedance over NML (dB)	Management Procedures (see definition above)
Standard Hours During approved working hours	0 - 3	GMM
	4 - 10	GMM, PN, V [1], CMS, AC
	> 10	GMM, PN, V, CMS, SN, AC
Outside Standard Hours	0 - 10	GMM, AC
	11 - 20	GMM, PN, V [1], CMS, AC
	> 20	GMM, PN, V, CMS, SN, RO, AC

Notes

1. Verification monitoring to be undertaken upon complaints received from affected receivers

Please note the following regarding the allocation of these procedures:

- The exceedances have been estimated as part of the acoustic assessment, and these are summarised in Section 5.1.
- The allocation of procedures is based on the assumptions used for noise level predictions (refer to Section 5.1). Consequently, these allocations can be further refined once additional details of the construction program become available.

For non-residential receivers (such as commercial), management measures are provided in Section 6.3.4.

6.1.2 Allocation of Vibration Management Procedures

Table 21~~Table 21~~ below summarises the vibration management procedures to be adopted based on exceedance scenarios (i.e., whether the exceedance occurs over human comfort criteria, building damage criteria, or criteria for scientific and medical equipment). Please note these management procedures apply for any type of affected receiver (i.e., for residences as well as non-residential receivers).

Table 21 Allocation of vibration management procedures

Construction Hours	Exceedance Scenario	Management Procedures
Standard Hours During Approved working hour	Over human comfort criteria (refer to Section 4.2.1)	GMM, PN, V, RO
	Over building damage criteria (refer to Section 4.2.2)	GMM, V, AC
Outside Standard Hours	Over human comfort criteria (refer to Section 4.2.1)	GMM, SN, V, RO, CMS
	Over building damage criteria (refer to Section 4.2.2)	GMM, V, AC

6.2 Site Specific Noise Mitigation Measures – High Noise Affected Appliances

Predicted noise levels outlined in section 5.1 indicate exceedances above the Noise Management Levels (NMLs) as well as the Highly Noise Affected Level (HNAL) when in proximity to a boundary. To militate against any exceedances, the site will need to introduce periods of respite for activities which are creating noise levels above the HNAL only (i.e. greater than 75dBA). See below.

Table 22 Recommended Respite Periods

Monday to Friday	Saturday
7:00am to 8:00am – No noisy works (Respite Period)	8:00am to 9:00am – No noisy works (Respite Period)
8:00am to 11:30am – Works	9:00am to 12:00pm – Works
11:30am to 12:30pm – No noisy works (Respite Period)	12:00pm to 1:00pm – No noisy works (Respite Period)
12:30pm to 3:30pm – Works	
3:30pm to 4:30pm – No noisy works (Respite Period)	
4:30pm to 6:00pm – Works	

The required respite times of high noise affected levels have been developed in accordance with the projects SSD Conditions of Consent and the community consultation with the surrounding receivers including the Kira Child Care centre, UTS and NRL.

Details of the consultation with the surrounding receivers is included in Appendix C.

6.3 Environmental Site Representative

BESIX Watpac will include a member of the site staff as a Environmental Site Representative who will act as the Responsible Person with respect to noise and vibration. They will be responsible for implementing the measures within this CNVSP and will be responsible for:

(i) Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise;

(ii) Ensuring good work practices are adopted to avoid issues such as noise from dropped items and all reasonable and feasible mitigations are implemented as a part of the construction of the project including those detailed in this report.

6.3.1 Site personnel

The following measures must be implemented for staff working on site:

- Ensuring good work practices are adopted to avoid issues such as noise from dropped items, noise from communication radios is kept as low as is practicable;
- Avoid the use of stereos/radios outdoors;
- Avoid shouting and minimise talking loudly, swearing and slamming vehicle doors.
- 'Toolbox talks' will be held at regular intervals with the contractor workers, including discussion of noise and vibration mitigation, monitoring and assessment. These topics will also be covered under induction processes.
- Operate two way radios at the minimum effective volume, and avoid shouting or whistling at the site.

- Identification of reasonable and feasible noise mitigation methods will be conducted by the Environmental Site Representative on a daily basis during noisy works. The Environmental Site Representative will have the authority to modify work practices in response to complaints, where investigation has identified it is required.

6.3.2 General Comments

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures. These measures shall include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.
- Where practicable and without compromising the safety of construction staff or members of the public, the use of 'quackers should be used on all equipment and viechles on the site.

In order to minimise noise impacts during the works, the contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

6.3.3 Noise Monitoring

Noise monitoring, if required, will be performed by an acoustical consultant directly engaged by the contractor.

Noise monitoring is recommended to be undertaken by attended noise measurements at the start of any new phase of works (i.e. demolition, excavation or remediation works etc.). The statistical parameters to be measured should include the following noise descriptors: L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq}. Unattended noise measurements should be conducted over consecutive 15 minute periods.

This monitoring should also be complemented by undertaking attended noise measurements in order to:

- Differentiate between construction noise sources and other extraneous noise events (such as road traffic and aircraft noise)
- Note and identify any excessive noise emitting machinery or operation.

Noise monitoring and measurements on the site will include the following:

- Noise monitoring during the required demolition to be completed on the site.
- Periodic attended noise measurements during the bulk earthworks to be completed on the site, typically monthly.

In addition to the above detailed measurements, should any complaints be received which have not been determined previously, it should be confirmed by conducting additional attended noise measurements.

The survey methodology and any equipment should comply with the requirements discussed in Standard AS 1055.1-1997.

6.3.4 Noise Mitigation Measures

Based on the predicted constriction noise levels all reasonable and feasible noise mitigation and management of construction activities are to be undertaken on the site, this should include:

- Undertake general mitigation measures as discussed in Section 6
- Issue project updates to tenants in affected premises. The updates can include overview of current and upcoming works, as well as advanced warning of potential disruptions. These updates can also be issued through an email distribution list or via social media.
- Signage to be posted in order to provide stakeholders information regarding project details, emergency contacts and enquiry contact information.

6.3.5 Alternate Equipment or Process

Exceedance of the site's NMLs should result in an investigation as to whether alternate equipment could be used, or a difference process could be undertaken.

In some cases, the investigation may conclude that no possible other equipment can be used, however, a different process could be undertaken.

6.3.6 Acoustic Enclosures/Screening

Typically, on a construction site there are three different types of plant that will be used: mobile plant (i.e., excavators, skid steers, etc.), semi mobile plant (i.e., hand tools generally) or static plant i.e. (diesel generators).

For plant items which are static it is recommended that, in the event exceedances are being measured due to operation of the plant item, an acoustic enclosure/screen is constructed to reduce impacts. These systems can be constructed from Fibre Cement (FC) sheeting or, if airflow is required, acoustic attenuators or louvres.

For semi mobile plant, relocation of plant should be investigated to either be operated in an enclosed space or at locations away from a receiver.

With mobile plant it is generally not possible to treat these sources. However, investigations into the machine itself may result in a reduction of noise (i.e., mufflers/attenuators etc).

6.4 Vibration Mitigation Measures

6.4.1 General Comments

As part of the CNVMP, the following vibration mitigation measures should be implemented:

- Any vibration generating plant and equipment is to be in areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of construction plant and equipment; that is, smaller capacity plant.
- Minimise conducting vibration generating works consecutively in the same area (if applicable).
- Schedule a minimum respite period of at least 30 minutes before activities commence which are to be undertaken for a continuous 4-hour period.
- Use only dampened rock breakers and/or "city" rock breakers to minimise the impacts associated with rock breaking works.
- Conduct attended measurements of vibration generating plant at commencement of works in order to validate the indicative safe working distances advised in Table 25 and, consequently, to establish safe working distances suitable to the project. Measurements should be conducted at the nearest affected property boundary. These safe working distances should be defined by considering the vibration criteria discussed in Section 2 (i.e., criteria for structural damage, human comfort and impact to scientific or medical equipment).

6.4.2 Vibration Monitoring

Vibration monitoring will be undertaken at the nearest most affected structures and include the following:

1. Attended vibration surveys resulting from high vibration generating activities which are within the recommended safe working distances detailed in Table 18 above. Vibration assessments should include attended vibration measurements of proposed activities to be undertaken on the site.

The vibration monitoring equipment would be operated and analysed by the acoustical consultant.

Reports of the measured vibration levels and their likely impacts would be prepared by the acoustical consultant and issued to the contractor.

6.5 Noise and Vibration Monitoring

As part of the management of noise from the proposed construction activities to be undertaken on the site the following noise and vibration monitoring is to be undertaken:

1. Noise Monitoring–

    a. Existing permanent noise monitoring was installed by the Early works contractor (John Holland) The location at noted as NRL, ARU and Kira Child Care. BesixWatpac will undertake permanent noise monitoring at these 3 locations surround this site which is indicated in the figure below.

    b. Attended noise monitoring of excavation and construction activities is to be undertaken during the following periods:
        i. Periodically at 3 monthly periods in accordance with the requirements of items C17 of the SSD.
        ii. Commencement of any rock breaking, piling or sawing on the site.
        iii. In response to any ongoing complaints received from neighbours.

2. Vibration – Based on the proximity of the surrounding receivers to the works magnitudes of vibration resulting from construction activities required to be undertaken on the site are not expected to approach vibration limits detailed in Section 0 of this report, therefore permanent continuous vibration monitoring is not recommended.

    Attended vibration monitoring is to be undertaken at the following periods:
    a. Commencement of any high vibration generating activities including hydraulic hammering, rock breaking, piling or vibration rolling on the site.
    b. receiver location in the event complaints resulting from construction activities resulting from the perception of vibration are experienced by the occupants of buildings within the vicinity of the site.

6.5.1 Stop-work notice

A stop-work notice will be issued if either of the following two parameters are exceeded as a result of construction activities at a residential receiver location of:

- $L_{Aeq,8h}$ of 85 dB(A)
- $L_{C,peak}$ of 140 dB(C).

6.6 Vibration Impact on Busby Bore

Based on the SSD monitoring of vibration of the Busby bore is required, as detailed in Item C19, which includes the following:

Vibration Criteria

C19. Vibration caused by construction activities at any residence or adjoining structure including all surrounding heritage items within or outside the boundary of the site must be limited to:

(a) the latest version of *DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures* (German Institute for Standardisation) for structural damage;

(b) 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), for human exposure; and

(c) the vibration requirements of the *Methodology Statement – Working Near Busby's Bore* prepared by Infrastructure NSW dated September 2018 as updated by condition B22 (being part of the CNVMP in condition B28).

(d) a maximum peak particle velocity of 5 mm/second in the vicinity of Shafts **8,** 9 and 10 of the Busby's Bore.

[SSD-9835-Mod-7]

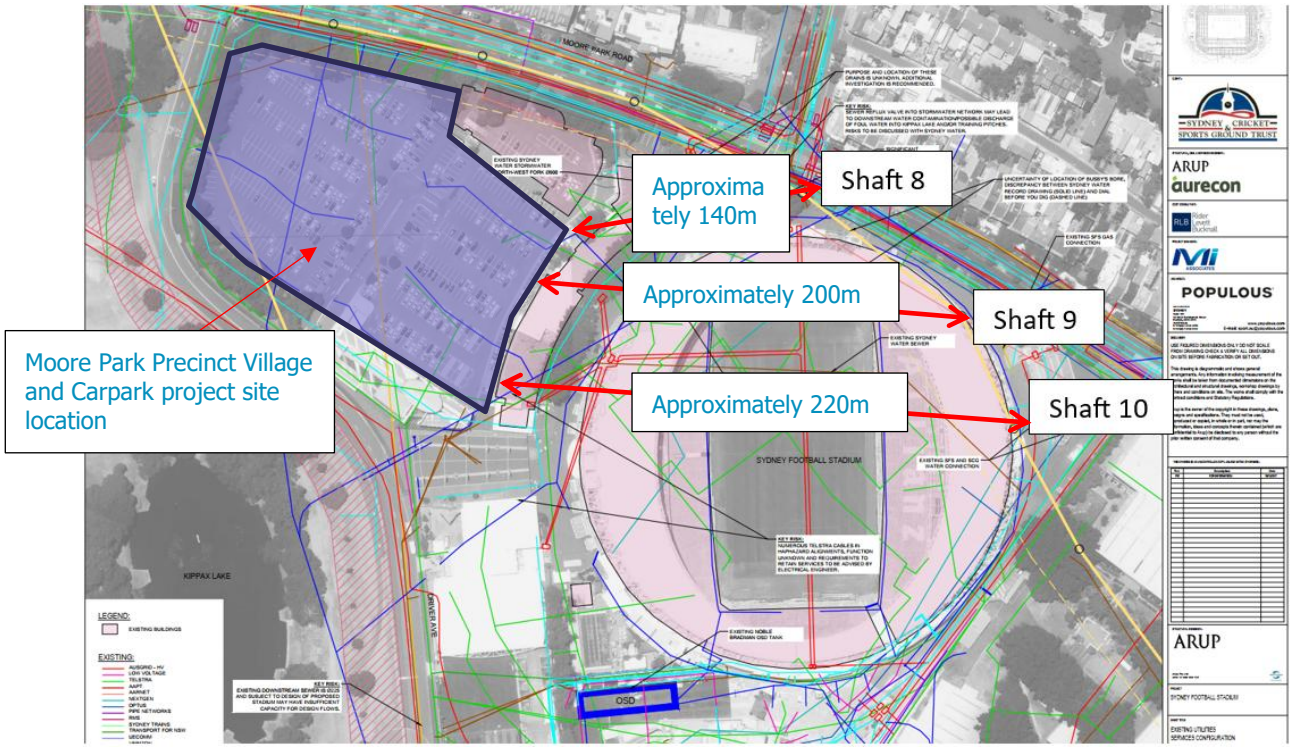
C20. Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition C19.

C21. Vibration during the construction works must comply with the limits specified in conditions C19 and C20, unless otherwise agreed in the CNVMP as required by condition B28 and forming a part of the CEMP.

C22. Ongoing vibration monitoring must be conducted during the excavation works in the vicinity of Shafts **8,** 9 and 10 of the Busby's Bore.

Based on the location of the busby bore shafts 8, 9 and 10 and the proximity to the Moore Park Precinct Village and Carpark project the following is discussed:

(i) Shafts 8, 9 and 10 include those which are located to the north and east of the completed Sydney Football stadium with a significant distance from the proposed carpark site, see the figure below. These shafts include a separation from the carpark site, such that the potential vibration from construction activities would not result in vibration above the required criteria of 5mm/s.



(ii) Based on the requirements of the ARUP CNVMP and the SSD conditions of consent monitoring of construction activities is required to include the following:

a. In the event vibration compactors are required to be used within 30m of residential buildings.

Based on the details include in this section of the report and the requirements of the SSD Conditions vibration monitoring of Busby Bore would not be required as part of the construction activities to be undertaken as part of the Moore Park Precinct Village and Carpark project.

6.7 Vibration Impact on SCG and Ladies Stands

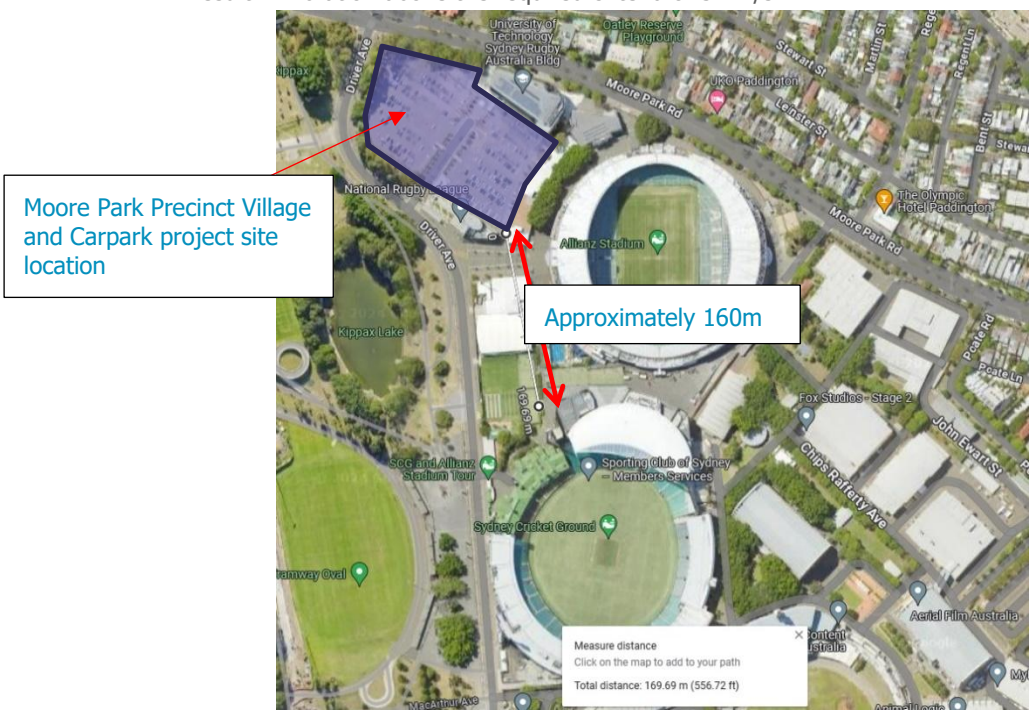
Based on the SSD monitoring vibration impact of the SCG and Ladies Stands is required to be undertaken, including that detailed in B28 (h), which includes the following:

(h) include details of management measures to avoid any adverse vibration impacts on the nearby following heritage items during construction:
  (i) Member's stand, SCG; and
  (ii) Lady's Member Stand, SCG.

Based on the location of the Moore Park Precinct Village and Carpark project to the SCG and Ladies Stand the following is discussed:

(i) The location of the SCG and Ladies Stand includes that to the south of the Moore Park Precinct Village and Carpark project, which a distance separation of approximately 160m (see figure below).

(ii) Based on the distance separation of the required works to be conducted as part of the Moore Park Precinct Village and Carpark project the potential vibration from construction activities would not result in vibration above the required criteria of 5mm/s.



(iii) Based on the requirements of the ARUP CNVMP and the SSD conditions of consent monitoring of construction activities is required to include the following:

a. In the event vibration compactors are required to be used within 30m of residential buildings.

Based on the details include in this section of the report and the requirements of the SSD Conditions vibration monitoring of SCG or the Ladies Stand would not be required as part of the construction activities to be undertaken as part of the Moore Park Precinct Village and Carpark project.

6.8 Complaints management process and Community Communication Strategy

6.8.1 Enquiries and complaints management

BESIX Watpac will manage all enquiries and complaints in a timely and responsive manner and detailed in the projects Community Communication Strategy including that undertaken in accordance with item E28 of the SSD.

Prior to project delivery, a complaint could be related to lack of community consultation, design of the project, lack of project progress, etc.

During project delivery, a complaint is defined as in regard to construction impacts – such as – safety, dust, noise, traffic, congestion, loss of parking, contamination, loss of amenity, hours of work, property damage, property access, service disruption, conduct or behaviour of construction workers, other environmental impacts, unplanned or uncommunicated disruption to the receiver.

As per our planning approval conditions, a complaints register is updated monthly and will be publicly available. The complaints register will record the number of complaints received, the nature of the complaints and how the complaint was resolved.

6.8.2 Complaints management process

All complaints will be conducted in accordance with the projects Community Communication Strategy. Any face to face complaints will be directed to the hotline as detailed in the Community Communication Strategy.

6.8.3 Community and Stakeholder Communication and Engagement

Community and stakeholder communication and engagement will be undertaken in accordance with Condition B19 of the SSD.

A Community Communication Strategy (CCS) has been prepared (SFSR Community Communication Strategy, January 2020) which provides mechanisms to facilitate communication between the Applicant and the community during the construction works. The CCS was endorsed by the Planning Secretary's delegate on 4 March 2020 and is available on the Infrastructure SFSR webpage at: http://www.infrastructure.nsw.gov.au/projects- nsw/sydney-football-stadiumredevelopment/.

Consistent with the approved CCS, there are several tools and activities that are being employed to notify the community about the project. These include:

- Availability of all approved project related information on the Infrastructure SFSR webpage at: http://www.infrastructure.nsw.gov.au/projects-nsw/sydney- football-stadiumredevelopment/ and https://www.venuesnsw.com/page/publications
- Project updates continue to be available on Infrastructure NSW's SFSR and Venues NSW websites.

Prior to the works onsite being undertaken, BESIX Watpac will undertake notifications of the works to be conducted as well provide details of contact details to the following receivers within the vicinity of the site:

Receiver 1:	Residential receivers located to the west of the site including those on Moore Park Road and located to the west of Greens Road.
Receiver 2:	Residential receivers located to the north east of the site including those on Moore Park Road and located to the east of Oatley Road.
Receiver 3:	Residential receivers located to the north of the site including those on Leinster Street and located to the east Oatley Road.
Receiver 4:	Commercial receivers including within the University of Technology building (including Rugby Australia) of Moore Park Road and located to the north of the site.

Receiver 5: Commercial receivers including those within the National Rugby Leage building of Driver Avenue and located to the south of the site.

Receiver 6: Commercial receivers including those located to the north of the site opposite on Moore Park Road.

Receiver 7: The Childcare centre located to the north of the site and opposite on Moore Park Road.

Communication notification, should not be limited to the beginning of the onsite works but throughout, providing the community with constant updates on the progress and upcoming works. In our experience these could include:

- Project website.
- Email notifications; and
- Letterbox drops.

6.8.4 Community Engagement

Consultation with University of Technology Sydney, Rugby Australia, NRL Building and Kira Child Care Centre will occur during fortnightly site walks and meetings. During these forums, the construction program dates/duration for the proposed construction works of the Precinct Village and Car Park have been shared to understand noise sensitive periods of both premises, including exam periods at the University of Technology.

6.9 Works shall be scheduled outside of these periods where possible. Where not possible, notification shall be given to these premises as early as possible to allow the scheduling of sensitive activities outside works hours.Complaints Management System

Should complaints arise they must be dealt with in a responsible and uniform manner, therefore, a management system to deal with complaints is detailed above.

6.10 Contingency Plans

Contingency plans are required to address noise or vibration problems if excessive levels are measured at surrounding sensitive receivers and/or if justified complaints occur. Such plans include:

- Stop the onsite works.
- Identify the source of the main equipment within specific areas of the site which is producing the most construction noise and vibration at the sensitive receivers; and
- Review the identified equipment and determine if an alternate piece of equipment can be used or the process can be altered.
- In the event an alternate piece of equipment or process can be used, works can re-commence.
- In the event an alternate piece of equipment or process cannot be determined implement a construction assessment to be performed by a suitably qualified acoustic consultant.

The Superintendent shall have access to view the Contractor's noise measurement records on request. The Superintendent may undertake noise monitoring if and when required.

6.11 General Mitigation Measures (Australia Standard 2436-2010)

As well as the above project specific noise mitigation controls, AS 2436-2010 "*Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*" sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on the subject project are listed below, including the typical noise reduction achieved, where applicable.

6.11.1 Adoption of Universal Work Practices

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration.
- Regular identification of noisy activities and adoption of improvement techniques.
- Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby sensitive receivers.
- Where possible, avoiding the use of equipment that generates impulsive noise.
- Minimising the need for vehicle reversing for example (particularly at night), by arranging for one-way site traffic routes.
- Use of broadband audible alarms on vehicles and elevating work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

6.11.2 Plant and Equipment

- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.
- Operating plant and equipment in the quietest and most efficient manner.

6.11.3 On Site Noise Mitigation

- Maximising the distance between noise activities and noise sensitive land uses.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

6.11.4 Work Scheduling

- Providing respite periods which could include restricting very noisy activities to time periods that least affect the nearby noise sensitive locations, restricting the number of nights that after-hours work is conducted near residences or by determining any specific requirements.
- Scheduling work to coincide with non-sensitive periods.
- Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.
- Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
- Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

6.11.5 Source Noise Control Strategies

Some ways of controlling noise at the source are:

- Where reasonably practical, noisy plant or processes should be replaced by less noisy alternatives.
- Modify existing equipment: Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, trucks, etc. In order to minimise noise emissions, residential grade mufflers should be fitted on all mobile plant utilised on site.
- Siting of equipment: locating noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Regular and effective maintenance.

6.11.6 Miscellaneous Comments

Deliveries should be undertaken, where possible, during standard construction hours.

Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles at site and monitor the profiles in use.

It is advised that mobile plant and trucks operating on site for a significant portion of the project are to have reversing alarm noise emissions minimised. This is to be implemented subject to recognising the need to maintain occupational safety standards.

No public address system should be used on site (except for emergency purposes).

7 CONCLUSION

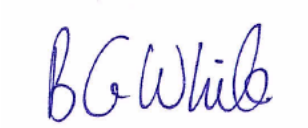
This report details the Construction Noise and Vibration Management Sub Plan for the construction of the the construction works associated with the Moore Park Precinct Village and Carpark project which includes part of the Sydney Football Stadium redevelopment site.

An assessment of noise and vibration impacts from the required processes to be undertaken during the construction period of the project (including ground works and construction) has been undertaken and suitable treatments, management controls, perioding measurements and community engagement has been detailed in this report.

Providing the recommendations in this report are included in the construction of the site, compliance with the relevant SSD-9835 requirements and the EPA's *Interim Construction Noise Guideline* will be achieved.

For any additional information please do not hesitate to contact the person below.

Regards



Ben White
Director

Pulse White Noise Acoustics

APPENDIX A: ACOUSTIC GLOSSARY

The following is a brief description of the acoustic terminology used in this report:

Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
dB(A)	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
dB (A)	'A' Weighted overall sound pressure level
Sound Pressure Level, LP dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, Lw dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt

8 APPENDIX B – BEN WHITE CV AND MATTHEW FURLONG

Curriculum Vitae – Benjamin White

Employment Experience:

Director – Pule White Noise Acoustics November 2020 – Present

Director - White Noise Acoustics: March 2019 – Present

Director/Engineer - Acoustic Logic Consultancy: March 2001 – July 2018

Experience:

Ben White the Director of White Noise has over 17 years of experience in acoustic.

Ben has significant experience in providing acoustic services and expert advice in the following areas:

- Residential acoustic reports including aircraft noise (AS2021) assessments, traffic noise, train noise and vibration assessments.
- Noise emission assessments for various projects including assessments with planning requirements using EPA, Department of Planning, Council DCP's and similar regulatory requirements.
- Planning approvals including Development Applications for multi dwelling residential developments, commercial developments, hotels and boarding houses, places of entertainment, carparks, mixed use developments, shopping centres and the like.
- Expert court witness including Land and Environment Court and other expert witness work.
- Project planning and specifications for types of projects including residential, commercial, retail, hotel accommodation, warehouses and industrial developments and mixed-use projects.
- Project delivery for all types of projects including, design advice and project delivery requirements at all stages of projects during design and construction.
- Certification works including on site testing for the provision of certification of all types of projects including items required to comply with Part F5 of the BCA as well as project specific acoustic requirements.
- Mechanical design and advice for the treatments of mechanical services with project requirements.
- External façade design and specification.
- Specialised acoustic design advice including areas of projects.
- Issues with existing building include site surveys and audits as well as advice regarding rectification if required.

AUSTRALIAN ACOUSTICAL SOCIETY

This is to certify that

BENJAMIN WHITE

was admitted to the grade of

MEMBER

of the Australian Acoustical Society

on 27th October 2020

and is entitled to use the letters

M.A.A.S.

issued on 26th November 2020

S. Moore

President

General Secretary

AUSTRALIAN ACOUSTICAL SOCIETY A.C.N. 000 712 658 The Common Seal Of

This certificate remains the property of the Australian Acoustical Society

9 APPENDIX C – SURROUNDING RECEIVER CONSULTATION