SYDNEY METRO - WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

NSW (Off-airport) Construction Noise and Vibration Management Sub-plan

Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works

Project number	WSA-200-SBT
Document number	SMWSASBT-CPG-1NL-NL000-NV-PLN-000001
Revision date	20 February 2024
Revision	3

Document approval

Rev	Date	Prepared by	Reviewed by	Approved by	Remarks
A	18 May 2022	[redacted]	[redacted]	[redacted]	For stakeholder consultation and review
0	24 August 2022	[redacted]	[redacted]	[redacted]	Revised to address Sydney Metro, ER and stakeholder comments
1	23 September 2022	[redacted]	[redacted]	[redacted]	Revised to address Sydney Metro and ER comments
2	23 January 2024	[redacted]	[redacted]	[redacted]	Annual review of CEMP and Sub-plans
3	20/02/2024	[redacted]	[redacted]	[redacted]	Updated to reflect ER comments
Signature:					

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Compliance

<table>
<tr><th>No.</th><th>Requirement</th><th>Reference</th></tr>
<tr><td colspan="3">SSI 10051 Planning Approval</td></tr>
<tr><td>C1</td><td>Construction Environmental Management Plans (CEMPs) and CEMP Sub-plans must be prepared in accordance with the Construction Environmental Management Framework (CEMF) included in the documents listed in Condition A1 to detail how the performance outcomes, commitments and mitigation measures specified in the documents listed in Condition A1 will be implemented and achieved during construction.</td><td>Section 1.2</td></tr>
<tr><td>C5</td><td>Of the CEMP Sub-plans required under Condition C1, the following CEMP Sub-plans must be prepared in consultation with the relevant government agencies identified for each CEMP Sub-plan. Details of issues raised by a government agency during consultation (as required by Condition A6) must be provided as part of the relevant CEMP Sub-Plan when submitted to the Planning Secretary / ER (whichever is applicable). Where a government agency(ies) request(s) is not included, the Proponent must provide the Planning Secretary / ER (whichever is applicable) justification as to why.
<table>
<tr><th></th><th>Required CEMP Sub-Plan</th><th>Relevant government agencies to be consulted for each CEMP Sub-plan</th></tr>
<tr><td>(a)</td><td>Noise and vibration</td><td>Relevant Councils and WaterNSW (in relation to its assets)</td></tr>
</table></td><td>Section 1.4</td></tr>
<tr><td rowspan="5">C6</td><td colspan="2">The CEMP Sub-plans must state how:</td></tr>
<tr><td>(a) the environmental performance outcomes identified in the documents listed in Condition A1 will be achieved;</td><td>Sections 1.3 & 6</td></tr>
<tr><td>(b) the mitigation measures identified in the documents listed in Condition A1 will be implemented;</td><td>Section 8</td></tr>
<tr><td>(c) the relevant terms of this approval will be complied with; and</td><td>Section 9</td></tr>
<tr><td>(d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed through SMART principles.</td><td>Sections 7, 8 and 9, Element 4</td></tr>
<tr><td>C7</td><td>With the exception of any CEMP Sub-plans expressly nominated by the Planning Secretary to be endorsed by the ER, all CEMP Sub-plans must be submitted to the Planning Secretary for approval.</td><td>Section 1.4
CEMP Section 1.4</td></tr>
<tr><td>C8</td><td>The CEMP Sub-plans not requiring the Planning Secretary's approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all relevant undertakings made in the documents listed in Condition A1. Any of these CEMP Sub-plans must be submitted to the ER with, or subsequent to, the submission of the CEMP but in any event, no later than one (1) month before construction or where construction is staged no later than one (1) month before the commencement of that stage.</td><td>Section 1.4
CEMP Section 1.4</td></tr>
<tr><td>C9</td><td>Any of the CEMP Sub-plans to be approved by the Planning Secretary must be submitted to the Planning Secretary with, or subsequent to, the submission of the CEMP but in any event, no later than one (1) month before construction or where construction is staged no later than one (1) month before the commencement of that stage.</td><td>Section 1.4
CEMP Section 1.4</td></tr>
</table>

<table>
<tr><th>No.</th><th>Requirement</th><th>Reference</th></tr>
<tr><td>C10</td><td>Construction must not commence until the CEMP and all CEMP Sub-plans have been approved by the Planning Secretary or endorsed by the ER (whichever is applicable), unless otherwise agreed by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by the Planning Secretary or endorsed by the ER (whichever is applicable), including any minor amendments approved by the ER, must be implemented for the duration of construction.</td><td>Section 1.4
CEMP Section 1.4</td></tr>
<tr><td>C13</td><td>The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies (as required by Condition A6) identified for each to compare actual performance of construction of the CSSI against the performance predicted in the documents listed in Condition A1 or in the CEMP. Where a government agency(ies) request(s) is not included, the Proponent must provide the Planning Secretary / ER (whichever is applicable) justification as to why.
Required Construction Monitoring Programs Relevant government agencies to be consulted for each Construction Monitoring Program
<table>
<tr><th></th><th>Required Construction Monitoring Program</th><th>Relevant government agencies to be consulted for each Construction Monitoring Program</th></tr>
<tr><td>(a)</td><td>Noise and vibration</td><td>Relevant Councils and WaterNSW (in relation to its assets)</td></tr>
</table></td><td>Annexure A (Section 2.3)</td></tr>
<tr><td>C14</td><td>Each Construction Monitoring Program must provide:</td><td></td></tr>
<tr><td></td><td>(a) details of baseline data available including the period of baseline monitoring;</td><td>Section 5
Annexure A (Section 3.2)</td></tr>
<tr><td></td><td>(b) details of baseline data to be obtained and when;</td><td>Annexure A (Section 3.2)</td></tr>
<tr><td></td><td>(c) details of all monitoring of the project to be undertaken;</td><td>Annexure A (Section 3.4 and 3.5)</td></tr>
<tr><td></td><td>(d) the parameters of the project to be monitored;</td><td>Annexure A (Section 3.4 and 3.5)</td></tr>
<tr><td></td><td>(e) the frequency of monitoring to be undertaken;</td><td>Annexure A (Section 3.4 and 3.5)</td></tr>
<tr><td></td><td>(f) the location of monitoring;</td><td>Annexure A (Section 3.4 and 3.5)</td></tr>
<tr><td></td><td>(g) the reporting of monitoring results and analysis results against relevant criteria;</td><td>Annexure A (Section 4.5)</td></tr>
<tr><td></td><td>(h) details of the methods that will be used to analyse the monitoring data;</td><td>Annexure A (Section 4.3)</td></tr>
<tr><td></td><td>(i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts;</td><td>Annexure A (Section 4.3)</td></tr>
</table>

No.	Requirement	Reference
	(j) consideration of SMART principles;	Annexure A (Section 3.4 and 3.5)
	(k) any consultation to be undertaken in relation to the monitoring programs; and	Section 1.4 Annexure A (Section 4.3)
	(l) any specific requirements as required by Conditions C15 to C16.	Refer to Condition C15 and C16
C15	The Noise and Vibration Construction Monitoring Program must include: (a) noise and vibration monitoring at representative residential and other locations (including at the worst- affected residences), subject to property owner approval, to confirm construction noise and vibration levels; (b) monitoring undertaken during the day, evening and night-time periods throughout the construction period and cover the range of activities being undertaken; (c) method and frequency for reporting monitoring results; and (d) a process to undertake real time noise and vibration monitoring. The results of the monitoring must be readily available to the construction team, the Proponent and ER. The Planning Secretary and EPA must be provided with access to the results on request.	Annexure A (Section 3.4 and 3.5)
C17	With the exception of any Construction Monitoring Programs expressly nominated by the Planning Secretary to be endorsed by the ER, all Construction Monitoring Programs must be submitted to the Planning Secretary for approval.	Section 1.4 Annexure A (Section 4.3)
C18	The Construction Monitoring Programs not requiring the Planning Secretary's approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all undertakings made in the documents listed in Condition A1. Any of these Construction Monitoring Programs must be submitted to the ER for endorsement at least one (1) month before the commencement of construction or where construction is staged no later than one (1) month before the commencement of that stage.	Section 1.4 Annexure A (Section 4.3)
C19	Any of the Construction Monitoring Programs which require Planning Secretary approval must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month before the commencement of construction or where construction is staged no later than one (1) month before the commencement of that stage.	Section 1.4 Annexure A (Section 4.3)
C20	Unless otherwise agreed with the Planning Secretary, construction must not commence until the Planning Secretary has approved, or the ER has endorsed (whichever is applicable), all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section 1.4 CEMP Section 1.4
C21	The Construction Monitoring Programs, as approved by the Planning Secretary or the ER has endorsed (whichever is applicable), including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary or the ER (whichever is applicable), whichever is the greater.	Section 1.4 CEMP Section 1.4

No.	Requirement	Reference
C22	The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, ER and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	Annexure A (Section 4.5)
Construction Environmental Management Framework		
3.5 (a)	Off-Airport Construction Environmental Management Sub-Plans (a) Subject to Section 3.4(b) the Principal Contractors will prepare issue-specific environmental sub plans to the CEMP which address each of the relevant environmental impacts at a particular site or stage of the project. Issue specific sub plans will include as a minimum: (iv) Noise and vibration management;	This Plan
3.5 (b)	Additional detail on the minimum requirements for these sub plans is provided in Sections 6 to14 of this CEMF.	Noted
5.1 (a)	Working Hours Standard working hours are between 7am – 6pm on weekdays and 8am – 1pm on Saturdays	Section 2.5
5.1 (b)	Works which can be undertaken outside of standard construction hours without any further approval include: i. Those which have been described and assessed in the environmental assessments. For example, tunnelling and underground excavations and supporting activities or works within Western Sydney International ii. Works which are determined to comply with the relevant Noise Management Level at sensitive receivers; iii. The delivery of materials outside of approved hours as required by the Police or other authorities(including Transport for NSW) for safety reasons; iv. Where it is required to avoid the loss of lives, property and / or to prevent environmental harm in an emergency; and v. Where written agreement is reached with all affected receivers	Section 2.5
5.1 (c)	Where off-airport works are being undertaken under an Environmental Protection Licence, Principal Contractors may apply for EPA approval to undertake works outside of normal working hours.	Section 2.5
5.3 (a)	Principal Contractors will consider the following in the layout of construction sites: i. The location of noise intensive works and 24 hour activities in relation to noise sensitive receivers; ii. The location of site access and egress points in relation to noise and light sensitive receivers, especially for sites proposed to be utilised 24 hours per day; iii. The use of site buildings to shield noisy activities from receivers; iv. The use of noise barriers and / or acoustic sheds where feasible and reasonable for sites proposed to be regularly used outside of daytime hours; and	Section 7.3 Annexure D

No.	Requirement	Reference
	v. Aim to minimise the requirement for reversing, especially of heavy vehicles.	
8.1 a	Construction Noise and Vibration Management Objectives The following noise and vibration management objectives will apply to construction: i. Minimise unreasonable noise and vibration impacts on residents and businesses; ii. Avoid structural damage to buildings or heritage items as a result of construction vibration; iii. Undertake active community consultation; iv. Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners; and	Section 1.3
8.2 a	Construction Noise and Vibration Management Implementation On-airport management of noise and vibration will be achieved through the implementation of the SMWSA Noise and Vibration CEMP and Principal Contractors will develop and implement a Construction Noise and Vibration Management Plan for all off-airport works consistent with the Interim Construction Noise Guidelines (Department of Environment and Climate Change, 2009). Both plans will include as a minimum:	This Plan
	i. Identification of work areas, site compounds and access points;	Annexure D
	ii. Identification of sensitive receivers and relevant construction noise and vibration goals;	Annexure D Section 6
	iii. Be consistent with, and include the requirements of the noise and vibration mitigation measures as detailed in the planning approval documentation and the Sydney Metro Construction Noise and Vibration Standard (CNVS), including the provision of respite;	Section 8
	iv. Details of construction activities and an indicative schedule for construction works, including the identification of key noise and/or vibration generating construction activities (based on representative construction scenarios) that have the potential to generate noise or vibration impacts on surrounding sensitive receivers, in particular residential areas;	Section 7
	v. Identification of feasible and reasonable procedures and mitigation measures to ensure relevant vibrations and blasting criteria are achieved, including a suitable blast program;	Section 6.5
	vi. The requirements of any applicable licence or approval (for example EPL);	Section 3.4 Part B
	vii. Additional requirements in relation to activities undertaken 24 hours of the day, 7 days per week;	Section 8.6.1
	viii. Pre-construction compliance requirements and hold points;	Section 9.3 Annexure B Annexure C
	ix. The responsibilities of key project personnel with respect to the implementation of the plan;	Section 4
	x. Noise monitoring requirements;	Annexure A

No.	Requirement	Reference
	xi. Compliance record generation and management; and	Annexure A (Section 3.6)
	xii. An Out of Hours Works Protocol applicable to all construction methods and sites.	Annexure B
8.2 (b)	Detailed Construction Noise and Vibration Impact Statements will be prepared for noise-intensive construction sites and or activities to ensure the adequacy of the noise and vibration mitigation measures. Specifically, Construction Noise and Vibration Impact Statements will be prepared for works proposed to be undertaken outside of standard construction hours and to support applications to undertake out of hours works (this includes variations of EPLs and applications to relevant agencies).	Section 7.3
8.2 (c)	Noise and vibration monitoring will be undertaken for construction as specified in the CNVS.	Annexure A
8.2 (d)	The following compliance records will be kept by Principal Contractors: i. Records of noise and vibration monitoring results against appropriate NMLs ii. Records of community enquiries and complaints, and the Contractor's response	Annexure A (Section 3.6)
8.3 (a)	Construction Noise and Vibration Mitigation All feasible and reasonable mitigation measures will be implemented in accordance with the CNVS. The on-airport Noise and Vibration CEMP and the off-airport Noise and Vibration Management Plan will include the following noise and vibration mitigation measures as well as relevant Conditions:	This Plan
	i. Construction hours will be in accordance with the working hours specified in Section 5.1;	Section 2.5
	ii. Hoarding and enclosures will be implemented where required to minimise airborne noise impacts; and	Section 8.2 & Annexure E
	iii. The layout of construction sites will aim to minimise airborne noise impacts to surrounding receivers	Section 8.2 Annexure E
	iv. Provision of respite periods	Section 8.7.2

Note: Other relevant SSI 10051 Planning Approval Conditions and the Revised Environmental Outcomes and Revised Environmental Mitigation Measures (REMMs) from Section 7 of the Submissions Report are addressed in Element 4: Package specific requirements of Part B.

Definitions

Term	Description
Ancillary facility	A temporary facility for construction of the CSSI including an office and amenities compound, construction compound, material crushing and screening plant, materials storage compound, maintenance workshop, testing laboratory and material stockpile area and parking facilities
AVTG	NSW Assessing Vibration – a technical guideline
At-property treatment	includes building treatments and courtyard walls. Building treatments may include but are not limited to ventilation, glazing, window and door seals, sealing of vents, underfloor areas, noise curtains, shutters and secondary glazing. Note: the At Receiver Noise Treatment Guideline (Roads and Maritime Services, 2017) provides more examples of building treatments
CEMP	Construction Environmental Management Plan
CEMF	Construction Environmental Management Framework
CNVMP	Construction Noise and Vibration Management Sub-Plan (or Sub-Plan)
CNVS	Construction Noise and Vibration Standard
CPBG	CPB Contractors Ghella Joint Venture
DCCEEW	Department of Climate Change, Energy, the Environment and Water (formerly DPE (Water))
DNVIS	Detailed Noise and Vibration Impact Statement Referred to as Construction Noise and Vibration Impact Statement within the EPL
DPE	NSW Department of Planning and Environment (now DPHI)
DPHI	NSW Department of Planning, Housing and Infrastructure (formerly DPE)
EIS	Environmental Impact Statement
ENMM	Environmental Noise Management Manual
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence under the POEO Act
ER	Environmental Representative
eVDV	Estimated Vibration Dose Value
GIS	Geographic Information System
GNML	Ground-borne noise management level
GNVIS	General Noise and Vibration Impact Statement
Highly noise affected	As defined in the ICNG
IC	Independent Certifier
ICNG	NSW Interim Construction Noise Guideline

Term	Description
LGA	Local Government Area
Local road	Any road that is not defined as a classified road under the Roads Act 1993 (NSW)
NCA	Noise Catchment Area
NML	Noise Management Level
NPfI	Noise Policy for Industry
Off-airport	Land not within the boundary of the Western Sydney Airport.
On-airport	Land within the boundary of the Western Sydney Airport
OOHW	Out-of-hours work
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
Project, the	Sydney Metro Western Sydney Airport (including Station Boxes and Tunnelling)
RBL	Rating Background Level
Relevant Council (s)	Liverpool City Council and/or Penrith Council
REMM	Revised Environmental Mitigation Measure
RNP	NSW Road Noise Policy
RT&A	Renzo Tonin & Associates
SBT Works	Station Boxes and Tunnelling Works
Sensitive land uses	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres and passive recreation areas (including outdoor grounds used for teaching). Receivers that may be considered to be sensitive include commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces), and industrial premises as identified by the Planning Secretary.
SMART Principles	Specific, Measurable, Achievable, Realistic, and Timely
SPL	Sound Pressure Level
SWL	Sound Power Level
Submissions report	Sydney Metro's response to issues raised in submissions received in relation to the application for approval for the CSSI under the EP&A Act
TBM	Tunnel Boring Machine
TfNSW	Transport for NSW
WSI	Western Sydney International
VC	Vibration criterion
VDV	Vibration Dose Values

Part A: Overview

1. Introduction

1.1. Purpose and application

This NSW (Off-airport) Construction Noise and Vibration Management Sub-plan (CNVMP or Sub-Plan) is applicable to the Station Boxes and Tunnelling Works (SBT Works) Package of the Sydney Metro Western Sydney Airport (the Project). This Sub-plan describes how the CPB Contractors Ghella Joint Venture (CPBG) will minimise and manage the noise and vibration impacts of the SBT Works in NSW.

This Sub-Plan has been prepared to address the requirements of the:

- State Significant Infrastructure (SSI) 10051 Planning Approval (dated 23 July 2021)
- Environment Protection Licence (EPL) 21672
- Sydney Metro Western Sydney Airport – CSSI Staging Report (Revision 6) (Staging Report)
- AS/NZS ISO 14001:2016 Environmental Management Systems – Requirements with guidance for use
- Sydney Metro Construction Environmental Management Framework (CEMF)
- Environmental Impact Statement (EIS) and the Submissions Report, including the Revised Environmental Mitigation Measures (REMMs)
- Contractual requirements, including the SBT Design and Construction Deed and General and Particular Specifications
- Applicable legislation (NSW and Commonwealth).

Operational noise and vibration impacts and operational mitigation measures are outside the scope of this CNVMP and therefore are not included within the processes contained within this Sub-Plan.

1.2. Sub-plan context

To achieve the intended environmental performance outcomes of the Project, CPBG have an established Environmental Management System (EMS) in accordance with the requirements of ISO 14001:2016. Guided by the Environment and Sustainability Policy, the EMS consists of a Construction Environmental Management Plan (CEMP), aspect-specific procedures and Sub-Plans as illustrated in Figure 1. Implementation of the EMS is achieved through tools, checklists and forms as detailed in Section 5.2 of the CEMP.

The SBT Works are located within the Penrith and Liverpool Local Government Areas (LGAs) and traverse from St Marys to Orchard Hills in the north and from WSI to the new Bradfield City Centre (Aerotropolis) in the south. The section of the SBT Works passing through WSI is not covered by this CNVMP as it falls under Commonwealth legislation. This CNVMP applies to the SBT Works components that are located outside WSI (off-airport). Suburbs that will have SBT Works construction sites include St Marys, Claremont Meadows, Orchard Hills, Bringelly and Badgerys Creek.

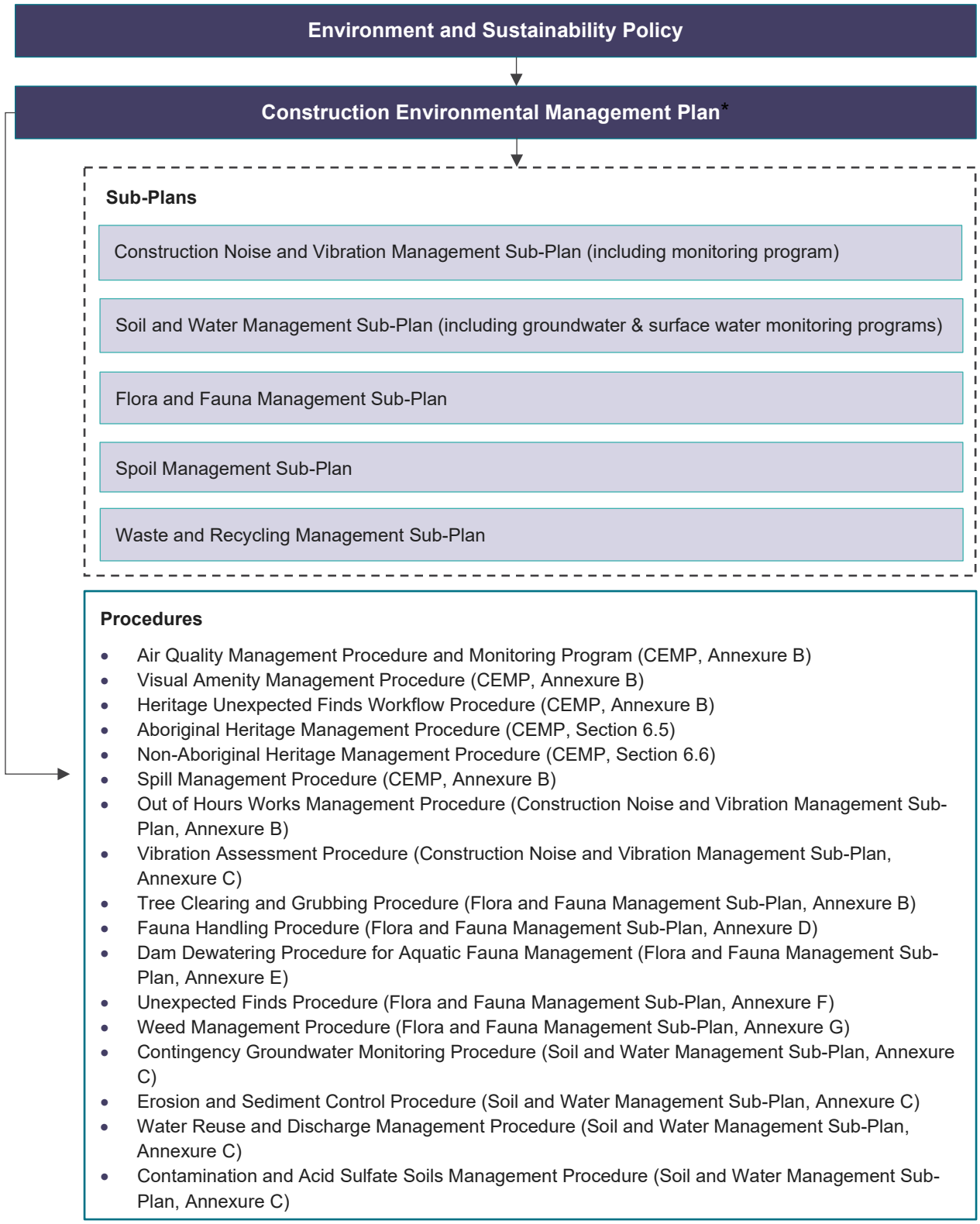


Figure 1: EMS Overview

1.3. Objectives, targets and key performance indicators

The objectives, targets and key performance indicators for noise and vibration management are detailed in Table 1.

Table 1: Objectives, targets and key performance indicators

Objectives	Targets	Key Performance Indicators
• Ensure the requirements of the SSI 10051 Planning Approval, REMMs, performance outcomes, EPL and CEMF are described, scheduled and assigned responsibility within this Sub-Plan	No breaches or regulatory infringements (PINs or prosecutions)	Number of breaches or regulatory infringements
• Construction noise and vibration impacts on local communities (including airborne noise and ground-borne noise and vibration) are managed in accordance with the Construction Noise and Vibration Standard and the Interim Construction Noise (ICNG, DECC 2009) • Minimise unreasonable noise and vibration impacts on residents and businesses • Undertake active community consultation • Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners	No divergence from the noise management process	Number of noise or vibration non-compliances
	Implementation of reasonable and feasible mitigation measures to minimise unreasonable noise and vibration impacts on the acoustic amenity of surrounding residents, commercial and other sensitive receivers, in accordance with the Construction Noise and Vibration Standard (CNVS) [5] and the Interim Construction Noise Guideline (ICNG, DECC 2009) [6]	Number of avoidable noise or vibration complaints
	100% of workers to attend Environmental Induction	Percentage of worker attendance at Environmental Induction
	100% of Out of Hours Works (OOHW) conducted in accordance with an approved OOHW Application Form	Number of OOHW non-compliances
• Structural damage to buildings, heritage items and public utilities and infrastructure from construction vibration to be avoided	100% notification of owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owners and occupiers will be provided a schedule of potential exceedances on a monthly basis for the duration of the works.	Percentage of notifications to owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage
	100% of condition surveys prepared for all buildings, structures, utilities identified in the EIS and Submissions Report as being at risk of damage	Percentage of condition surveys completed

1.4. Consultation and approval

1.4.1. Relevant government agencies and council(s)

Reflecting the requirements of Conditions A6, C5(a) and C6, this Sub-Plan and the Noise and Vibration Monitoring Program (Program) (Annexure A) has been prepared in consultation with Penrith City Council and City of Liverpool Council.

While Conditions C5(a) and C13(a) also include consultation with WaterNSW, it is noted that this requirement is in relation to relevant assets. The Warragamba to Prospect Water Supply Pipeline is not located in the vicinity of the SBT Works and therefore consultation with WaterNSW is not triggered.

A detailed consultation report, including matters raised by stakeholders and CPBG responses is provided in Annexure F.

Construction will not commence until this Sub-plans and Program have been approved by the Planning Secretary or endorsed by the ER (whichever is applicable), unless otherwise agreed by the Planning Secretary. This Sub-plan and Program, as approved by the Planning Secretary, including any minor amendments approved by the ER, will be implemented for the duration of the SBT Works.

The Sydney Metro Western Sydney Airport Out-of-hours Work Protocol [6] has been prepared by Sydney Metro in accordance with E42 and consultation was undertaken with the ER. Details on this consultation is featured in Section 2.2 of the Protocol. In addition, CPBG have prepared an Out of Hours Works Management Procedure (Annexure B).

1.4.2. Community consultation

As detailed in Section 8.6.4 and in accordance with Condition E57, consultation will be undertaken with the community to identify appropriate respite periods for out-of-hours-works (OOHW). The outcomes of the community consultation will be provided to the ER, EPA and the Planning Secretary prior to the commencement of the OOHW.

In accordance with Condition E47, consultation regarding specific mitigation measures will be undertaken with affected sensitive land users near construction works that exceed the noise and/or vibration objectives that is detailed in Section 6. The mitigation measures will be included in the Detailed Noise and Vibration Impact Statements (DNVIS) for each worksite.

Furthermore, for works near community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres), consultation will be undertaken where noise and/or vibration generating works are predicted above the noise and/or vibration objectives in Section 6, to satisfy Condition 45.

Residential receivers affected by noise and/ or vibration from the SBT Works will be determined through the assessment included in the DNVIS and any subsequent noise and vibration assessments completed with Gatewave (Section 7.4). Community notification and consultation requirements for these works will be identified and described in each DNVIS.

Community feedback and complaints relating to construction noise and vibration will be managed with in accordance with Section 7.7 of the CEMP .

1.4.3. Cumulative and consecutive noise impact

Ongoing consultation will include regular coordination with State significant developments; all noise and vibration predictions will be presented (as a minimum) as facade noise maps for a distance of at least 300 m in all directions from each work site / project area under assessment. This consultation will be undertaken with the aim of coordinating works to manage cumulative noise and

vibration impacts through SMART principles, in accordance with Conditions C6(d) and Condition E56. In response to the consultation, CPBG will:

- Reschedule any work to provide respite to impacted noise sensitive land use(s) so that the respite is achieved in accordance with Condition E57; or
- Consider the provision of alternative respite or additional feasible and reasonable mitigation to impacted noise sensitive land use(s); and
- Provide documentary evidence to the ER in support of any decision made by CPBG in relation to respite or mitigation.

1.5. Sub-Plan structure

Part A: Overview	• Section 1: An introduction to the Sub-Plan and the SBT Works • Section 2: Project overview • Section 3: Legal and other requirements • Section 4: People and collaboration • Section 5: Existing environment • Section 6: Noise and vibration objectives for NSW • Section 7 Environmental aspects and impacts • Section 8: Environmental control measures • Section 9: Compliance management • Section 10: Review and improvement • Section 11: References
Part B: Implementation	• Element 1: Training • Element 2: Monitoring and reporting • Element 3: Auditing, review and improvement • Element 4: Package specific requirements
Part C: Annexures	• Annexure A Noise and Vibration Monitoring Program • Annexure B Out of Hours Works Management • Annexure C Vibration Assessment Procedure • Annexure D Land Use Survey • Annexure E Indicative Noise and Vibration Mitigation • Annexure F Consultation Report

2. Project overview

2.1. Background

The Sydney Metro Western Sydney Airport will become the transport spine for Greater Western Sydney, connecting communities and travellers with the new Western Sydney International (Nancy-Bird Walton) Airport (referred to as Western Sydney International) and the growing region.

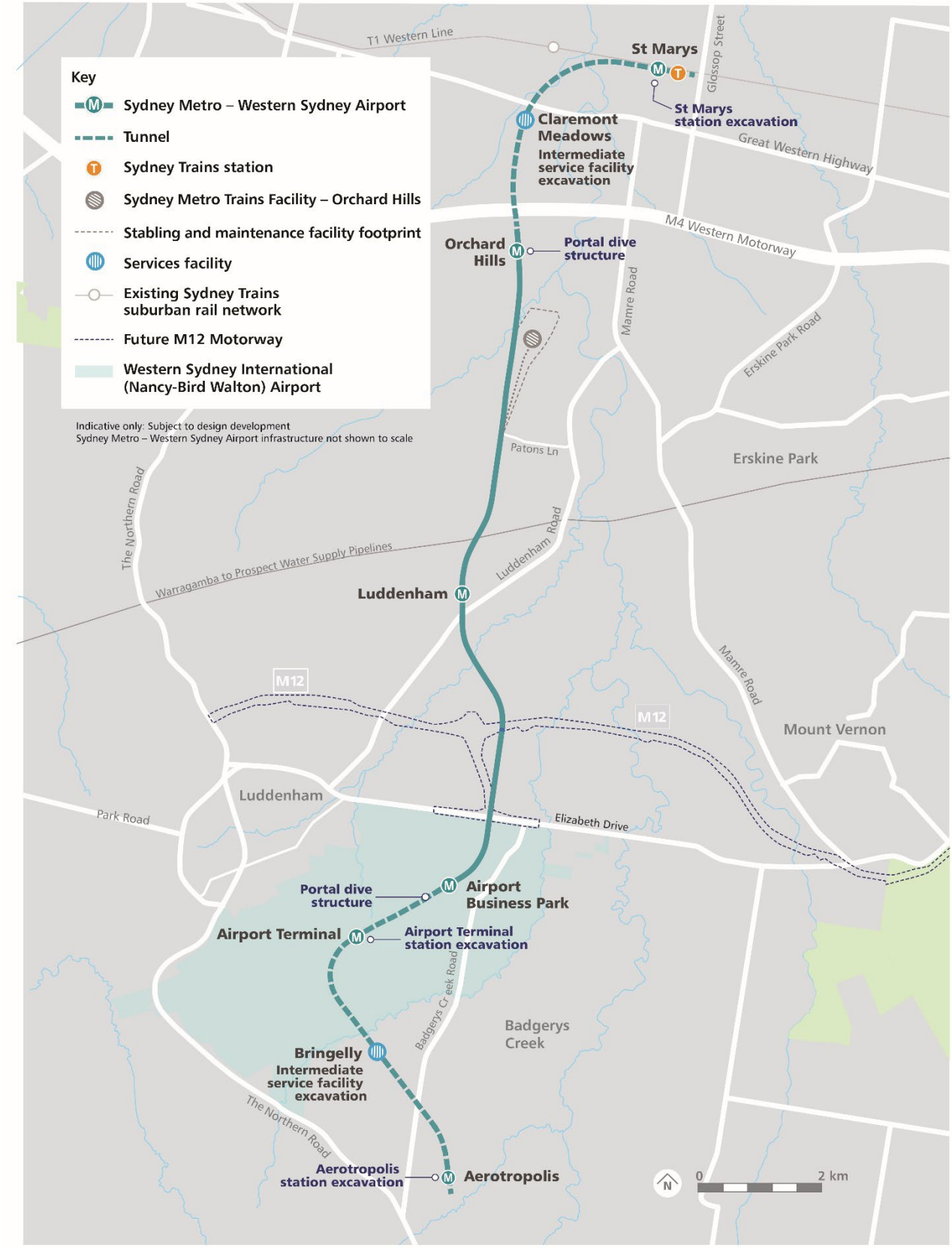
The Sydney Metro Western Sydney Airport EIS was prepared in October 2020 to assess the impacts of construction and operation of the Project and was placed on public exhibition between 21 October 2020 and 2 December 2020. The Project was declared a Critical State Significant Infrastructure (CSSI) Project and is listed in Schedule 5 of State Environmental Planning Policy (State and Regional Development).

The Sydney Metro Western Sydney Airport was approved by the Minister for Planning and Public Spaces on 23 July 2021 (SSI 10051) under section 5.19 of the Environmental Planning and Assessment Act 1997 (EP&A Act).

2.2. Project description

The Project forms part of the broader Sydney Metro network. It involves the construction and operation of a 23km new metro rail line that extends from the existing Sydney Trains suburban T1 Western Line (at St Marys) in the north and the Aerotropolis (at Bringelly) in the south. The alignment includes a combination of tunnels and civil structures, including viaduct, bridges, surface and open-cut troughs between the two tunnel sections (Figure 2)

Figure 2: Project Overview



2.3. Project Staging

2.3.1. Overview

As detailed in the Staging Report, the Project will be delivered through the following stages:

- Advanced and Enabling Works – Site investigations, modification of the existing transport network, power and water supply for construction sites, utility and stormwater diversions and some demolition works.
- SBT Works – delivered through the following sub-stages:
  - Preparatory Works – Including NSW (off-airport) demolition works, site levelling/grading, site access and parking, utility and temporary services works, erection of demountable buildings and noise barriers, tunnelling preparatory works and use of ancillary facilities including onsite parking.
  - Bulk Excavation and Tunnelling Works (the subject of this Sub-Plan) – Preparatory Works (works not completed prior to approval of this CEMP), bulk excavation, acoustic shed installation (where required), tunnelling and cross passage installation.
- Surface and Civil Alignment Works – Construction of bridges and viaducts to cross floodplains, watercourses and existing and proposed permanent infrastructure. Delivered through two sub-stages including Preparatory Works and Main Excavation and Viaduct Works.
- Stations, Systems, Trains, Operations and Maintenance – Station design and fit-out, testing and commissioning, and operation of the Western Sydney Airport metro service
- Finalisation Auxiliary Works.

2.4. SBT Works Scope

2.4.1. Station Boxes and Tunnelling Works

The SBT Works include the design and construction of:

- Two sections of twin tunnels with a total combined length of approximately 9.8km, including associated portal structures; Orchard Hills to St Marys (off-airport) and Western Sydney International (WSI) airport to the new Aerotropolis Station (off-airport)
- Excavations at either end to enable trains to turn back and stub tunnels to enable future extensions
- Station box excavations with temporary ground support for four stations at St Marys (off-airport), Orchard Hills (off-airport), Airport Terminal (on-airport) and Aerotropolis (off-airport)
- Excavations for two intermediate service facilities, one in each of the tunnel sections at Claremont and Bringelly (both off-airport).

An overview of the SBT Works at each worksite is provided in Table 2.

Table 2: SBT Works overview

Jurisdiction	Worksite	Indicative scope of works
NSW	St Marys	• Preparatory CEMP scope (not completed prior to approval of the Bulk Excavation and Tunnelling Works CEMP) • Demolition of existing industrial premises • Offices, amenities, car parking and access roads • Piling and station box excavation using rippers and rock hammers • Stub tunnel excavation using roadheaders • TBM retrieval

Jurisdiction	Worksite	Indicative scope of works
NSW	Claremont Meadows	• Preparatory CEMP scope (not completed prior to approval of the Bulk Excavation and Tunnelling Works CEMP) • Offices, amenities, car parking, and access roads • Piling and services facility shaft excavation using ripper and rock hammers • Construction of part of the cast-in-situ permanent shaft • Cross passage construction support • Invert construction support (subject to Sydney Metro approval)
NSW	Orchard Hills	• Preparatory CEMP scope (not completed prior to approval of the Bulk Excavation and Tunnelling Works CEMP) • Demolition of existing buildings and removal of septic tanks • Offices, amenities, car parking, and access roads • Lansdowne Road temporary diversion and construction of the permanent road bridge • Piling and portal, station box and dive excavation using rippers and rock hammers • Construction of cast-in-situ permanent portal structure • TBM assembly, launch and tunnelling support works • Cross passage construction support • Precast segment storage
On-Airport	Airport Portal Dive Structure	• Offices, amenities, car parking and access roads • Piling and portal excavation using rippers and rock hammers • Open cut dive excavation using rippers and rock hammers • Construction of cast-in-situ permanent dive structure • TBM assembly, launch and tunnelling support works • Cross passage construction support
On-Airport	Airport Terminal and TBM shaft	• Offices, amenities, car parking and access roads • Piling and station box and shaft excavation using rippers and rock hammers • TBM re-launch and tunnelling support works • Cross passage construction support
On-Airport	Primary Spoil Receival	• Access road • TBM spoil conveyor set up • Earthworks in accordance with Sydney Metro Specifications
NSW	Bringelly	• Preparatory CEMP scope (not completed prior to approval of the Bulk Excavation and Tunnelling Works CEMP) • Offices, amenities, car parking and access roads • Piling and services facility shaft using rippers and rock hammers • Construction of part of the cast-in-situ permanent shaft • Cross passage construction support • Invert construction support (subject to Sydney Metro approval)
NSW	Aerotropolis	• Preparatory CEMP scope (not completed prior to approval of the Bulk Excavation and Tunnelling Works CEMP) • Offices, amenities, car parking and access roads • Piling and Station box excavation using rippers and rock hammers • Stub tunnel excavation using roadheaders • TBM retrieval

Note: Worksites shown in grey are within the boundary of the Western Sydney International (On-Airport), are regulated under the Commonwealth Airports Act 1996 and are outside the scope of this Plan.

2.4.2. Construction methodology

The construction methodology for the SBT Works entails:

- Utility works including removal, diversion, protection and connection to SBT worksites
- Local area works including provision of site accesses and some road upgrades
- Site establishment works including:
  - Fencing
  - Installation of environmental mitigation including erosion and sediment controls, noise barriers, and acoustic enclosures
  - Clearing and grubbing of existing vegetation
  - Demolition of existing buildings and structures
  - Site levelling and drainage works
  - Establishment of internal access roads, hardstand areas and onsite parking
  - Erection of demountable buildings including offices and amenities
  - Other ancillary facility works including the erection of sheds, establishment of materials laydown and stockpiling areas and Tunnel Boring Machines (TBMs) support works including spoil conveyors.
- Construction of station, shaft and dive excavations predominately completed by piling and excavators with rippers and hammers. A roadheader will also be used at St Marys and Aerotropolis to complete the stub tunnels
- Four TBMs will be used to construct the mainline tunnels as follows:
  - Two earth pressure balance TBMs will be launched from Orchard Hills tunnel approximately 4.3 km north to St Marys, including traversing the Claremont Shaft, and be retrieved from the St Marys Station Box.
  - Two double shield TBMs will be launched from the Airport Dive and tunnel south, traverse the Airport Terminal Station Box and Shaft, whereupon tunnelling will cease, and the conveyor and backend equipment will be demobilised from the Airport Dive and re-established at Airport Terminal Shaft. The TBMs will recommence tunnelling including traversing the Bringelly Shaft and be retrieved from the Aerotropolis Station Box (a distance of 5.5 km from the Airport Dive, with 2.5 km of the southern tunnels located off-airport within NSW land).
  - Cross passages will be constructed using concrete saws and excavators with hammers.

It is anticipated that the shaft and station excavations will be completed in advance of TBM tunnel construction. The TBMs will be delivered via oversize heavy vehicles to Orchard Hills and the Airport Dive site and retrieved from St Marys and Aerotropolis, subject to relevant approvals.

The SBT Works do not include any surface works between the northern and southern tunnel sections, which are to be undertaken by another contractor as part of the Surface and Civil Alignment Works stage.

Tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunnelling), will be undertaken 24 hours a day, seven days per week. Utility and local area works which cannot be completed during standard daytime hours due to Road Occupancy Licence (ROL) requirements or utility authority requirements will also be undertaken outside of standard hours.

Completed sections of the SBT Works, including established construction worksites, will be progressively handed over to Sydney Metro to enable follow-on contractors to commence works.

Changes to the SBT Works scope may be required to facilitate constructability, amenity and staging. This may include but is not limited to refinement of site layouts based on detailed construction planning and safety assessment. For example:

- Relocation of internal access roads to allow for refinements in heavy vehicle/light vehicle movements
- Separation of people and plant
- Alteration to car parking/container and laydown areas to allow for safe working distances
- Movement of portable site offices, workshops and containers for construction staging.

As detailed in CEMP (Section 7.12.2), any changes to SBT Work scope will be provided to the ER for endorsement in accordance with Condition A32(j).

2.5. Hours of work

Construction hours are set out in Conditions E38 to E41 and are summarised in Table 3.

Table 3: Construction hours

SSI 10051 Condition	Construction activity	Monday to Friday	Saturday	Sunday and public holidays
E38	Standard construction hours	7.00am to 6.00pm	8.00am to 1.00pm	No work
E39	Highly noise intensive works (+ respite)[1]	8.00am to 6.00pm	8.00am to 1.00pm	No work
E41(a)	Safety and emergency works[2]	During standard hours and outside standard hours		Outside standard hours
E41(b)	Low impact works[3]	During standard hours and outside standard hours		Outside standard hours
E41(c)	Works approved under and EPL or Out-of-Hours Work Protocol	During standard hours and outside standard hours		Outside standard hours
E41(d)	By Prescribed activity including:			
	(i) tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunnelling) are permitted 24 hours a day, seven days a week; or	24 hours 7 days a week		
	(ii) grout batching at the Orchard Hills construction site is permitted 24 hours per day, seven days per week; or	24 hours 7 days a week		
	(iii) delivery of material that is required to be delivered outside of standard construction hours in Condition E38 to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Orchard Hills ancillary facility; or	24 hours 7 days a week. except between the hours 10:00 pm and 7:00 am to / from the Orchard Hills construction site; or		

SSI 10051 Condition	Construction activity	Monday to Friday	Saturday	Sunday and public holidays
	(iv) haulage of spoil generated through tunnelling is permitted 24 hours per day, seven days per week except between the hours of 10:00 pm and 7:00 am to / from the Orchard Hills construction site; or	24 hours 7 days a week. except between the hours 10:00 pm and 7:00 am to / from the Orchard Hills construction site; or		
	(v) works within an acoustic enclosure are permitted 24 hours a day, seven days a week where there is no exceedance of noise levels or intermittent vibration levels under Low impact circumstances identified in Condition E41(b), unless otherwise agreed with the Planning Secretary; or	24 hours 7 days a week		
	(vi) tunnel and underground station box fit out works are permitted 24 hours per day, seven days per week.	24 hours 7 days a week		
	Notes: 1. Tunnelling does not include station box excavation. 2. Tunnelling ancillary support activities includes logistics support and material handling and delivery			

NOTES:

1. Where highly noise intensive works exceed the applicable Noise Management Level (NML) at the same receiver, they must be undertaken in continuous blocks not exceeding three hours, each with a minimum respite from those works of not less than one hour between each block. The applicable NML for residential receivers is the highly noise affected level of 75dB(A).

2. For the delivery of materials required by the NSW Police Force or other authority for safety reasons or where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property, or to prevent environmental harm.

3. Construction that causes $L_{Aeq(15\ minute)}$ noise levels no more than 5dB(A) above the Rating Background Level (RBL) at any residence; and/or no more than the 'noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s). Construction that causes continuous/impulsive/intermittent vibration values at the most affected residence, no more than the preferred values for human exposure to vibration, specified in Table 2.2 and Table 2.4 of the AVTG.

Approval from the EPA via the EPL will be obtained for OOHW in accordance with Condition E41(c). Key examples include essential local area and utility works which cannot be performed during standard hours and require a road occupancy licence and/or disruption to services that is minimised by undertaking night works.

OOHW that are not subject to an EPL will be conducted in accordance with the Sydney Metro OOHW Protocol.

3. Legal and other requirements

3.1. Legislation

This Sub-Plan has been prepared in accordance with legislative requirements, including the:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Protection of the Environment Operations Act 1997* (POEO Act).

Refer to the CEMP (Section 3) for further details.

3.2. Guidelines

Guidelines and standards relating to management of construction noise and vibration on the SBT Works include:

- Sydney Metro CNVS SM-20-00098866 v4.3, Sydney Metro 4 November 2020
- ICNG, Department of Environment and Climate Change 2009
- Noise Policy for Industry (NPfI), Environment Protection Authority 2017
- NSW Road Noise Policy (RNP), Department of Environment, Climate Change and Water 2011
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Australian Standard AS/NZS 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS 2187.2 Explosives – Storage and use – Part 2 Use of explosives
- Australian Standard AS2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
- British Standard BS 6472-2008 Evaluation of human exposure to vibration in buildings (1-80Hz)
- British Standard 7385: Part 2-1993 Evaluation and measurement of vibration in buildings
- German Standard DIN4150-1999 Structural vibration Part 3: Effects of vibration on structures
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration, Australian and New Zealand Environment Council, 1990.

3.3. Sydney Metro Construction Noise and Vibration Standard

The Sydney Metro CNVS establishes a consistent strategy for the assessment, mitigation and monitoring of noise and vibration generated by construction activities associated with the construction of the Project. It defines a minimum standard for managing noise and vibration impacts that considers current best practice guidelines and other regulatory requirements.

This CNVMP applies the Sydney Metro CNVS to ensure construction noise and vibration impacts are quantified, assessed, mitigated and managed consistently across the SBT Works.

3.4. Other environmental requirements

Other environmental requirements relevant to managing construction noise and vibration issues that are addressed in or by this Sub-Plan include the conditions of EPL 21672 (refer to Element 4: Project Specific Requirements).

4. People and collaboration

4.1. Our team

The roles and responsibilities of key project personnel with respect to construction noise and vibration are outlined in Table 4.

Table 4: Roles and responsibilities with respect to construction noise and vibration

Role	Responsibility and Authority
Project Director	• Manage the delivery of the SBT Works including overseeing the SSI 10051 Planning Approval and environmental management • Hold the authority to direct personnel and/or subcontractors to carry out actions to avoid or minimise unintended noise & vibration impacts • Act as Contractor's Representative
Approvals, Environment & Sustainability Manager (Environment Manager)	• Report to the Project Director on noise and vibration related matters • Oversee the implementation of all noise and vibration management initiatives, including coordinating the CPBG's response to noise and vibration complaints • Ensure reasonable and feasible measures, including methodologies, are considered and implemented to limit/mitigate noise and vibration impacts
Stakeholder and Community Engagement Manager and delegates	• Manage community notifications and consultation • Work collaboratively with the Environment Manager to resolve environmental complaints
Commercial Manager	• Ensure sufficient and competent resources are allocated to noise and vibration management • Ensure noise and vibration related requirements and specifications are considered in procuring materials, equipment and services
Construction Managers and delegates	• Manage noise and vibration aspects of construction in conjunction with the Environment Manager and Environment Coordinators • Direct personnel and/or subcontractors to carry out actions to avoid or minimise unintended noise and vibration impacts • Ensure compliance with this Sub-Plan and procedures
Environmental Coordinators	• Assist the Environment Manager and Construction Managers in implementing this Sub-Plan • Oversee noise and vibration training, including inductions, toolbox talks and specific technical training on monitoring equipment • Monitor and report on compliance • Manage, review and continuously improve this Sub-Plan • Assist staff with noise and vibration inquires • Assist in the implementation of site noise and vibration mitigation measures and controls • Undertake noise and vibration related monitoring, audits, investigations and inspections
Project Managers, Project Engineers, Site Supervisors	• Assist the Construction Managers in implementing this Sub-Plan • Ensure compliance with this Sub-Plan • Conduct daily site inspections that consider Noise and Vibration aspects

4.2. Specialist acoustic consultant

Renzo Tonin & Associates (RT&A) has been engaged to undertake comprehensive noise and vibration modelling of the tender design and construction methodology and prepare this Sub-Plan. During delivery, RT&A will continue to provide specialist advice and services in the implementation of this Sub-Plan and associated documents to ensure impacts can be avoided, minimised or appropriately mitigated, including:

- Preparing DNVISs and providing advice on reasonable on feasible mitigation measures and methodologies to limit noise and vibration impacts
- Undertaking noise and vibration monitoring when required
- Assisting in community consultation when required.

4.3. Collaboration with Sydney Metro, ER, and IC

The ER engaged by Sydney Metro, and the Independent Certifier (IC) have roles that include overseeing noise and vibration management. CPBG will provide Sydney Metro, the ER and the IC with:

- Noise and vibration documents
- Access to monitoring activities and data.

CPBG will work collaboratively with Sydney Metro, the ER and the IC to ensure all reasonable and feasible noise mitigation measures are implemented.

4.4. Proactive and responsive community and stakeholder consultation

Local government, agency, community, and stakeholder consultation is set out in Section 1.4. While developing the DNVISs, CPBG will also consult with:

- Potentially affected community, religious and educational institutions
- Proponents of other construction works near the SBT Works
- Other relevant agencies.

Stakeholder feedback relevant to construction noise and vibration will be included in the DNVISs and this Sub-Plan where appropriate.

5. Existing environment

5.1. Background

This Sub-Plan builds on the noise and vibration assessment and analysis undertaken in the EIS [1] and Submissions Report [4]. As part of the EIS, a detailed construction noise and vibration assessment was prepared to address the Environmental Assessment Requirements issued by the Department of Planning, Housing and Infrastructure (DPHI, formerly DPE) The noise and vibration assessment was summarised in Chapter 10 of the EIS and detailed in the Noise and Vibration Technical Working Paper (EIS Technical Paper 2) [3].

The EIS concludes that sensitive receivers in the vicinity of the Project will be impacted by noise and vibration from the construction works. However, these impacts will be managed through the implementation of mitigation and management measures described in the Sydney Metro CNVS and this CNVMP.

5.2. Surrounding communities

Building on the land use survey presented in the EIS, an updated land use survey is included in Annexure D of this Sub-Plan, to satisfy Condition E37. The survey brings the NSW cadastral database and identified land use details into a Geographic Information System (GIS). The GIS allows potentially critical areas that are sensitive to construction noise, vibration and ground-borne noise impacts to be easily identified and updated as land uses change during the delivery of the SBT Works. The data can be readily included into DNVISs, to allow effective identification and management of noise and vibration impacts on identified sensitive receivers.

To facilitate the assessment of noise impacts from the SBT Works, receivers along the route have been divided into Noise Catchment Areas (NCAs). NCAs group individual sensitive receivers by common traits, such as existing noise environment and location in relation to the SBT Works. The EIS assessment process identified a total of 12 NCAs between St Marys and Bradfield City Centre. A review of the EIS assessment process determined that NCAs 01-08 and NCA 11-12 are relevant to the SBT Works (off-airport).

5.3. Existing acoustic environment

Existing noise levels vary across the SBT Works. The northern surface sites are close to major sources of existing transport noise, such as T1 Western Line near St Marys, the Great Western Highway and the M4 Western Motorway near Claremont Meadows and Orchard Hills. The southern surface sites are located in a semi-rural area characterised by natural sounds, with the exception of The Northern Road near Bradfield City Centre.

As part of the EIS process, baseline noise monitoring was conducted between February and March 2020 at 18 locations between St Marys and Bradfield City Centre. The ambient noise monitoring locations were selected with reference to the procedures outlined in the NPfI. Noise monitoring was used to determine appropriate RBLs and ambient noise levels (LAeq) for each NCA. Further detail on the method, instrumentation and quality control is contained within Appendix A of Noise and Vibration Technical Working Paper (EIS Technical Paper 2) [3].

Noise monitoring data for the relevant NCAs are summarised in Table 5.

Table 5: Summary of baseline noise monitoring data from EIS

NCA	Nearest construction work area	Monitor ID	Rating Background Noise (RBL)[1]			Ambient Noise Level (LAeq)[1]		
			Day[2]	Eve[2]	Ngt[2]	Day[2]	Eve[2]	Ngt[2]
NCA01	St Marys	NM01	38	38[3]	38[3]	53	53	50
NCA02	St Marys	NM02	37	37[3]	36	55	59	51
NCA03	St Marys	NM02	37	37	36	55	59	51
NCA04	St Marys / Claremont Meadows	NM14	35	32	31	48	47	43
NCA05	St Marys / Claremont Meadows	NM05	40	40[3]	40[3]	54	51	50
NCA06	Claremont Meadows / Orchard Hills	NM07	37	37	36	48	49	45
NCA07	Orchard Hills	NM16	47	42	30[4]	59	56	54
NCA08	Orchard Hills	NM15	44	44[3]	40	55	53	50
NCA11	Bringelly Services Facility	NM20	39	37	30[4]	49	47	42
NCA12	Bringelly Services Facility / Bradfield City Centre	NM13	38	35	34	58	52	51

NOTES:

1 RBL and LAeq noise levels determined with reference to NPfI procedures

2 Day is 7.00am to 6.00pm; Eve (evening) is 6.00pm to 10.00pm; Ngt (night) is 10.00pm to 7.00am

3 The monitored evening and/or night level was found to exceed that of the daytime. In this situation, the NPfI requires that the evening/night level be reduced to match the daytime

4 The monitored night level was found to be below the minimum assumed rating background noise levels outlined in the NPfI and have been adjusted to 30dBA during the night period, in accordance with the NPfI.

Further details regarding baseline monitoring are presented in the Construction Noise and Vibration Monitoring Program in Annexure A and Appendix A of Noise and Vibration Technical Working Paper (EIS Technical Paper 2) [3].

6. Noise and vibration objectives for NSW

The EPA recommends management levels and goals when assessing construction noise and vibration impact on human comfort. Further, the Sydney Metro CNVS requires construction noise and vibration to be managed according to recommended standards and guidelines. These are outlined in Table 6.

Table 6: Standards and guidelines applicable to construction noise and vibration management

Environmental impact	Standard/ guideline used to establish noise and vibration objectives
Construction hours	• SSI 10051 Planning Approval • EPL (when granted)
Airborne noise	• SSI 10051 Planning Approval • ICNG • EPL • CNVS
Sleep disturbance and maximum noise events	• Construction noise – NPfI • Road traffic noise – RNP and the RMS Environmental Noise Management Manual (ENMM) Practice Note 3 • CNVS
Ground-borne noise	• SSI 10051 Planning Approval • ICNG • Australian Standard AS/NZS 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors • CNVS
Construction-related road traffic noise	• No specific guidelines, but guidance taken from the ICNG and the RNP • CNVS
Vibration (disturbance to building occupants)	• SSI 10051 Planning Approval • AVTG, which incorporates British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz) • CNVS
Vibration (structural damage to buildings)	• SSI 10051 Planning Approval • British Standard 7385:1993 Evaluation and measurement of vibration in buildings – Part 2 Guide to damage from ground-borne vibration • German Standard DIN 4150:2016 – Part 3 Structural vibration in buildings – Effects on structures • CNVS
Vibration (structural damage to buried services)	• German Standard DIN 4150:2016 – Part 3 Structural vibration in buildings – Effects on structures • CNVS
Vibration (sensitive scientific and medical equipment)	• ASHRAE Applications Handbook (SI) 2003, Chapter 47 Sound and Vibration Control • Gordon GC 28 September 1999 Generic Vibration Criteria for Vibration Sensitive Equipment • Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
National Standard for occupational noise	• Project worksites will be managed to ensure conformance with the National Standard for exposure to noise in the occupational environment of an eight-

Environmental impact	Standard/ guideline used to establish noise and vibration objectives
	hour equivalent continuous A-weighted sound pressure level of LAeq,8h of 85dB(A) • Consider no project related work workers in adjacent premises and public areas exposed to high noise intensive activities from the SBT project

6.1. Airborne construction noise objectives

The ICNG provides guidelines for the assessment and management of airborne construction noise. The ICNG focuses on applying a range of work practices to minimise construction noise impacts rather than focusing on achieving numeric noise levels. The main objectives of the ICNG are to:

- Identify and minimise noise from construction works
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts
- Encourage construction during the recommended standard hours only and ensure all out of hours works are undertaken in accordance with Section 8.6
- Reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

6.1.1. Residential receivers

Table 7, (sourced from the ICNG (DECC, 2009)), shows how NMLs at residential receivers are determined and how they are to be applied. The rating background level (RBL) is used when determining the noise management level (NML). 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 and methodology to obtain RBLs is described in detail within the NPfI (EPA, 2017).

Table 7: Airborne NMLs at Residential Receivers

Time of Day	Noise Management Level (NML) LAeq(15min)	How to Apply
Standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm	Noise affected RBL + 10 dB(A)	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) 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 75dB(A)	• The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, CPBG will carefully consider other ways to reduce noise to below this level. If no quieter work method is feasible or reasonable and the works proceed, the proponent will provide respite periods and communicate with the impacted residents.
Outside recommended standard hours	Noise affected RBL + 5 dB(A)	• A strong justification will typically be required for works outside the recommended standard hours.

Time of Day	Noise Management Level (NML) LAeq(15min)	How to Apply
		• 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, additional noise mitigation measures should be applied in accordance with RMS CNVG.

Project noise management levels for residential receivers are summarised in Section 6.1.3.

6.1.2. Sleep disturbance

The Sydney Metro CNVS refers to the Noise Policy for Industry (EPA 2017) for assessing the potential impacts. A detailed noise assessment will be undertaken where night-time noise levels at a residential location exceed the:

- LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or the
- LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater

The detailed assessment will cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.

Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts be completed.

Project sleep disturbance levels for residential receivers are summarised in Section 6.1.3.

6.1.3. Adopted Project noise management levels for residential receivers

Table 8 shows the NMLs for residential receivers for each of the NCAs shown and described in Section 5. NMLs apply at the most noise-affected affected locations within the property boundary 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.

Table 8: Noise Management Levels (NMLs) for residential receivers (external)

NCA	Nearest construction work area	Monitor ID	Noise Management Level (NML) LAeq(15minute – dB(A) 1				Sleep disturbance	
			Standard hours1 (RBL+10)	Out-of-hours2 (RBL+5 dB)			LAeq (15min)	LAFmax
				Day	Evening	Night		
NCA01	St Marys	NM01	48	43	43	43	43	53
NCA02	St Marys	NM02	47	42	42	41	41	52
NCA03	St Marys	NM02	47	42	42	41	41	52
NCA04	St Marys / Claremont Meadows	NM14	45	40	37	36	40	52
NCA05	St Marys / Claremont Meadows	NM05	50	45	45	45	45	55
NCA06	Claremont Meadows / Orchard Hills	NM07	47	42	42	41	41	52
NCA07	Orchard Hills	NM16	57	52	47	35	40	52
NCA08	Orchard Hills	NM15	54	49	49	45	45	55
NCA11	Bringelly Services Facility	NM20	49	44	42	35	40	52
NCA12	Bringelly Services Facility / Bradfield City Centre (Aerotropolis)	NM13	48	43	40	39	40	52

NOTES:

- Standard construction hours from 7am to 6pm Monday to Friday and from 8am to 1pm Saturday
- Out-of-hours (OOH): OOH Day from 1pm to 6pm Saturday; 8 am to 6 pm Sunday and Public holidays (OOHW P1); Evening from 6 pm to 10 pm Monday to Saturday (OOHW P1) and 6pm to 10pm Sunday (OOHW P2); Night from 10pm to 7am Monday to Friday, and from 10pm to 8am Saturday, Sunday and Public holidays (OOHW P2)

6.1.4. Other sensitive land uses

The ICNG provides NMLs for commercial and industrial premises and 'other sensitive' land uses (ICNG, Table 3). The management levels for other noise sensitive receivers not listed in the ICNG that are applicable to the SBT Works, such as hotels and libraries, are derived from AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors [15] and the AAAC Guideline for Child Care Centre Acoustic Assessment [16]. The management levels from AS2107 are the upper range levels to account for the variable and short-term nature of construction noise. This approach is consistent with Section 2.2.1 of the CNVS. NMLs for other sensitive receivers are featured in Table 9.

Table 9: Noise Management Levels (NMLs) for other sensitive receivers (non-residential)

Land Use	NML LAeq(15min)	Where NML applies	Referenced from:	Assumed facade loss (conservative)	External equivalent NML - LAeq(15min)
Café (coffee bar)	50 dB(A)	Internal noise level	AS2107 'maximum'	10 dB(A)	60 dB(A)
Childcare centre (sleeping area)	40 dB(A)	Internal noise level	AAAC guideline	10 dB(A)	50 dB(A)
Classrooms at schools and other educational institutions	45 dB(A)	Internal noise level	ICNG	10 dB(A)	55 dB(A)
Commercial premise (including offices and retail outlets)	70 dB(A)	External noise level	ICNG	-	70 dB(A)
Community centre – Municipal Building	50 dB(A)	Internal noise level	AS2107 'maximum'	10 dB(A)	60 dB(A)
Hospital ward/ operating theatre	45 dB(A)	Internal noise level	ICNG	20 dB(A)	65 dB(A)
Hotel (Sleeping areas: Hotels near major roads)	40 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	60 dB(A)
Hotel (bar/ lounge)	50 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	70 dB(A)
Industrial premise	75 dB(A)	External noise level	ICNG	-	75 dB(A)
Library (reading area)	45 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	65 dB(A)
Place of worship	45 dB(A)	Internal noise level	ICNG	10 dB(A)	55 dB(A)
Recording studio (music)	25 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	45 dB(A)
Recreation area - Passive (e.g. area used for reading)	60 dB(A)	External noise level	ICNG	-	60 dB(A)

Land Use	NML LAeq(15min)	Where NML applies	Referenced from:	Assumed facade loss (conservative)	External equivalent NML - LAeq(15min)
Recreation area - Active (e.g. sports field)	65 dB(A)	External noise level	ICNG	-	65 dB(A)
Restaurant, bar (Bar/ Lounge/ Restaurant)	50 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	70 dB(A)
Theatre, auditorium (drama)	30 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	50 dB(A)

NOTE: 1. The assumed façade loss, that is the difference between the internal noise level and the external noise level is typically 10 dB(A) with windows open for adequate ventilation (ICNG p12) and 20 dB(A) for a light framed building (RTA Environmental Noise Management Manual p20 [9]) This may be adjusted on a case-by-case basis, where the building construction is found to provide a different facade loss to that assumed.

6.1.5. Annoying noise

The ICNG identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction NML. Annoying activities identified in the ICNG include:

- Use of 'beeper' style reversing or movement alarms, particularly at night-time
- Use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work
- Grinding metal, concrete or masonry
- Rock drilling
- Line drilling
- Vibratory rolling
- Rail tamping and regulating
- Bitumen milling or profiling
- Jackhammering, rock hammering or rock breaking
- Impact piling.

Where monitoring has confirmed that activities described above do not possess annoying characteristics in accordance with the ICNG (i.e. tonality or impulsive etc), the above addition of 5 dB(A) will not apply.

6.2. Ground-borne noise management levels

The ICNG provides guidelines for the assessment and management of ground-borne construction noise. Ground-borne noise management levels (GNMLs) for residences are nominated in the ICNG and Condition E44. Mitigation measures must be applied when residential ground-borne noise levels exceed the GNMLs in accordance with Condition E44. This is typically where noise sensitive receivers are located above tunnelling works or other construction activities (e.g. rock breaking).

Table 10 (taken from the ICNG and Condition E44) sets out the GNMLs and how they are to be applied to residential receivers. These levels are only applicable when ground-borne noise levels are higher than airborne noise levels. The ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home. During the daytime, ground-borne vibration criteria apply in relation to human disturbance, as outlined in Section 6.4.1.

Table 10: GNMLs at sensitive land users

Sensitive land user	Time of day	Ground-borne NML LAeq(15min)	Referenced from:
Residential	7:00am to 6:00pm	Refer to vibration criteria for human disturbance, Section 6.4.1	
Residential	6:00pm to 10:00pm	40 dB(A) internal	ICNG
Residential	10:00pm to 7:00am	35 dB(A) internal	ICNG

For other noise sensitive receivers, such as cinema spaces and recording studios, guidance is taken from the ICNG or from the recommended 'maximum' internal noise levels in AS/NZS 2107:2000 'Acoustics – For recommended design sound levels and reverberation times for building interiors' to determine suitable noise management levels (refer to Table 9).

6.3. Construction-related road traffic noise

When trucks and other vehicles are operating within the boundary of a construction site, road vehicle noise contributions are included in the overall predicted LAeq(15minute) construction site noise emissions. When construction-related traffic moves onto the public road network a different noise assessment methodology is appropriate, as vehicle movements will be regarded as 'additional road traffic' rather than as part of the construction site.

The community may associate heavy vehicle movements with the SBT Works, when vehicles are travelling on roads located immediately adjacent to construction sites. However, once the heavy vehicles move further from construction sites onto major collector or arterial roads, the noise may be perceived as being part of the general road traffic.

The ICNG and the CNVS refers to the NSW Road Noise Policy (RNP) for the assessment of noise from construction traffic on public roads. In line with the RNP and the CNVS, CPBG will adopt the following approach for assessing and managing construction traffic noise impact:

- Complete an initial screening test to evaluate whether traffic noise levels increase by more than 2 dB(A) caused by construction traffic to and from SBT sites (within approx. 600 metres of site)
- Where increases are 2 dB or less than the corresponding 'without construction traffic' scenario, no further assessment is required
- Where the road traffic noise levels are predicted to increase by more than 2 dB due to construction traffic, consider the actual noise levels associated with construction traffic and whether or not these levels comply with the following road traffic noise criteria in the RNP:
    - 60 dB LAeq(15hour) day and 55 dB LAeq(9hour) night for existing freeway/arterial/sub-arterial roads
    - 55 dB LAeq(1hour) day and 50 dB LAeq(1hour) night for existing local roads.
- Where total road traffic noise levels are less than or equal to RNP noise criteria, no further assessment is required.
- Where total road traffic noise levels are above the RNP noise criteria, feasible and reasonable noise mitigation measures will be applied to reduce the potential noise impacts and preserve acoustic amenity. This may include consideration of alternative truck routes or potential reduction of truck movements.

In addition to the above, where heavy vehicles and other vehicles are using public roads during the night period, assessment of sleep disturbance is required as outlined in Section 6.1.2.

6.4. Vibration criteria

6.4.1. Disturbance to building occupants

Vibration with the potential to disturb human occupants of buildings is managed with reference to DECC's Assessing Vibration: a technical guideline (Condition E43(b)). This document provides criteria which are based on the British Standard BS 6472-2008 Evaluation of human exposure to vibration in buildings (1-80Hz).

The guideline values for continuous, transient and intermittent vibration events that are based on a Vibration Dose Value (VDV), rather than a continuous vibration level. The VDV is dependent upon the level and duration of a short-term vibration event, as well as the number of events occurring during the daytime or night-time period. The VDV recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected are presented in Table 11.

Table 11: Vibration dose value ranges above which adverse comment may be expected

Sensitive land user	Low probability of adverse comment (m/s1.75)1	Adverse comment possible (m/s1.75)	Adverse comment probable (m/s1.75)2
Residential buildings 16hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Offices, schools, educational institutions and places of worship	0.4 to 0.8	0.8 to 1.6	1.6 to 3.2
Workshops	0.8 to 1.6	1.6 to 3.2	3.2 to 6.4

NOTES:

- Below these ranges adverse comment is not expected
- Above these ranges adverse comment is very likely

6.4.2. Structural damage to buildings

Cosmetic damage vibration limits for buildings and associated minimum working distances are identified in the CNVS based on British Standard BS7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2 (Condition E43(d)). The cosmetic damage levels set by BS7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types.

Table 12 sets out the recommended vibration limits from BS7385 for transient vibration to ensure minimal risk of cosmetic damage to residential, commercial and industrial buildings and is frequency dependent and specific to particular categories of structure.

Table 12: BS 7385 Transient vibration values for minimal risk of cosmetic damage

Line	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	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz

6.4.3. Heritage items

BS 7385 notes that heritage buildings and structures should not be assumed to be more sensitive to vibration, unless structurally unsound. The CNVS notes that heritage buildings and structures will be assessed as per the vibration criteria identified in Section 6.4.2 as they should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound.

As outlined in the CNVS, if a heritage building or structure is found to be structurally unsound (following inspection) a more conservative 2.5 mm/s peak component particle velocity (based on the German Standard DIN 4150-2016 Structural Vibration Part 3: Effects of Vibration on Structures) will be considered as a screening level. If found to be a risk, the cosmetic damage criteria in DIN 4150-2016 will apply (Condition E43(e)) and further evaluation will be undertaken. The criteria will be based on the 'Group 3' type structures because of their potential sensitivity to vibration and intrinsic value.

Table 13: DIN 4150-3 guideline values for short-term vibration velocity on structures for Group 3 sensitive structures

Foundations, all directions at a frequency of:			Topmost floor, horizontal	Floor slabs, vertical
1 to 10Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
3 mm/s	3 to 8 mm/s	3 to 8 mm/s	8 mm/s	20 mm/s

6.4.4. Other structures and utilities

Where structures and utilities are encountered that are considered to be sensitive to vibration, a vibration goal which is more stringent than structural damage goals presented in Section 6.4.2 may need to be adopted. Examples of such structures and utilities include:

- Tunnels
- Buried pipework (e.g. gas pipelines)
- Fibre optic cables.

Specific vibration goals will be determined on a case-by-case basis. Table 14 will be used as a guide and further consultation with utility owners and pipeline operators will be undertaken to apply the most appropriate vibration criteria for each utility. Where consultation confirms that alternate vibration criteria are required for specific utilities or pipeline operators, a technical memorandum will be completed (as required) for that asset and provided to the asset owner (Note: these technical memorandums will sit outside of this Sub-Plan). Where assets have a specific exclusion zone for vibration intensive works, this will also be considered in the technical memorandum.

Table 14: DIN 4150-3 guideline values for short-term vibration on buried pipework

Line	Pipe material	Guideline values for vibration velocity measured on the pipe
1	Steel (including welded pipes)	100 mm/s
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80 mm/s
3	Masonry, plastic	50 mm/s

6.4.5. Sensitive scientific and medical equipment

Some scientific equipment, such as electron microscopes and microelectronics manufacturing equipment, can require stringent vibration goals than those applicable to human comfort or cosmetic building damage. Where vibration sensitive equipment is potentially affected by construction works, vibration limits for the operation of the equipment should be taken from manufacturer's data or provided by the equipment owner.

Where this is not available the generic Vibration Criterion (VC) curves as published by the Society of Photo-Optical Instrumentation Engineers (Colin G. Gordon - 28 September 1999) will be adopted as vibration goals. These generic VC curves are provided below in Table 15.

Table 15: VC curves for Vibration Sensitive Equipment

Criterion curve	Max level (µm/sec, rms)1	Detail size (microns)2	Description of Use
VC-A	50	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	12.5	1	A good standard for most lithography and inspection equipment to 1 micron detail size.
VC-D	6	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs and SEMs) and E-Beam systems, operating to the limits of their capability.
CV-E	3	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems requiring extraordinary dynamic stability.

NOTES:

1. As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz.
2. The detail size refers to the line widths for microelectronics fabrication, the particle (cell) size for medical and pharmaceutical research, etc. The values given consider the observation requirements of many items depend upon the detail size of the process.

6.4.6. Vibration screening criteria assessment approach

6.4.6.1. Human disturbance

To simplify the assessment approach for human disturbance, an initial (conservative) screening test will be done based on peak velocity units, as this metric is also used for the building damage vibration assessment. The screening test is based on the continuous vibration velocity (i.e. vibration that continues uninterrupted for a defined period).

The initial screening test values (taken from Table C1.1 of Assessing Vibration: A technical Guideline) are:

- Residential buildings 16hr day: 0.56 mm/s
- Residential buildings 8hr night: 0.40 mm/s
- Offices, schools, educational institutions and places of worship: 1.1 mm/s
- Workshops: 2.2 mm/s.

If the predicted vibration exceeds the initial screening test, the total estimated Vibration Dose Value (i.e. eVDV) will be determined based on the level and duration of the vibration event causing exceedance and assessed against the limits set out in Section 6.4.1.

6.4.7. Structural damage to buildings

The limits presented in Table 12 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, then the guide values in Table 12 may need to be reduced by up to 50 percent. This is especially applicable at the lower frequencies where lower guide values apply.

On this basis, consistent a conservative vibration screening criteria per receiver type is given below:

- Reinforced or framed structures (Line 1): 25.0 mm/s
- Unreinforced or light framed structures (Line 2): 7.5 mm/s.

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure will be required to determine the applicable safe vibration level. The analysis will take into consideration the transient vibration guide values for minimal risk of cosmetic damage set out in Table 12.

6.5. Blast criteria

Blasting is not proposed as part of the SBT Works and is not permitted under Condition E40.

7. Environmental aspects and impacts

7.1. Indicative construction schedule

An indicative construction sequence, including key noise and vibration generating equipment is summarised in Table 16. It is noted that the key noise and vibration generating equipment identified in the list is not exhaustive and will be specified in each DNVIS together with a detailed construction schedule (Section 7.3). All construction activities have the potential to generate noise or vibration impacts on surrounding sensitive receivers; refer to the specific DNVIS for the controls that will be implemented to mitigate impacts (Section 7.3). The timeframes provided in Table 16 are indicative only and will be refined during the development of the construction program.

Table 16: Key noise and vibration generating equipment

Construction Sequence	Indicative timeframe	Key noise and vibration generating equipment (to be refined in DNVIS)	Potential to generate noise or vibration impacts on surrounding sensitive receiver
Preparatory CEMP scope	4 to 6 months	Generator, road truck, light vehicles, compressor, hand tools, water cart, street sweeper, franna crane, excavator, chainsaw, tub grinder/mulcher, concrete Agi, pneumatic vibrator, concrete pump, mobile crane, elevated work platform, excavator with hammer, truck-mounted drill rig, saw cutter, jackhammer, Moxie truck, semi-trailer truck, grader, vibratory roller, paving machine, bobcat, wacker plate, non-destructive digger, truck and dog, bulldozer, piling rig, telehandler	✓
Demolition of existing industrial premises	1 to 2 months	Excavator (with bucket), excavator (with hydraulic hammer / rockhammer), Moxie truck, bulldozer, chainsaw, franna crane, mobile crane, water cart, street sweeper, truck and dog, saw cutter, jack hammer, bobcat, circular saw, concrete saw, generator, power tools.	✓
Offices, amenities, car parking and access roads	1 to 2 months	Excavator (with bucket), excavator (with hydraulic hammer / rockhammer), vibratory roller, Moxie truck, grader, bulldozer, chainsaw, franna crane, mobile crane, water cart, street sweeper, concrete agi, concrete pump, concrete truck, truck and dog, delivery trucks, saw cutter, jack hammer, wacker packer/plate, paving machine, bobcat, circular saw, concrete saw, generator, power tools.	✓
Piling and excavation using ripper and rock hammers	2 to 3 months	Ripper and rock hammer, excavator (with bucket), excavator (with hydraulic hammer / rockhammer), Moxie truck, franna crane, mobile crane, water cart, street sweeper, concrete agi, concrete pump, concrete truck, truck and dog, delivery trucks, piling rig, saw cutter, jack hammer, generator, power tools.	✓
TBM assembly, launch and tunnelling support works	1 to 2 months	Roadheader, Tunnel Boring Machine (TBM), excavator (with bucket), excavator (with hydraulic hammer / rock hammer), vibratory roller, Moxie truck, chainsaw, franna crane, mobile crane, water cart, street sweeper, concrete agi, concrete pump, concrete truck, pneumatic vibrator, compressor, truck and dog, delivery trucks, saw cutter, jack	✓

Construction Sequence	Indicative timeframe	Key noise and vibration generating equipment (to be refined in DNVIS)	Potential to generate noise or vibration impacts on surrounding sensitive receiver
		hammer, bobcat, circular saw, concrete saw, generator, power tools.	
Stub tunnel excavation using roadheaders	> 6 months	Roadheader, TBM, excavator (with bucket), excavator (with hydraulic hammer /rockhammer), vibratory roller, Moxie truck, chainsaw, franna crane, mobile crane, water cart, street sweeper, concrete agi, concrete pump, concrete truck, pneumatic vibrator, compressor, truck and dog, delivery trucks, saw cutter, jack hammer, bobcat, circular saw, concrete saw, generator, power tools.	✓
Cast-in-situ permanent shaft and permanent portal structure	> 6 months	Moxie truck, chainsaw, franna crane, mobile crane, water cart, street sweeper, concrete agi, concrete pump, concrete truck, pneumatic vibrator, compressor, truck and dog, delivery trucks, saw cutter, jack hammer, bobcat, circular saw, concrete saw, generator, power tools.	✓
Cross passage construction support	> 6 months	Roadheader, TBM, excavator (with bucket), excavator (with hydraulic hammer/rockhammer), vibratory roller, Moxie truck, chainsaw, franna crane, mobile crane, water cart, street sweeper, concrete agi, concrete pump, concrete truck, pneumatic vibrator, compressor, truck and dog, delivery trucks, saw cutter, jack hammer, bobcat, circular saw, concrete saw, generator, power tools.	✓
Precast segment storage	> 6 months	Franna crane, mobile crane, water cart, street sweeper, delivery trucks.	✓
Invert construction support (subject to Sydney Metro approval)	> 6 months	Excavator (with hydraulic hammer/rockhammer), vibratory roller, Moxie truck, chainsaw, franna crane, mobile crane, water cart, street sweeper, concrete agi, concrete pump, concrete truck, pneumatic vibrator, compressor, truck and dog, delivery trucks, saw cutter, jack hammer, bobcat, circular saw, concrete saw, generator, power tools.	✓
TBM retrieval	1 to 2 months		✓

7.2. Construction noise and vibration impact assessment

The potential for noise and vibration impacts on sensitive receivers or structures (including utilities) will depend on several factors. Typically, these might include:

- The type of equipment in use
- The number of equipment simultaneously in use
- Ground condition
- Topography and other physical barriers
- Proximity to sensitive receivers

- The physical condition of sensitive receiver structure
- Hours/duration of construction works
- Existing background noise.

Noise and vibration impacts attributable to the Project are anticipated and are outlined in the EIS and the Response to Submissions Report [4]. Section 8 of this Sub-Plan provides a suite of mitigation measures that will be implemented to avoid or minimise impacts on the receiving community and/or built environment.

The process of assessing construction noise and vibration impacts is detailed in Figure 3. This process will form the basis of the assessments that will be prepared prior to construction works commencing. Sensitive receivers specific to each worksite will be identified, including Aboriginal places, environmental heritage buildings and items, public utilities and infrastructure. Where significant new/additional activities and/or significant changes to site layout or construction methodology are proposed, additional assessment as per this section will be undertaken. Site-specific or activity-specific noise assessments will be prepared to assess all construction activities for the SBT Works. Noise and vibration monitoring data will be collected throughout the delivery of the SBT Works in accordance with the Construction Noise and Vibration Monitoring Program (refer to Annexure A).

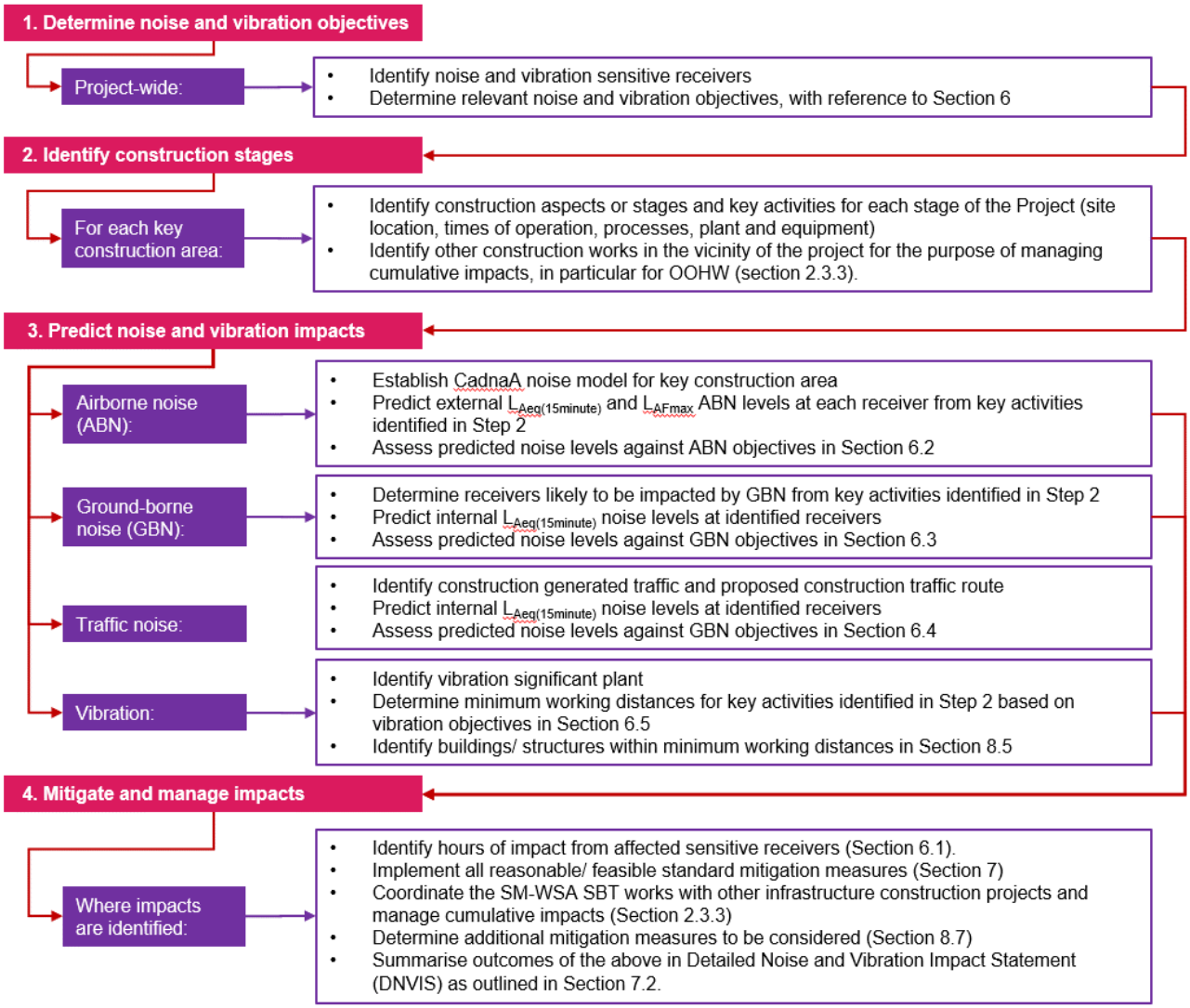


Figure 3: Construction noise and vibration impact assessment process

7.3. Detailed Noise and Vibration Impact Statements

The Detailed Noise and Vibration Impact Statements (DNVIS) will be a key site management tool that give CPBG clear instructions for managing construction activities being undertaken on each worksite. In accordance with Condition E47, each DNVIS will be prepared before commencement of works that may exceed the NMLs, vibration criteria and/ or ground-borne noise levels specified in specified in Conditions E43 and E44 (Section 6) at any residence outside standard construction hours (Section 2.5), or where receivers will be highly noise affected or subject to vibration levels above those otherwise determined as appropriate by a suitably qualified structural engineer under Condition E87.

The DNVIS will be progressively prepared through the construction phase to identify noise and vibration impact predictions and applicable management measures. Any construction work identified in the DNVIS as exceeding the noise management levels, vibration criteria and/ or ground-borne noise levels established in Section 6 will be managed in accordance with this CNVMP.

The EIS concludes that, under typical case construction, Highly Noise Affected receivers occur predominantly in association with excavation and earthworks including station box excavation, services shaft excavation, and tunnel portal / portal access excavation. Highly Noise Affected receivers are also expected to occur under typical case construction in association with demobilisation of site compounds and facilities. Consequently, these activities will commence only once the DNVIS that assesses them is prepared and approved.

All DNVIS will be prepared by an appropriately qualified and experienced acoustic consultant. A copy of the DNVIS will be provided to the ER before the commencement of the associated works and will be submitted to the Planning Secretary and the EPA on request. The DNVIS will be provided to Penrith City Council and the City of Liverpool Council for information.

Each DNVIS will be undertaken in accordance with Section 3.1 of the CNVS, and will:

- Identify adjacent residential and other noise and vibration sensitive receivers that may be affected by the works
- Determine the appropriate noise and vibration management levels
- Determine the source noise levels (Sound Power Levels) of each noise generating plant and equipment item required to undertake the construction activity scenario
- Confirm construction activities (including ‘typical’ and ‘worst case’), likely plant and equipment, and indicative program to establish the input assumptions for noise and vibration predictions
- Clearly indicate the standard mitigation and management measures that have been incorporated into the assessment and set out the measures that must be in place prior to the commencement of:
  - Construction
  - Activities that will exceed the highly noise affected criteria during ‘typical case’ construction
  - 24/7 operations on relevant worksites

  Mitigation measures include but are not limited to noise walls, acoustic enclosures around fixed plant and acoustic sheds (where required). These will help minimise noise impacts during typical and worst-case construction activities, in addition to enabling tunnelling support activities to continue during 24-hour operations. Specific additional mitigation measures will be identified through consultation with affected sensitive land users and will be implemented for the duration of the works.
- Establish the noise and vibration monitoring requirements and auditing process for the works
- Provide a subjective classification of the noise (and vibration) impact, evaluated and documented as low/ medium/ high impact, as required by the CNVS.

The key DNVIS to be prepared under this CNVMP are summarised in Table 17. Further to this, the Gatewave noise and vibration management tool will be used to manage ongoing noise and vibration risks (including cumulative impacts) as works progress, as outlined in Section 7.4.

Table 17: Indicative DNVIS prepared under this CNVMP

Construction worksite	Construction activity
St Marys Station	Civil works (station box excavation and construction) Tunnelling support works (mined stub tunnels)
Claremont Meadows Services Facility	Civil works (permanent shaft excavation and construction) Tunnelling support works (cross passage and tunnel invert construction)
Orchard Hills	Civil works (road works, station box excavation and construction) Tunnelling support works (TBM assembly/ launch/ tunnelling and cross passage construction)
Bringelly Services Facility	Civil works (permanent shaft excavation and construction) Tunnelling support works (cross passage and tunnel invert construction)
Bradfield City Centre	Civil works (station box excavation and construction) Tunnelling support works (mined stub tunnels)
Tunnelling	Tunnel excavation works

7.4. Gatewave noise and vibration management tool

A 3D construction noise and vibration management tool, Gatewave (www.gatewave.com.au), has been adapted for the SBT Works to allow defined work areas and activities to be planned, assessed and managed as construction works progress. It will also allow cumulative noise impact from other aspects of the Project or, where relevant, noise from other construction projects, to be assessed and managed in accordance with this CNVMP.

Gatewave incorporates ground elevation contours, building heights, the built environment and atmospheric conditions to predict construction noise in accordance with the International Standard ISO 9613-2:1996 implementing quality standard ISO 17534-1:2015. All sensitive receivers identified by the land use survey (see Section 5.2) are integrated into the Gatewave tool.

DNVISs to be prepared for the SBT Works will establish the overall impacts associated with worksites, ancillary facilities and tunnelling excavation. The CPBG environment team will use Gatewave to manage construction noise and vibration impact by defining specific work areas/activities in the DNVIS as construction progresses and identifying:

- Sensitive receivers where predicted noise levels are above the NMLs so that, where there are residual impacts even after all feasible and reasonable mitigation measures have been adopted, mitigation and management measures can be applied in accordance with this CNVMP
- Buildings/structures within minimum working distances established for cosmetic damage and human annoyance so that appropriate mitigation and management measures can be applied in accordance with this CNVMP.

Noise and vibration monitoring data will be collected throughout the delivery of the SBT Works. This feedback loop will ensure the prediction tool is verified and adjusted as required to ensure accuracy across the SBT Works.

8. Environmental control measures

8.1. Construction Noise and Vibration Management System

The CPBG's Noise and Vibration Management System is illustrated in Figure 4.

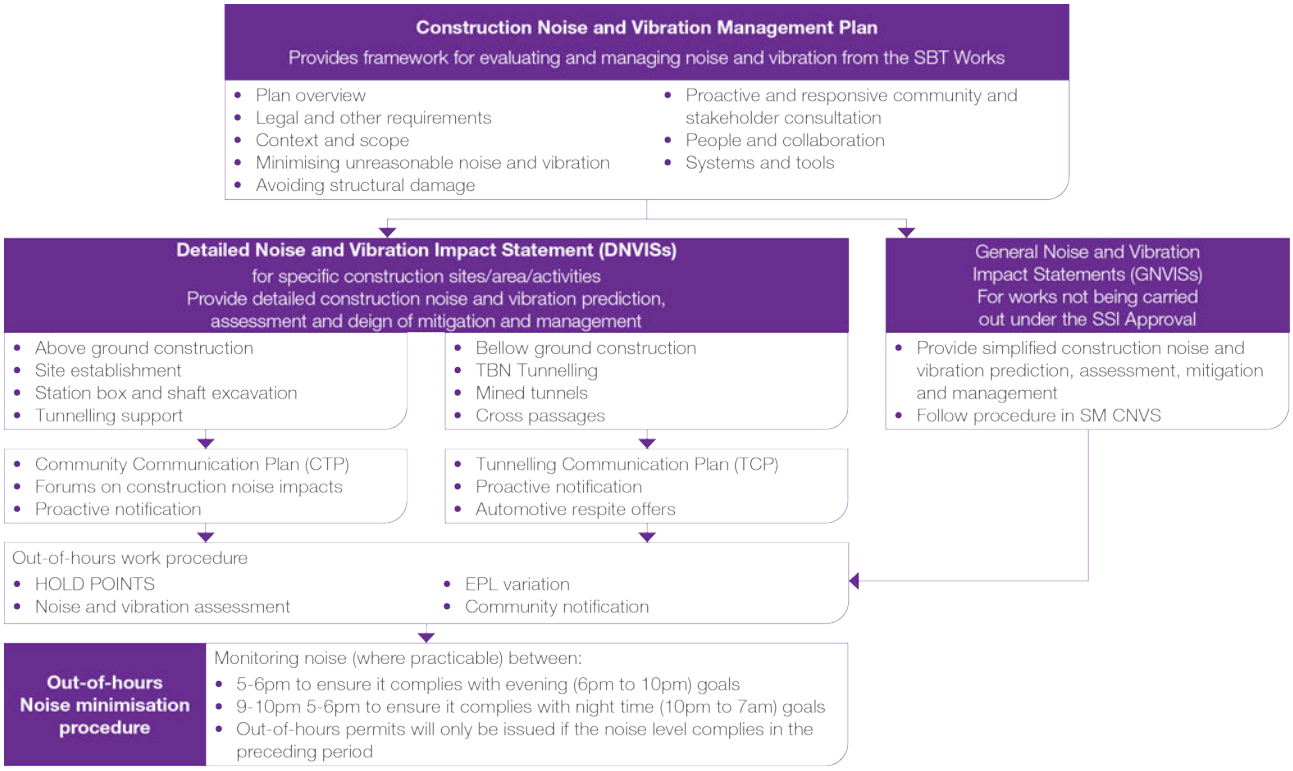


Figure 4: Construction Noise and Vibration Management System

8.2. Noise and vibration mitigation and management measures

In accordance with Condition E43, mitigation measures will be implemented with the aim of achieving the following construction noise management levels and vibration criteria:

- Construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009)
- Preferred vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure)
- Australian Standard AS 2187.2 - 2006 "Explosives - Storage and Use - Use of Explosives" (for human exposure)
- BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"
- Vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage).

All reasonable and feasible mitigation measures (as detailed in Table 18) will be applied when the following residential ground-borne noise levels are exceeded:

- Evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A)
- Night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A).

Table 18 details the industry best practice construction methods to be implemented where reasonably practicable to ensure that noise and vibration levels are minimised around sensitive land uses. Practices include:

- Use of regularly serviced low sound power equipment (NVMM12)
- At source control, temporary noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities such as rock hammering and concrete cutting (NVMM17, NVMM18 and NVMM24)
- Use of non-tonal reversing alarms (NVMM14)
- Use of alternative construction and demolition techniques (NVMM13 and NVMM15).

Should the noise and vibration mitigation and management measures identified in Table 18 be insufficient in achieving construction noise management levels and vibration criteria, additional mitigation measures will be implemented in accordance with Section 8.7 and the Noise and Vibration Monitoring Program.

Table 18: Noise and vibration management and mitigation measures

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
Management Measures						
NVMM1	Project and activity specific mitigation measures will be identified and confirmed in the DNVIS prepared for the Project and implementation as early as practicable, as noted in the DNVIS.	DNVIS Gatewave report	Prior to identified noise/ vibration generating activity commencement	Environment Manager	Conditions E43, E44 and E47 REMM NV1 CNVS	Environmental Inspection Checklists
NVMM2	Implement community consultation or notification measures as detailed in the Community Communication Strategy (CCS) (SMWSASBT-CPG-1NL-NL000-CY-PLN-000002) and Section 8.6.4 and Section 8.7 of this Sub-Plan	DNVIS or Gatewave report	Prior to noise generating activities	Stakeholder and Community Engagement Manager	Condition E69 CNVS	Consultation records
NVMM3	A register of all noise and vibration sensitive receivers will be kept on site. The register will include the following details for each receiver: • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number	Land Use Survey DNVIS	Prior to construction Construction	Environment Manager Stakeholder and Community Engagement Manager	CNVS	Noise and vibration sensitive receiver register
NVMM4	Where feasible and reasonable, construction will be carried out during the standard construction hours as outlined in Table 3.	CNVMP Induction materials	Construction	Project Managers	Condition E38 CNVS	Induction records Environmental Inspection Checklists

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
NVMM5	Work generating high noise and/or vibration levels will be scheduled during less sensitive time periods, in particular works adjacent to theatres, precision laboratories, educational institutions and places of worship. Scheduling particularly noisy activities around HSC exam times, childcare sleep times and other identified sensitive times will be considered, where feasible and reasonable.	DNVIS or Gatewave report	Prior to the commencement of work generating high noise and/or vibration levels at sensitive receivers	Environment Manager Stakeholder and Community Engagement Manager	Condition E35	Consultation records
NVMM6	All noise and vibration predictions are to be presented (as a minimum) as facade noise maps for a distance of at least 300 m in all directions from each work site / project area under assessment. Cumulative construction noise and vibration impacts will be managed through consultation with proponents of other construction works within 300 metres of the SBT Works area. Undertake reasonable steps to coordinate works to minimise impacts and maximise respite for affected sensitive receivers.	DNVIS or Gatewave report CCS	Prior to the commencement of works	Environment Manager Stakeholder and Community Engagement Manager	Conditions C6(d)	OOHW Coordination Meeting
NVMM7	Training will be provided to relevant personnel, including relevant sub-contractors on noise and vibration requirements from this CNVMP through inductions, toolboxes or targeted training.	Induction materials Toolbox talk	Prior to construction Construction	Construction Manager	CPBG practice	Induction records Toolbox talk record Pre-start records
NVMM8	All employees, contractors & subcontractors are to receive a Project induction prior to commencing work on site. The environmental	Induction materials	Prior to construction Construction	Construction Manager	CNVS	Induction records Toolbox talk record

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
	component, covered in either the induction or toolboxes, must include: • relevant licence & approval conditions • permissible hours of work • limitations on high noise activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • relevant site-specific and standard mitigation measures • site opening/ closing times (including deliveries) • OOHW approval process • appropriate behavioural practices, including no swearing or unnecessary shouting or loud stereos/radios; no dropping of materials from height; throwing of metal items; and slamming of doors, no excessive revving of plant and vehicle engines and controlled release of compressed air • environmental incident procedures.					
NVMM9	Noise and vibration verification monitoring is to be undertaken in accordance with this Sub-Plan, as identified in the DNVISs and any EPL conditions.	Noise and Vibration Monitoring Program (Appendix A) DNVIS	Construction	Environment Manager	Condition C15 CNVS EPL	Monitoring records
NVMM10	Prior to arriving on site, drivers will be advised of designated vehicle routes, parking locations, acceptable delivery hours for the site and other relevant practices (i.e. minimising the use of	DNVIS Induction materials	Construction	Supervisor / Site Engineer	CPBG Practice	Induction records Vehicle Management Plans

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
	engine brakes and no extended periods of engine idling). This will be communicated by CPBG using notifications under contract provisions and communication with schedulers from companies using heavy vehicles.			Environment Manager		OOHW records
NVMM11	Building condition surveys will be completed before and after construction works where buildings or structures are within the minimum vibration working distances for cosmetic damage.	Section 8.5.2 DNVIS CCS	Prior to construction Construction	Construction Project Managers	Condition E84	Condition survey report
NVMM12	All construction plant and equipment used on the site will, in accordance with the manufacturer's specifications be: • Fitted with properly maintained noise suppression devices • Operated in a proper and efficient manner • Serviced and maintained in an efficient condition. If a piece of plant or equipment is found to exceed the noise levels included in modelling, the following will occur: • At-source control or a quieter or less vibration emitting piece of plant or equipment will be utilised in place of the offending plant / equipment (If available and appropriate); • On-site mitigation (e.g. noise blankets) will be reviewed; and /or	Plant risk assessment Manufacturer's specifications DNVIS or Gatewave	Construction	Supervisor Environmental Coordinators	Condition E46	Plant inspection records Environmental Inspection Checklists Spot checking noise monitoring records SWMS Toolbox talk record

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
	• The noise assessment will be repeated with the accurate noise level of the plant / equipment.					
NVMM13	Minimise disturbance arising from materials delivery to worksites by: • Loading and unloading of materials/deliveries as far as possible from sensitive receivers • Planning traffic flow and selecting site access points and roads as far as possible away from sensitive receivers • Dedicated loading/unloading areas to be shielded if close to receivers • Out-of-hours deliveries will be minimised where possible. • Where out of hours deliveries are required, due care will be taken to minimise impacts (i.e. no extended periods of engine idling, use of radios instead of shouting, non-tonal reversing beepers where possible, unloading / loading to be undertaken during standard hours).	Site planning and design Induction materials DNVIS	Construction	Supervisor Site Engineer	E41(d)(iii) and (iv)	Plant/ site inspection records Design Report Vehicle Management Plans Induction records
NVMM14	Non-tonal movement alarms (or an equivalent mechanism) will be fitted and used in place of tonal reversing alarms for all construction vehicles and mobile plant regularly used on site and for any out of hours work	Plant risk assessment Toolbox talk SWMS	Construction	Supervisor	Condition E46 CNVS	Plant/ site inspection records SWMS Toolbox talk record
NVMM15	Manage the use and siting of plant, where practicable by:	Induction materials Toolbox talk	Construction	Supervisor	CPBG Practice	Induction records

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
	• Avoiding simultaneous operation of noisy plant within discernible range of a sensitive receiver; • Maximising the offset distance between noisy or vibration significant plant and adjacent sensitive receivers; • Switching off when it is not in use for more than 15 minutes; • Directing noise-emitting plant away from sensitive receivers, particularly during OOHW; and • Using only necessary size, power and number of equipment on site. NOTE: Due to limited land available for construction this may not at times be practical.	SWMS				Environmental Inspection Checklists Pre-start briefing SWMS Noise monitoring records DNVIS
NVMM16	Plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the levels in Section 8.4.2 of this Sub-Plan, and Table 13 of the CNVS, or as specified in the DNVIS. Sound Power Levels specified in the DNVIS will be no higher than the levels presented in Table 13 of the CNVS, unless justified. Regular compliance checks on the noise emissions of all plant and machinery used for the Project will indicate whether noise emissions from plant items were higher than predicted. This also identifies defective silencing equipment on the items of plant.	DNVIS or Gatewave report Plant risk assessment Manufacturer's specifications	Construction	Supervisor	CPBG practice	Plant/ site inspection records

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
NVMM17	Additional temporary screening or enclosures will be considered for plant and equipment where additional measures are required to meet relevant NMLs, or where plant and equipment is known to exceed the NMLs	DNVIS or Gatewave report SWMS	Construction	Supervisor Environmental Coordinator	Condition E46	Environmental Inspection Checklists SWMS Work Packs
NVMM18	Stationary noise sources will be enclosed or shielded where reasonable and feasible. This will apply to plant and equipment such as generators, stationary concrete cutters, stationary asphalt corers, stationary vacuum trucks, and stationary jack hammers.	DNVIS or Gatewave report SWMS	Construction	Supervisor	Condition E46	Environmental Inspection Checklists SWMS Work Packs
NVMM19	The implementation of procedures to maximise the night-time onsite spoil storage capacity where spoil is produced between the hours of 10.00 pm and 7.00 am	DNVIS or Gatewave report	Construction	Construction Project Managers	CNVS	Environmental Inspection Checklists SWMS Work Packs
NVMM20	High noise and vibration generating activities (includes jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block ("Continuous" includes any period during which there is less than a 60 minutes respite between ceasing and recommencing any of the work)	Induction materials Toolbox talk SWMS	Construction	Supervisor	ICNG CNVS	Environmental Inspection Checklists SWMS Work Packs
Path controls						

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
NVMM21	Acoustic sheds (where required by DNVIS within indicative sites identified in Annexure E) will be designed, constructed and operated to minimise noise emissions. This will include the following considerations: • All significant noise producing equipment that will be used during the night-time will be inside the sheds, where feasible and reasonable • Noise generating ventilation systems such as compressors, scrubbers, etc, will be located inside the sheds and external air intake/discharge ports will be appropriately acoustically treated • The doors of acoustic sheds will be kept closed during the night-time period. Where night-time vehicle access is required at sites with nearby residences, the shed entrances will be designed and constructed to minimise noise breakout. • The internal lining and type of material used in the construction of the sheds would be considered during design development and construction planning to ensure appropriate attenuation is provided.	DNVIS Design reports	Construction	Construction Project Managers Environment Manager	Condition E50 REMM NV1	Environmental Inspection Checklists Meeting minutes
NVMM22	Noise barriers and boundary screening (such as site hoardings) will be constructed around ancillary facilities as detailed within the DNVIS (Note: this does not include temporary noise blankets, whose location is not specified in the	DNVIS	Prior to construction Construction	Construction Project Managers	Condition A47	Environmental Inspection Checklists

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
	DNVIS). Boundary screening will minimise noise impacts on adjacent sensitive receivers.					
NVMM23	Structures will be used as noise barriers at compounds where appropriate.	DNVIS Site layout drawings	Construction	Construction Project Managers Environment Manager	CNVS CPBG Practice	Environmental Inspection Checklists Design Reports
NVMM24	Additional temporary screening or enclosures will be considered for plant and equipment where additional measures are required to meet relevant NMLs, or where plant and equipment is known to exceed the NMLs	DNVIS or Gatewave reports SWMS	Construction	Supervisor	CNVS CPBG Practice	Environmental Inspection Checklists SWMS
NVMM25	At-property construction noise mitigation treatments must be installed prior to the commencement of typical construction works that may cause the receiver to be highly noise affected. Path controls will be considered in conjunction with at-property treatment and nominated in the DNVIS.	At-property Noise Mitigation Report CCS DNVIS	Prior to construction Construction	Stakeholder and Community Engagement Manager Construction Project Managers Environment Manager	Conditions E49 and E51 CPBG Practice	At-property Noise Mitigation Report Community notifications Meeting minutes
Consultation and Complaints Management						
NVMM26	Sensitive receivers, including owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage, will be notified before works that generate vibration or affect their noise amenity. Information provided will include:	Communications Strategy DNVIS or Gatewave report CEMP	Prior to construction Construction	Stakeholder and Community Engagement Manager Construction Project Managers/	CNVS Conditions E48 and E57	Community notifications OOHW records

ID	Measure / Requirement	Resource needed	When to implement	Responsibility	Reference	Evidence
	• A description of the works, types of activities and location of works to be undertaken, • The timing of activities including expected start and finish, and • Mitigation and management measures which aim to achieve the noise and vibration goals • Details of the community information line and how to make an enquiry and / or complaint. If the potential vibration exceedance is to occur more than once or extend over a period of 24 hours, owner and occupiers will be provided a monthly schedule of potential exceedances for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier.			Environment Manager		

8.2.1. Indicative noise and vibration mitigation measures

The indicative management of construction noise and vibration impacts at each SBT worksite is outlined in Attachment E. The detailed mitigation and management measures will be presented in the DNVIS for each worksite, as outlined in Section 7.3.

8.3. Alternative construction techniques

Condition E46 requires consideration of alternative construction techniques. It should be noted that in rock with closer joint spacings, and particularly shale, a bulldozer or excavator with a ripper attachment can be used in place of rock hammering. An analysis of SBT excavations where bulldozers with rippers could be used is set out in Table 19. Noise generated by a ripping method is approximately half the intensity of noise generated by rock hammering. In addition, the noise is not impulsive or tonal in nature, making it less annoying to receivers. Using a ripper attachment also greatly reduces vibration (less than half) compared to rock hammering and associated ground-borne noise.

Table 19: Review of potential for excavation within using a bulldozer with a ripper*

SBT worksite	Total Depth of Excavation	Depth from surface that can be excavated using methods other than hammering	Construction team comment
North: St Marys station box	20m	15m minimum	Favourable Shale III conditions throughout depth of station box. Stronger Shale II or better towards last 5m at the eastern end of box.
North: Claremont Meadows shaft	22.3m	22.3 m	Favourable Shale III and IV/V conditions for entire depth of shaft expected.
North: Orchard Hills	14m	8m minimum	Based on available data
South: Bringelly Services Shaft	32.4m	15.2m	Favourable Shale III and IV/V/VI expected for the first 15.2m, then the remaining 17.2m to the bottom of the shaft is expected to be Shale II.
South: Aerotropolis	21m	10m	Favourable shale conditions in the top half of excavation should not require use of rock hammers.

* Shale III (3-10MPa) addressed with v bratory ripper and hammering in Shale II or better.

Excavations will also provide additional noise attenuation as work progresses as the excavation acts as a noise barrier itself. This means that the noise impacts associated with this work will reduce over time as the excavation depth increases.

8.4. Minimising noise impacts

8.4.1. Highly noise affected receivers

The Interim Construction Noise Guideline (DECC, 2009) sets the highly noise affected level as $L_{Aeq(15min)}$ 75 dB(A). Physical mitigation measures applied to the worksite, such as noise barriers or acoustic enclosures, will reduce noise from both 'typical case' and 'worst case' noise levels. Where 'typical case' noise levels can't be reduced below 75 dB(A) with physical mitigation measures, at-property treatment will be triggered.

As required by Condition E49, where sensitive land uses are identified in Appendix B of the Planning Approval as exceeding the highly noise affected criteria during 'typical case' construction,

mitigation measures must be implemented with the objective of reducing 'typical case' construction noise below the highly noise affected criteria at each relevant sensitive landuse(s). Activities that would exceed highly noise affected criteria during typical case construction will not commerce until the measures identified in this condition have been implemented, unless otherwise agreed with the Planning Secretary.

The EIS concludes that, under 'typical case' construction, Highly Noise Affected receivers occur predominantly in association with excavation and earthworks including station box excavation, services shaft excavation, and tunnel portal / portal access excavation. Highly Noise Affected receivers are also expected to occur under typical case construction in association with demobilisation of site compounds and facilities. Consequently, these activities will commence only once a DNVIS that assesses them is prepared and approved.

The DNVIS prepared for each worksite (in accordance with Condition E47 and the Sydney Metro CNVS) will include mitigation measures which aim to reduce noise levels at receivers below the highly noise affected level of 75 dB(A) during ‘typical case’ construction. Where construction worksites can be designed to mitigate ‘typical case’ construction noise below the highly noise affected level, no at-property treatment will be offered. This will be clearly stated in the DNVIS prepared for each worksite. Where the optimum suite of mitigation measures identified in the DNVIS is unable to reduce ‘typical case’ construction noise below the highly noise affected level, at-property treatment will be offered to affected receivers.

The indicative path controls including noise barriers and acoustic enclosures for the SBT Works in accordance with Condition E49 are set out in Annexure E. Indicative mitigation measures include limitations on plant and equipment use, noise walls, acoustic enclosures around fixed plant, acoustic sheds (where required) have been developed to meet the requirements of relevant Conditions.

8.4.2. Maximum noise levels for plant and equipment

The Sound Power Level (SWL) represents the total noise output of operating plant and equipment. The SWL is used in computer noise models to predict Sound Pressure Levels (SPLs) at nearby receivers.

When undertaking site compliance measurements, it is normally the SPL that is measured at a specified distance (typically 7m) from the plant or equipment.

All plant and equipment used for the SBT Works should have SWL and SPL which are no higher than the corresponding figures shown in Table 20 below, Table 13 of the CNVS, or as specified in the DNVIS. Sound Power Levels specified in the DNVIS will be no higher than the levels presented in Table 13 of the CNVS, unless justified. Plant and equipment with SWLs or SPLs higher than those on the table will be deemed to be emitting an excessive level of noise and will not be permitted to operate on the SBT Works. Plant and equipment will be subject to regular noise level checks to verify compliance as detailed in Annexure A.

Table 20: Maximum Allowable Sound Power Levels for Construction Equipment

Equipment	Maximum Allowable Sound Power Level (dB) L_{Aeq}	Maximum Allowable Sound Pressure Level (dB) L_{Aeq} at 7 m	Not recommended Out of Hours (where practicable)
Asphalt – Truck & Sprayer	106	81	
Backhoe	111	86	
Bulldozer - equiv. CAT D8	118	93	
Bulldozer - equiv. CAT D9	120	95	
Bulldozer - equiv. CAT D10	121	96	
Chainsaw 4-5hp	114	89	✓
Compactor	106	81	
Compressor ~600CFM	100	75	
Compressor ~1500CFM	105	80	
Concrete pump	109	84	
Concrete saw	118	93	✓
Concrete truck	109	84	
Concrete vibrator	105	80	
Crane – Fixed	113	88	
Crane - Franna 20t	103	78	
Crane – Mobile	113	88	
Crane – Truck mounted <60t	108	83	
Crusher – rock	118	93	✓
Excavator ≤ 10 tonne	100	75	
As above + hydraulic hammer	118	93	✓
Excavator ≤ 20 tonne	105	80	
Excavator ≤ 30 tonne	110	85	
As above + hydraulic hammer	122	97	✓
Excavator ≤ 40 tonne	115	90	
Grader 35t	113	88	
Lighting tower - daymaker	98	73	
Light vehicles (eg 4WD)	103	78	
Line marking truck	108	83	
Loader - Front end (wheeled) 23t	112	87	

Equipment	Maximum Allowable Sound Power Level (dB) L_{Aeq}	Maximum Allowable Sound Pressure Level (dB) L_{Aeq} at 7 m	Not recommended Out of Hours (where practicable)
Loader – Skidsteer ½t	107	82	
Loader – Tracked <50kW	115	90	
Loader – Tracked 200-300kW	121	96	✓
Pavement laying machine	114	89	
Pavement profiler	117	92	✓
Piling rig - bored	116	91	✓
Piling rig – vibratory driven	121	96	✓
Piling rig – impact hammer	134	109	✓
Pneumatic hammer (jackhammer)	115	90	✓
Power generator (diesel/ petrol)	104	79	
Power generator (attenuated)	92	67	
Rattle gun (hand held)	104	79	
Roller (large pad foot)	109	84	✓
Roller (smooth drum)	107	82	✓
Roller – vibratory 10t	109	84	✓
Scissor lift (EWP)	98	73	
Scraper - equiv. 651	110	85	
Truck – concrete	109	84	
Truck – dump 15t	110	85	
Truck – medium rigid 20t	103	78	
Truck – road truck/ truck & dog 30t	108	83	
Tub grinder/ mulcher 40-50hp	116	91	✓
Vacuum truck/ non-destructive digger	109	84	
Vibrator – concrete	113	88	
Vibratory roller ~10t	114	89	✓
Water cart	107	82	
Welding equipment	110	85	

Notes:

1. The Sound Power Level (SWL) represents the total noise output of the plant of equipment. The SWL is normally used in computer noise models to predict the Sound Pressure Levels (SPLs) at nearby receivers. When undertaking site compliance measurements, it is normally the SPL that is measured at a specified distance (typically 7m) from the plant or equipment.

2. The SWLs presented in the above table have been compiled from the TfNSW Construction Noise & V bration Strategy (April 2018), the RMS Construction Noise & Vibration Guideline (August, 2016) and from past projects and information held in the Renzo Tonin & Associates l brary files
3. Equipment with special audible characteristics.

8.5. Minimising vibration impacts

The pattern of vibration radiation is very different to the pattern of airborne noise radiation and is very site specific. Final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

Recommended minimum working distances presented in the following sections provide a conservative screening method for indicating buildings and structures where there is a risk of vibration impact. Vibration monitoring will be carried out to confirm the minimum working distances at specific sites, where vibration significant plant is required to operate within or near the recommended minimum working distances.

8.5.1. Human exposure

Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures. At properties near the construction works, nearby receivers may be able to feel vibration when vibration-generating equipment is being utilised. For this reason, it is appropriate identify properties where there is a probability of adverse comment so that impacts can be managed.

Recommended minimum working distances for typical vibration intensive construction equipment for human comfort (response) are shown in Table 21. These recommended distances relate to continuous vibration and are presented as a guide only. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels occurring over shorter time periods are allowed (see Section 6.4.1).

Table 21: Recommended minimum working distances (m) - human comfort (response)

Vibration significant plant item	Residence (Day)	Residence (Night)	Office	Workshop
Concrete saw	10	10	5	5
Excavator (tracked) ≤ 5t + hydraulic hammer	20	20	15	10
Excavator (tracked) ≤ 15t + hydraulic hammer	20	25	15	10
Excavator (tracked) ≤ 35t + hydraulic hammer	25	30	20	15
Percussive drill (small)	10	15	5	5
Piling rig – bored (rock)	15	15	10	10
Piling rig – bored (soft ground)	10	10	5	5
Piling rig - vibratory driven	170	225	100	55
Pneumatic hammer (jackhammer)	15	20	10	5
Terrain leveller	15	20	5	5
Vibratory roller (11t) padfoot - High vibration	70	90	40	25
Vibratory roller (11t) padfoot - Low vibration	60	80	35	20

Vibration significant plant item	Residence (Day)	Residence (Night)	Office	Workshop
Vibratory roller (13t) smooth drum - High vibration	55	75	30	15
Vibratory roller (13t) smooth drum - Low vibration	40	55	20	10
Wacker packer	10	15	5	5

8.5.2. Buildings and structures

To limit the risks of vibration-induced damage on all nearby buildings and structures, pre- and post-building condition surveys will be conducted by an appropriate professional. The inspections will document the location of all cracks and/or defects observed and any changes in crack width or defect size will be measured after construction completion (refer to Requirement 3.2B(2.5) Infrastructure Monitoring and Protection System). The post construction survey will record any changes to the property at construction completion.

Recommended minimum working distances to reduce the risk of cosmetic damage to buildings or structures from typical vibration intensive construction equipment are presented in Table 22. These are aimed at reducing the risk of cosmetic damage (as per BS 7385:1993 and DIN 4150-3:2016) and are based on the vibration screening criteria set in Section 6.4.2.

Unlike noise, vibration cannot be readily predicted. The minimum working distances below are indicative and will vary depending on the plant item, building types and foundations and local geotechnical conditions. Vibration monitoring will be carried out to confirm the site-specific minimum working distances for the SBT Works.

Table 22: Minimum working distances (m) - cosmetic damage1

Vibration significant plant item	Reinforced or frame structures (BS7385)[2]	Unreinforced or light framed structures (BS7385)[2]	Structurally unsound heritage structures (DIN 4150-3)[3]
Concrete/ road saw	5	5	5
Excavator (tracked) ≤ 15t + hydraulic hammer	5	5	10
Excavator (tracked) ≤ 35t + hydraulic hammer	5	10	10
Excavator (tracked) ≤ 50t + hydraulic hammer	5	10	20
Drill Rig	5	5	10
Pneumatic hammer (jackhammer)	5	5	5
Piling rig – bored (rock)	5	5	5
Piling rig – bored (soft ground)	5	5	5
Piling rig - impact hammer (high)	15	30	65
Piling rig - impact hammer (typical)	10	15	35
Piling rig - vibratory driven	10	20	50
Terrain leveller	5	5	5

Vibration significant plant item	Reinforced or frame structures (BS7385)[2]	Unreinforced or light framed structures (BS7385)[2]	Structurally unsound heritage structures (DIN 4150-3)[3]
Vibratory roller ≤ 25t padfoot	5	10	20
Vibratory roller ≤ 13t smooth drum - High vibration	5	5	15
Vibratory roller ≤ 13t smooth drum - Low vibration	5	5	10
Wacker packer	5	5	5

Notes:

1. Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method
2. Minimum working distance based on vibration screening criterion which reduced the cosmetic damage levels set by BS7385 (see Table 11) by 50% due to potential dynamic magnification.
3. A building condition inspection should determine whether a heritage item is structurally unsound.

8.6. Mitigation and management of out-of-hours Work

8.6.1. Strategy for 24-hour tunnelling operations

Tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunnelling) are prescribed activities that can be undertaken 24 hours a day, seven days a week. DNVISs will be prepared progressively for each stage of the works and submitted to the EPA for information.

Surface works to support tunnelling will also be undertaken in line with any EPL requirements.

OOHW and OOH noise minimisation procedures will be prepared to set out processes, roles and responsibilities, and Hold Points. These will ensure:

- All reasonable and feasible noise and vibration mitigation measures are implemented as works progress
- Compliance with the EPL.

Ground-borne noise and vibration impacts will be assessed and managed through the DNVIS prepared for tunnelling.

8.6.2. Emergency works

Where OOHW are required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm (Condition E41(b)), CPBG will notify the ER, the Planning Secretary and the EPA of the reasons for emergency works. In addition, CPBG will use best endeavours to notify all potentially noise and/or vibration affected sensitive receivers of the likely impact and duration of the emergency works at the earliest opportunity.

8.6.3. Out-of-Hours Works Protocol

The Sydney Metro Western Sydney Airport Out-of-Hours Work Protocol (OOHW Protocol, ref: SM-21-00306108) has been prepared in accordance with Condition E42. The OOHW Protocol provides a process for the consideration, management, and approval of work outside the approved construction hours detailed in Section 2.5, and that is not subject to an EPL.

The aim of the OOHW Protocol is to ensure that OOHW not subject to an EPL are assessed and managed via a rigorous process to identify the associated risk of adverse impacts on sensitive receivers including:

- Justification for why OOHW need to occur
- Consideration of the OOHW against the relevant NMLs and vibration criteria, and providing a determination of low or high-risk work
- Processes for selecting and implementing mitigation measures for residual impacts in consultation with the community, including respite periods consistent with the requirements of Condition E56
- Procedures to facilitate the coordination of OOHW with those approved under an EPL or undertaken by a third party, to ensure appropriate respite is provided
- An approval process for OOHW that considers risks, proposed mitigation, management and coordination, and includes review and approval by the ER for low risk activities and by the Planning Secretary for high-risk activities
- Details of notification requirements for affected receivers for all approved OOHW, including notification to the Planning Secretary for approved low risk OOHW.

The Out of Hours Works Protocol was prepared by Sydney Metro and was reviewed and approved by DPHI on 8 November 2021.

8.6.4. Community consultation on respite

To satisfy Condition E57, consultation with the community to determine appropriate respite periods for OOHW will be undertaken where works are:

- Undertaken outside standard construction hours; and
- Likely to exceed the noise and vibration objectives identified in Conditions E43 and E44.

The consultation will include, but not be limited to providing the community with:

- A progressive schedule of likely OOHW for a period no less than three (3) months
- A description of the potential work, location and duration
- The noise characteristics and likely noise levels of the Work
- Likely mitigation and management measures to be implemented which aim to achieve the relevant NMLs under Condition E43 (including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers).

Note: Respite periods can be any combination of days or hours where OOHW will not be more than 5 dB(A) above the rating background level at any residence.

Noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs will not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.

The standard approach to managing noise and vibration impact from OOHW, including respite periods and temporary alternative accommodation, is outlined in Section 8.7. These approaches will form the basis of discussions with the community. The outcomes of the community consultation, including the identified respite periods and the scheduling of OOHW will be documented and provided to the ER, EPA and Planning Secretary for information prior to the OOHW commencing.

8.7. Managing residual noise impacts

8.7.1. At-property treatment or other noise mitigation measures

Construction worksites will be designed with the aim of meeting the ICNG NMLs and vibration criteria. All reasonable and feasible mitigation and management measures will be implemented with the aim of achieving the NMLs and vibration criteria.

Sensitive receivers that, after all reasonable and feasible mitigation and management measures have been implemented, are still predicted to be above the ICNG NML or vibration criteria will be identified as 'residual impacts' that require further investigation and management.

Review of residual impacts will take into consideration properties that have already been treated for noise (e.g. road traffic or aircraft noise). At treated receivers, the external NMLs may be conservatively increased by 10dB. Higher adjustments may be adopted, if a qualified acoustic consultant has determined that windows and façades of individual buildings provide a higher level of sound attenuation than 20dB and if it can be demonstrated or reasonably assumed that the windows are fixed or kept closed. Properties that are likely to experience construction noise levels above the adjusted external NML will be managed in accordance with the Sydney Metro CNVS.

Residual impacts will be managed based on the level and duration of exceedance of the NML, namely:

- Exceeds NML and the Additional Mitigation Measure trigger level (short term (less than six months) (Section 8.7.2): consideration will be given to offering respite in the form of noise cancelling headphones, movie tickets, coffee vouchers or similar
- Exceeds NML and the Additional Mitigation Measure trigger level (long term (greater than six months)) (Section 8.7.2): consideration will be given to at-property treatment, subject to consultation
- Exceeds NML and the highly noise affected level during typical case construction: consideration will be given to at-property treatment (subject to consultation) with the objective of reducing typical case construction noise below the highly noise affected criteria at each relevant sensitive landuse. Activities that will exceed highly noise affected criteria during typical case construction will not commerce until the measures identified in this Sub-Plan have been implemented, unless otherwise agreed with the Planning Secretary.

Where at-property treatment (temporary or permanent) is the appropriate measure to reduce noise impacts, this at-property treatment will be offered to landowners of residential properties for habitable living spaces, unless other mitigation or management measures are agreed to by the landowner. Landowners will be advised of the range of options that can be installed at or in their property and given a choice as to which of these they agree to have installed. A copy of all guidelines and procedures that will be used to determine at-property treatment at their residence will be provided to the landowner.

Any offer for at-property treatment or the application of other noise mitigation measures in accordance with Condition E51, will not expire until the noise impacts specified in Condition E49, affecting that property are completed, even if the landowner initially refuses the offer. Note that construction may proceed if an offer for at-property treatment or the application of other noise mitigation measure has been made but is not accepted.

The implementation of at-property treatment will not preclude the application of other noise and vibration mitigation and management measures including temporary and long term accommodation.

8.7.2. Additional mitigation measures

The additional mitigation measures to be applied are outlined in Table 15 of the CNVS and below:

- **Alternative accommodation (AA)** options may be provided for residents living close to construction works that are likely to incur unreasonably high impacts over an extended period of time. Alternative accommodation will be determined on a case-by-case basis.
- **Monitoring (M)** of noise or vibration may be conducted at the affected receiver(s) or a nominated representative location where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals. Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to

inform the relevant personnel when the noise or vibration goal has been exceeded so that additional management measures may be implemented.

- **Individual briefings (IB)** are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor will visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.
- **Letter box drops (LB)** in the form of a monthly newsletter produced and distributed to the local community via letterbox drop or email via the project mailing list. The newsletter will provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on the community.
- **Project specific respite offers (RO)** provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact (for example noise cancelling headphones, movie tickets, coffee vouchers or similar).
- **Phone calls and emails (PC)** detailing relevant information about construction works will be made to identified noise or vibration affected stakeholders within 7 days of proposed work to provide tailored advice and the opportunity for stakeholders to provide comments on the proposed work and specific needs etc.
- **Specific notifications (SN)** will be letterbox dropped or hand distributed to identified stakeholders no later than 7 days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications, or to advertise unscheduled works.

It is noted that the above additional mitigation measures are often used in combination with each other (where moderate to higher impacts are predicted) to provide a comprehensive and systematic approach to ensuring the affected community receivers are informed and mitigated.

The standard hours and OOHW periods are depicted in Figure 5. The OOHW periods are further defined as OOHW Period 1 and 2, where the OOHW period covers more than one assessment period (e.g. OOH Day and Evening periods on Saturdays).

Figure 5: Construction assessment periods

Day/ Time	12am to 1am	1am to 2am	2am to 3am	3am to 4am	4am to 5am	5am to 6am	6am to 7am	7am to 8am	8am to 9am	9am to 10am	10am to 11am	11am to 12pm	12pm to 1pm	1pm to 2pm	2pm to 3pm	3pm to 4pm	4pm to 5pm	5pm to 6pm	6pm to 7pm	7pm to 8pm	8pm to 9pm	9pm to 10pm	10pm to 11pm	11pm to 12pm
Monday to Friday											Standard construction hours									OOHW Period 1				
Saturday		OOHW Period 2																						
Sunday or Public Holiday												OOHW Period 1								OOHW Period 2				

Figure 6 to Figure 8 detail the additional mitigation measures for airborne noise, ground-borne noise and vibration respectively, as recommended in the CNVS, for standard hours and OOHW. Where feasible and reasonable, this approach will be implemented. Additional mitigation measures will be considered to ensure additional respite is provided to affected residents including special circumstances. An example is during daytime works where highly sensitive receivers (e.g. shift workers at home during the day) may be subject to high levels of noise.

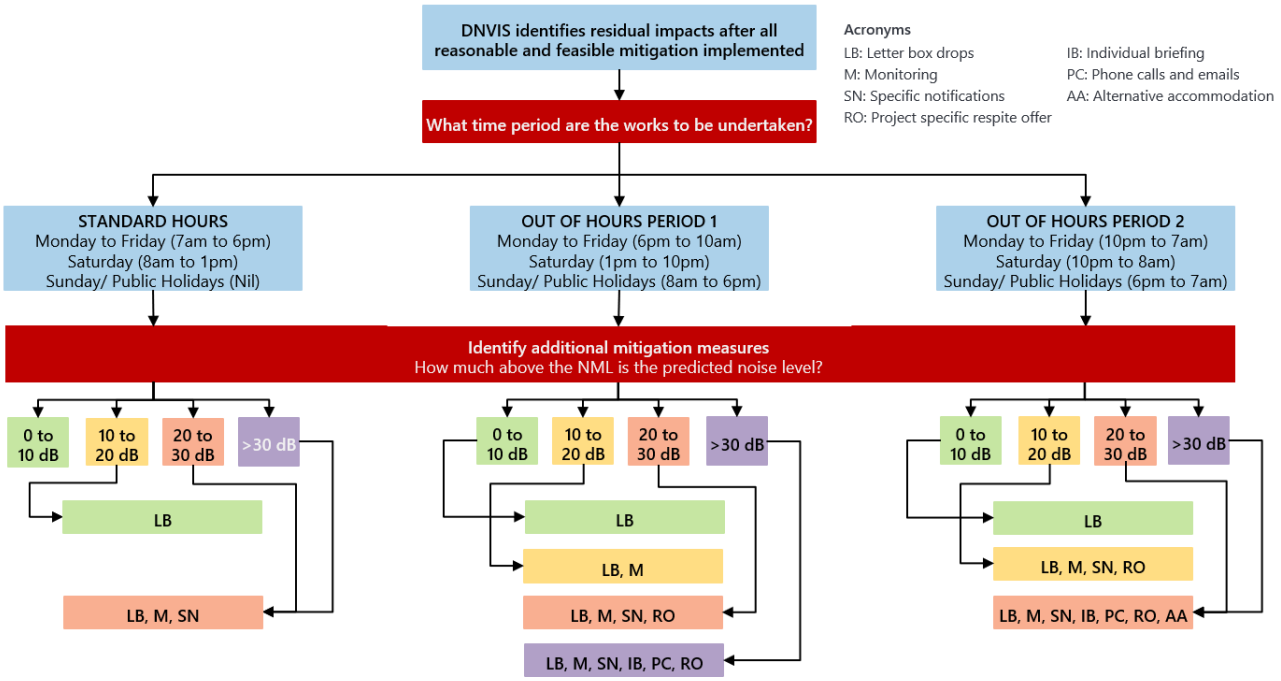


Figure 6: Additional airborne noise mitigation measures

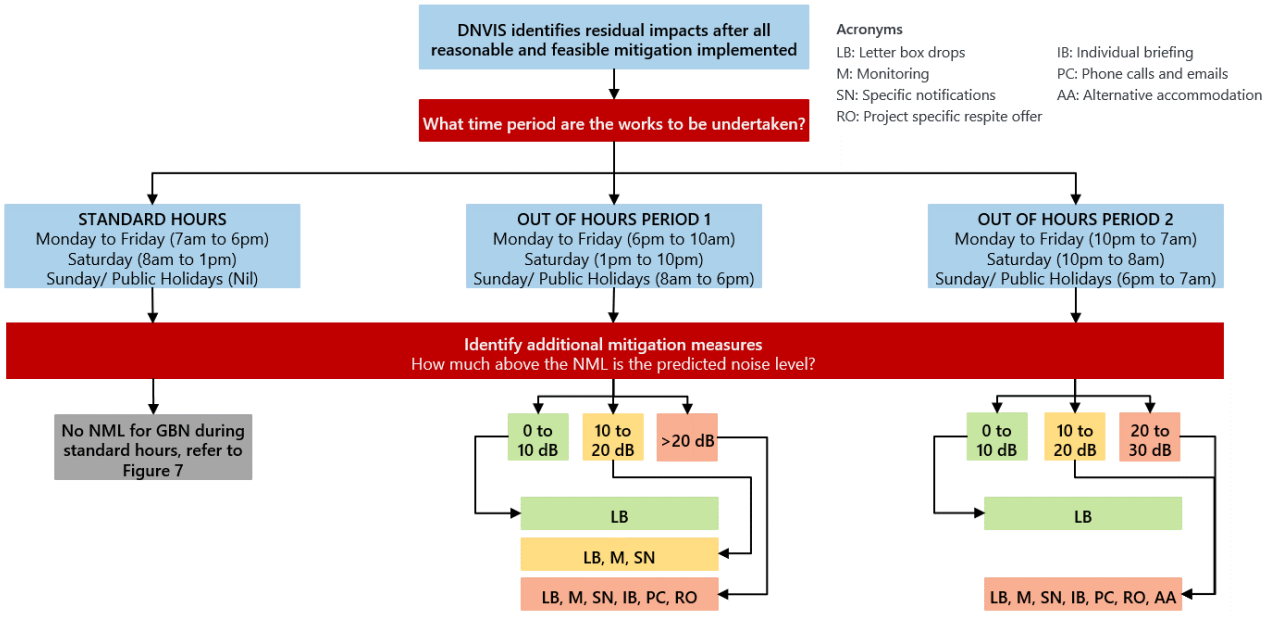


Figure 7: Additional ground-borne noise mitigation measures

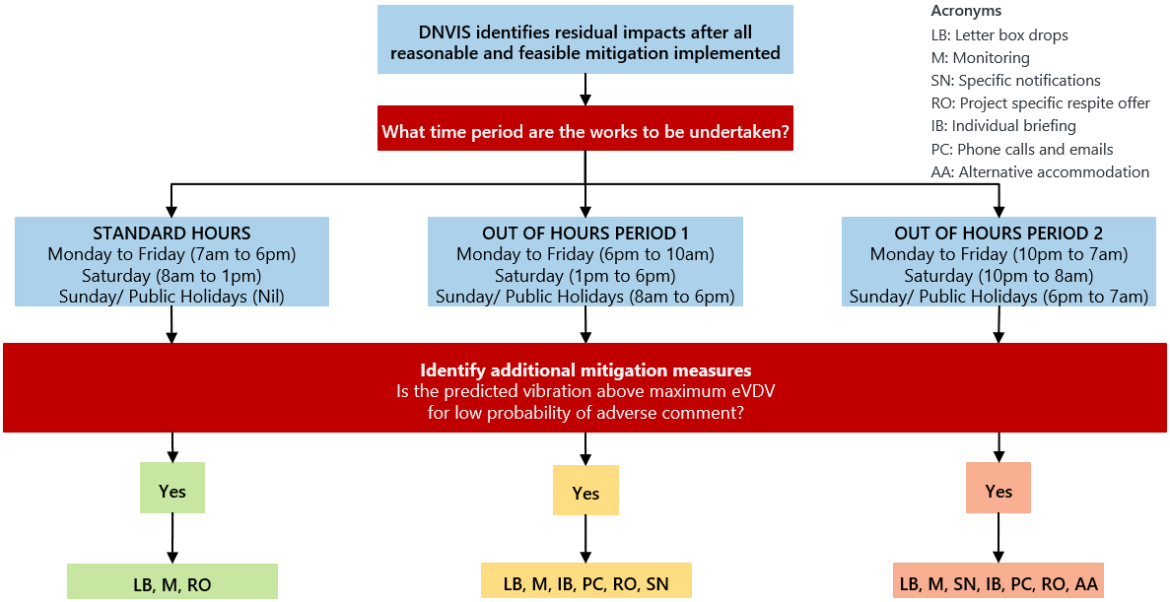


Figure 8: Additional vibration mitigation measures

9. Compliance management

The CPBG Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Part B of this Sub-Plan.

9.1. Training

All employees, contractors, sub-contractors and utility staff working on site will undergo site induction training that includes construction noise and vibration management issues. The induction training will address elements related to noise and vibration management including:

- Relevant licence & approval conditions
- Permissible hours of work
- Limitations on high noise activities
- Location of nearest sensitive receivers
- Construction employee parking areas
- Designated loading/unloading areas and procedures
- Relevant site-specific and standard mitigation measures
- Site opening/ closing times (including deliveries)
- OOHW approval process
- Appropriate behavioural practices, including no swearing or unnecessary shouting or loud stereos/radios; no dropping of materials from height; throwing of metal items; and slamming of doors, no excessive revving of plant and vehicle engines and controlled release of compressed air
- Environmental incident procedures.

Further details regarding staff induction and training are outlined in Element 1: Training.

9.2. Inspections and monitoring

Weekly and other routine inspections by the CPBG Environment Team, TfNSW and ER will occur throughout construction. Detail on the nature and frequency of these inspections and activities are documented in Element 2: Monitoring and reporting, Element 3: Auditing, review and improvement and in Section 7 of the CEMP.

Noise and vibration monitoring will also occur routinely for the duration of the SBT Works, in accordance with the Noise and Vibration Monitoring Program, which is detailed in Annexure A of this Sub-Plan.

The Noise and Vibration Monitoring Program details when monitoring will be undertaken, as well as the representative locations adjacent to the construction works where noise and vibration monitoring will be undertaken.

To satisfy Condition C15, where noise and vibration monitoring is undertaken, the data will be readily available and will be reported on a six monthly basis to the construction team, Sydney Metro, ER and DPHI.

Monitored noise and vibration levels will be analysed against the predictions made in the relevant noise and vibration assessments. Where monitored noise levels are found to be above modelling predictions or vibration goals are exceeded, the following actions will be undertaken:

- Cease the noise and/or vibration generating source which causes the exceeded predictions
- Confirm the monitored levels are not being impacted by other (non-SBT related) noise or vibration sources
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment in accordance with Section 6.1 of the CNVS

- Identify if the equipment can be swapped out for another piece of equipment or alternative equipment or plant, or if additional mitigation can be included in the site design in accordance with Section 6.1 of the CNVS
- Confirm that the modelling reflects the actual activity being undertaken
- Confirm that the noise and vibration management and mitigation measures (Section 8 of the CNVMP and specific mitigation and management measures identified in the relevant DNVIS) have been implemented
- Implement other feasible and reasonable measures which may include reducing plant size, modifying time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilising alternative construction methodology or a combination of these
- Review work practices to ensure compliance with the management levels set out in this CNVMP
- Ensure that the learnings from the above are fed back into the noise modelling assessment process for fine-tuning
- Continue work where impacts can be reduced
- Communicate lessons learnt to relevant personnel.

In accordance with Condition E54, consultation with a heritage specialist will be undertaken prior to the installation of any monitoring equipment, where installation may impact on heritage listed structures.

9.3. Hold Points

The activities detailed in Table 23 are recognised as hold points and will not proceed without objective review and approval by the nominated authority.

Table 23: Noise and vibration hold points

Hold Point Details	Document Reference	Responsibility	Timing
To demonstrate compliance with Condition E41, any work to be undertaken outside of standard construction hours will require an approved OOHW Application Form.	Section 8.6 Annexure B	Project Engineer Environmental Coordinator	Prior to and during works
As per Condition E49, adequate mitigation measures will be implemented prior to commencement of works that are predicted to exceed the highly noise affected criteria within sensitive land uses with the objective of reducing typical case construction noise below the highly noise affected criteria at each relevant sensitive landuse(s).	Section 8	Site Supervisor Environmental Coordinator	Prior to works
As per Condition E48, owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage will be notified prior to commencement of works. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owners and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the works.	Section 8.5 Annexure C	Site Supervisor Community Liaison Officer	Prior to works
As per Condition E84, a condition survey must be prepared for all buildings, structures, utilities identified in the EIS and	CEMP Section 6.10	Appropriate professional	Prior and during works

Hold Point Details	Document Reference	Responsibility	Timing
Submissions Report as being at risk of damage. The condition survey must be prepared before commencement of any work that could impact on the subject surface / subsurface structure. Refer to CEMP Section 6.10 for further details.		nominated by Construction Manager	

9.4. Complaints

Complaints will be recorded and managed as detailed in Section 7.7 of the CEMP and the CCS.

9.5. Auditing

Both external audits (Independent and Sydney Metro) and internal audits will be undertaken in accordance with the combined audit schedule to verify compliance with SSI 10051 Planning Approval and legal requirements, EPL and this Sub-Plan.

Audit requirements are detailed in Section 7.13.1 of the CEMP.

9.6. Reporting

Reporting requirements and responsibilities are documented in Section 7.13.1 of the CEMP and are further detailed in the Noise and Vibration Monitoring Program in Annexure A.

10. Review and improvement

10.1. Continual improvement

The continual improvement process will be undertaken in accordance with Section 7.13.4 of the CEMP and the intention of this process is to:

- Identify opportunities for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

10.2. Update and amendment

The processes described in Section 7.12 of the CEMP may result in the need to update or revise this Sub-Plan. This will occur as needed, in accordance with the process outlined in Section 7.12.2 of the CEMP.

A copy of the updated Sub-Plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure.

11. References

[1] Sydney Metro 2021 Construction Environmental Management Framework (CEMF)

[2] M2A Joint Venture 2020 Sydney Metro – Western Sydney Airport Environmental Impact Statement

[3] M2A Joint Venture 2020 Sydney Metro – Western Sydney Airport Environmental Impact Statement Technical Paper 2: Noise and Vibration

[4] M2A Joint Venture 2021 Sydney Metro – Western Sydney Airport Submissions Report

[5] Sydney Metro 2020 Sydney Metro Construction Noise and Vibration Standard (reference: SM-20-00098866, version 4.3)

[6] Sydney Metro 2021 Sydney Metro Out-of-hours Work Protocol (reference: SM- 21-00306108, version 2.0)

[7] Department of Environment and Climate Change 2009 NSW Interim Construction Noise Guideline (ICNG)

[8] Department of Environment, Climate Change and Water 2011 NSW Road Noise Policy (RNP)

[9] Roads and Traffic Authority 2001 Environmental Noise Management Manual (ENMM) RTA Publication Number RTA–Pub.01.142

[10] Department of Environment Conservation NSW 2006 Assessing Vibration; a technical guideline (AVTG)

[11] British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz)

[12] German Standard DIN 4150-3: 1999-02, Structural vibration - Effects of vibration on structures, February 1999

[13] ASHRAE Applications Handbook (SI) 2003, Chapter 47 Sound and Vibration Control, pp47.39-47.40

[14] Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration, p16

[15] Australian Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors

[16] Association of Australasian Acoustical Consultants (AAAC) 2020 Guideline for Child Care Centre Acoustic Assessment Version 3.0

Part B: Implementation Systems and Tools

Part B of this Sub-Plan explains how the construction noise and vibration impacts of the SBT Works will be minimised. All relevant mitigation measures from the CEMF and REMMs are addressed in this Section. Compliance with these systems and tools is required at all times to minimise the risk of unauthorised environmental harm and reduce environmental impact.

Part B contains the following:

- **Environmental Elements and Expectations:** These describe what is required of the SBT Works in order to implement the objectives of CPBG's Environment and Sustainability Policy:
  - **Element** – Key aspects for managing this function in delivering the SBT Works
  - **Intent** – A one-line statement describing the overall purpose of the Element
  - **Expectation** – The outcomes achieved as part of each Element.
- **Requir**ements: These are the specific actions performed in order to demonstrate compliance with the Elements and Expectations.
- Responsibility and Key Contributor: This information is included to ensure absolute clarity as to those people responsible for achieving compliance with the stated Expectation, as well as those that will need to assist/contribute to achieving compliance.
- Deliverab**les**: This column of the table lists the tangible outcomes to be produced in order to demonstrate compliance with the environmental Elements and Expectations.

Element 1: Training

All staff, employees and subcontractors will actively drive continuous improvement in the environmental performance of the SBT Works

Expectations	How will CPBG meet the Expectation?	Responsible Key Contributor	Deliverables
1.1. All personnel have completed an induction containing relevant environmental information before they are authorised to work on the SBT Works	All personnel working on the SBT Works will undertake a site induction, which will provide initial training on various environmental aspects, including noise and vibration. It will cover: • relevant licence & approval conditions • permissible hours of work • limitations on high noise activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • relevant site-specific and standard mitigation measures • site opening/ closing times (including deliveries) • OOHW approval process • appropriate behavioural practices, including no swearing or unnecessary shouting or loud stereos/radios; no dropping of materials from height; throwing of metal items; and slamming of doors, no excessive revving of plant and vehicle engines and controlled release of compressed air • environmental incident procedures	**Human** Resources Manager Environment Manager Environment Coordinators	Induction presentation
1.2. Personnel are trained and assessed according to the training matrix	Targeted environmental training will be provided including: • Training in noise modelling targeted at engineers, environment and community personnel • Training in noise, vibration, and ground-borne noise monitoring targeted at engineers, environment and community personnel	**Human Resources Manager** Environment Manager	Training matrix Training records Training evaluation forms
1.3. Toolbox talks are used to reinforce key management	Toolbox talks on DNVIS requirements will be held regularly, and will reinforce and reiterate information from inductions. Toolbox talks will be presented when changes in work practices (e.g. OOHW) or seasonal weather increases the risk of adverse impacts from noise and/or vibration.	**Environment** Manager Site Supervisor Environment Coordinators	Toolbox records

Expectations	How will CPBG meet the Expectation?	Responsible Key Contributor	Deliverables
requirements and lessons learnt			

Element 2: Monitoring and reporting

All staff, employees and subcontractors will actively drive complaint environmental performance of the SBT Works

Expectations	How will JHCPBG meet the Expectation?	Responsible Key Contributor	Deliverables
1.4. Worksites are regularly inspected to ensure the adequacy of controls	Site Supervisor to undertake daily inspections of worksite to ensure management of noise and vibration controls. Weekly inspection of onsite noise and vibration management controls will be undertaken as part of joint environment inspections.	**Environment Manager** Superintendents Site Supervisors Soil Conservationist	Site Diary entries Environmental Inspection Reports
1.5. Monitoring is performed to establish baseline data and ensure compliance is maintained	Monitoring is carried out to establish pre-construction benchmarks, confirm compliance with the conditions of environmental approvals and laws, and to provide early indication of potential adverse impacts to the environment or community. The Environment Manager is accountable for managing environmental monitoring as required under the Noise and Vibration Monitoring Program. Results of monitoring will be used for: • The evaluation of performance relative to legal, regulatory, contract, permit, licence and other commitments • The prompt identification and correction of incidents or possible incidents • Providing feedback on this Sub-Plan • Providing the basis of internal and external reporting. • Refer to Annexure A for more detail.	**Environment Manager** Environmental Coordinators	Monthly EPA Report
1.6. Monitoring records are maintained	The results of noise and vibration monitoring will be documented and published on CPB Contractors' website where required, in accordance with the POEO Act and Regulations.	**Environment Manager** Environmental Coordinators	Monthly EPA Report

Element 3: Auditing, review and improvement

We will continually improve our environmental systems and environmental performance by monitoring and reviewing their effectiveness.

Expectations	How will JHCPBG meet the Expectation?	Responsible Key Contributor	Deliverables
1.7. Review this Sub-Plan to ensure compliance with the EPL	• CPB on behalf of CPBG will obtain an EPL from the EPA. If required, this Sub-Plan will be updated to include relevant conditions of the EPL • Review of this Sub-Plan will be undertaken in accordance with Section 7.12.2 of the CEMP • Any updates to this Sub-Plan require approval by the ER under Condition A32(j).	**Environment Manager** Environment Representative	Updates to this Plan if required during delivery
1.8. Audits are undertaken to ensure compliance with the requirements of this Sub-Plan	• Audits will be performed in line with the CEMP (Section 7.13.1), and we will update this Sub-Plan and/or the associated DNVIS or procedures if required.	**Environment Manager** Environmental Coordinators	Audit Reports
1.9. All non-compliances are reported and actioned	A noise or vibration non-compliance can generally be defined as a failure to comply with: • SSI 10051 Planning Approval • Environment Protection Licence. Where a non-compliance is raised as part of an audit or an incident or complaint investigation the audit, incident or complaint report may be used to close out the non-compliance and it is not necessary to raise a separate non-compliance reporting process. Procedures for corrective actions are addressed in the CEMP (Section 7.4.3). If monitoring identifies that noise or vibration levels are above predictions, an investigation will be undertaken to determine the cause and if additional mitigation is required.	**Environment Manager** Environmental Coordinators	Corrective Action Reports Complaint Reports Incident Reports Audit Reports

Element 4: Package specific requirements

SSI 10051 Planning Approval

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
E37	A detailed land use survey must be undertaken to confirm sensitive land use(s) (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration and construction ground-borne noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area before the commencement of work which generate construction noise, vibration or ground-borne noise in that area. The results of the survey must be included in the Detailed Noise and Vibration Impact Statements required under Condition E47.	An updated land use survey is included in this Sub-Plan (Section 5.2 and Annexure D)	RT&A Construction managers Environmental Coordinators	Land use survey	Prior to commencement of work in an area
E38	Work must only be undertaken during the following hours: (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 1:00pm Saturdays; and (c) at no time on Sundays or public holidays.	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites	Environment Manager Construction Managers Environmental Coordinators RT&A	This Sub-Plan DNVIS	Prior to construction
E39	Except as permitted by an EPL or approved in accordance with the Out of Hours Works Protocol required by Condition E42, highly noise intensive work that result in an exceedance of the applicable NML at the same receiver must only be undertaken: (a) between the hours of 8:00 am to 6:00 pm Monday to Friday; (b) between the hours of 8:00 am to 1:00 pm Saturday; and (c) if continuously, then not exceeding three (3) hours,	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites	As above	As above	As above

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	with a minimum cessation of work of not less than one (1) hour. For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.				
E40	This approval does not permit blasting.	Section 6.5	Not Applicable	Not Applicable	Not Applicable
E41	Notwithstanding Conditions E38 and E39 work may be undertaken outside the hours specified in the following circumstances: (a) Safety and Emergencies, including: (i) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or (ii) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or (b) Low impact, including: (i) construction that causes LAeq(15 minute) noise levels: • no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and • no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and (ii) construction that causes: • continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or • intermittent vibration values measured at the most affected residence are no more than the preferred values	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites	Environment Manager Construction managers Environmental Coordinators RT&A	This Sub-Plan DNVIS	Prior to construction

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006). (c) By Approval, including: (i) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or (ii) works which are not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E42; or (iii) negotiated agreements with directly affected residents and sensitive land user(s). (d) By Prescribed Activity, including: (i) tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunneling) are permitted 24 hours a day, seven days a week; or (ii) grout batching at the Orchard Hills ancillary facility is permitted 24 hours a day, seven days a week; or (iii) delivery of material that is required to be delivered outside of standard construction hours in Condition E38 to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Orchard Hills ancillary facility; or (iv) haulage of spoil except between the hours of 10:00 pm and 7:00 am to / from Orchard Hills construction site; or (v) work within an acoustic enclosure are permitted 24 hours a day, seven days a week where there is no exceedance of noise levels or intermittent vibration levels under Low impact circumstances identified in Condition E41(b), unless otherwise agreed with the Planning				

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	Secretary; or (vi) tunnel and underground station box fit out works are permitted 24 hours per day, seven days per week. On becoming aware of the need for emergency work in accordance with (a)(ii) above, the ER, the Planning Secretary and the EPA must be notified of the reasons for such work. The Proponent must use best endeavours to notify as soon as practicable all noise and/or vibration affected sensitive land user(s) of the likely impact and duration of those work. Notes: 1. Tunnelling does not include station box excavation. 2. Tunnelling ancillary support activities includes logistics support and material handling and delivery				
E42	An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of work (not subject to an EPL) that is outside the hours defined in Conditions E38 and E39. The Protocol must be approved by the Planning Secretary before commencement of the out-of-hours work. The Protocol must be prepared in consultation with the ER. The Protocol must provide: (a) justification for why out-of-hours work need to occur; (b) identification of low and high-risk activities and an approval process that considers the risk of activities, proposed mitigation, management, and coordination, including where: (i) the ER reviews all proposed out-of-hours activities and confirms their risk levels; (ii) low risk activities can be approved by the ER; and	Section 8.6.3	Environment Manager Construction Managers	Sydney Metro Western Sydney Airport Out-of-Hours Work Protocol (ref: SM-21-00306108)	Prior to commencement of OOHW not subject to the EPL

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	(iii) high risk activities that are approved by the Planning Secretary; (c) a process for the consideration of out-of-hours work against the relevant NML and vibration criteria; (d) a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition E56. The measures must take into account the predicted noise levels and the likely frequency and duration of the out-of-hours works that sensitive land user(s) will be exposed to, including the number of noise awakening events; (e) procedures to facilitate the coordination of out-of-hours work including those approved by an EPL or undertaken by a third party, to ensure appropriate respite is provided; and (f) notification arrangements for affected receivers for all approved out-of-hours works and notification to the Planning Secretary of approved low risk out-of-hours works. This condition does not apply if the requirements of Condition E41 are met. Note: Out-of-hours work is any work that occurs outside the construction hours identified in Condition E38 and E39.				
E43	Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria: (a) construction 'Noise affected' noise management levels	Section 8.2 This Sub-Plan establishes the goals for noise and vibration	Construction Managers Project Managers Environment Manager	This Sub-Plan and DNVIS for worksites.	Prior to the start of construction stage on worksite/ tunnel

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	established using the Interim Construction Noise Guideline (DECC, 2009); (b) preferred vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure); (c) Australian Standard AS 2187.2 - 2006 "Explosives - Storage and Use - Use of Explosives" (for human exposure); (d) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and (e) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage). Any work identified as exceeding the noise management levels and / or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan. Note: The ICNG identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.	management and mitigation measures required in Section 8.2 . DNVIS prepared for each worksite will identify all feasible and reasonable mitigation measures, specific to each site.	Environmental Coordinators RT&A		
E44	All reasonable and feasible mitigation measures must be applied when the following residential ground-borne noise levels are exceeded: (a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and (b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A). The mitigation measures must be outlined in the Noise	Section 8.2 This Sub-Plan establishes the goals for noise and vibration management. The tunnelling DNVIS will identify all feasible	Construction Managers Project Managers Environment Manager Environmental Coordinators RT&A	This Sub-Plan and DNVIS for worksites.	Prior to the start of tunnelling

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	and Vibration CEMP Sub-plan, including in any Out-of-Hours Work Protocol, required by Condition E42.	and reasonable mitigation measures. Section 8			
E45	Noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.	Section 8.6.4	Senior Stakeholder and Community Relations Manager Environment Manager RT&A	CCA Consultation records DNVIS	Prior to relevant construction activities
E46	Industry best practice construction methods must be implemented where reasonably practicable to ensure that noise and vibration levels are minimised around sensitive land use(s). Practices may include, but are not limited to: (a) use of regularly serviced low sound power equipment; (b) at source control, temporary noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities such as rock hammering and concrete cutting; (c) use of non-tonal reversing alarms; and (d) use of alternative construction and demolition techniques.	Section 8.2 and 8.3 (alternative construction and demolition techniques)	Construction Managers Project Managers Environment Manager RT&A	DNVIS for worksites	Prior to the start of construction activity that causes noise or vibration impact
E47	Detailed Noise and Vibration Impact Statements (DNVIS) must be prepared for any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in Conditions E43 and E44 at any residence outside construction hours identified in Condition E38, or where receivers will be highly noise affected or subject to vibration levels above those otherwise determined as	Section 7.3 and 7.4	Construction Managers Project Managers Environment Manager RT&A	DNVIS for worksites	Prior to the start of construction activity that causes noise or vibration impact

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	appropriate by a suitably qualified structural engineer under Condition E87. The DNVIS must include specific mitigation measures identified through consultation with affected sensitive land user(s) and the mitigation measures must be implemented for the duration of the works. A copy of the DNVIS must be provided to the ER before the commencement of the associated works. The Planning Secretary and the EPA may request a copy (ies) of the DNVIS.				
E48	Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before works that generate vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owners and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Sub-plan.	Section 8.2 (Table 18, NVMM26)	Commercial Manager Design Team Manager	DNVIS for worksites Consultation Manager records	Pre-construction
E49	Where sensitive land use(s) are identified in Appendix B as exceeding the highly noise affected criteria during typical case construction, mitigation measures must be implemented with the objective of reducing typical case construction noise below the highly noise affected criteria at each relevant sensitive landuse(s). Activities that will exceed highly noise affected criteria during typical case construction must not commerce until the measures identified in this condition have been implemented, unless otherwise agreed with the Planning Secretary.	The requirements of this Condition are addressed in Section 8.4.1	Project Managers Environment Manager RT&A	DNVIS At-property Noise Mitigation Report	Prior to commencement of typical construction that causes sensitive land use to be highly noise affected.

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	Note: Mitigation measures may include path barrier controls such as acoustic sheds and/or noise walls, at-property treatment, or a combination of path and at-property treatment.				
E50	For all construction sites where acoustic sheds are installed, the sheds must be designed, constructed and operated to minimise noise emissions. This will include the following considerations: (a) all significant noise producing equipment that will be used during the night-time will be inside the sheds, where feasible and reasonable; (b) noise generating ventilation systems such as compressors, scrubbers, etc, will be located inside the sheds and external air intake/discharge ports will be appropriately acoustically treated; and (c) the doors of acoustic sheds will be kept closed during the night-time period. Where night-time vehicle access is required at sites with nearby residences, the shed entrances will be designed and constructed to minimise noise breakout.	Section 7.3 and Section 8.2 (Table 18, NVMM21) The requirement for acoustic sheds will be confirmed in the DNVIS for each worksite.	Project Managers Environment Manager RT&A	DNVIS	Prior to commencement work requiring acoustic shed to meet noise goals outlined in Section 6.1.
E51	Where Condition E49 determines that at-property treatment (temporary or permanent) is the appropriate measure to reduce noise impacts, this at-property treatment must be offered to landowners of residential properties for habitable living spaces, unless other mitigation or management measures are agreed to by the landowner. Landowners must be advised of the range of options that can be installed at or in their property and given a choice as to which of these they agree to have installed. A copy of all guidelines and procedures that will be used	Section 8.7.1 and Section 8.2 (Table 18, NVMM25) Sensitive land uses where at-property treatment is the appropriate mitigation measure will be identified in the	Project Managers Environment Manager RT&A	DNVIS At-property Noise Mitigation Report	Prior to construction that triggers at-property treatment.

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	to determine at-property treatment at their residence must be provided to the landowner.	DNVIS for each worksite.			
E52	Any offer for at-property treatment or the application of other noise mitigation measures in accordance with Condition E51 does not expire until the noise impacts specified in Condition E49 affecting that property are completed, even if the landowner initially refuses the offer. Note: If an offer has been made but is not accepted, this does not preclude the commencement of construction under Condition E49.	Section 8.7.1	As above	As above	As above
E53	The implementation of at-property treatment does not preclude the application of other noise and vibration mitigation and management measures including temporary and long term accommodation.	Section 8.7.1	As above	As above	As above
E54	Vibration testing must be conducted during vibration generating activities that have the potential to impact on Heritage items to verify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and attended monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures. Such measures must include, but not be limited to, review or modification of excavation techniques.	Annexure A (Section 3.5.2.2 and Section 4.3) The DNVIS will identify potentially impacted heritage items.	Project Managers Environment Manager RT&A	DNVIS	Prior to construction within minimum working distances for cosmetic damage.
E55	The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring at Heritage items.	Annexure A (Section 3.5.2.2) The DNVIS will identify potentially	Project Managers Environment Manager RT&A	DNVIS	Prior to construction within minimum working distances for

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
		impacted heritage items.			cosmetic damage.
E56	All work undertaken for the delivery of the CSSI, including those undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided. The Proponent must: (a) reschedule any work to provide respite to impacted noise sensitive land use(s) so that the respite is achieved in accordance with Condition E57; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive land use(s); and (c) provide documentary evidence to the ER in support of any decision made by the Proponent in relation to respite or mitigation. The consideration of respite must also include all other approved Critical SSI, SSI and SSD projects which may cause cumulative and / or consecutive impacts at receivers affected by the delivery of the CSSI.	Section 1.4.3	Project Managers Environment Manager	DNVIS	Construction
E57	In order to undertake out-of-hours work outside the work hours specified under Condition E38, appropriate respite periods for the out-of-hours work must be identified in consultation with the community at each affected location on a regular basis. This consultation must include (but not be limited to) providing the community with: (a) a progressive schedule for periods no less than three (3) months, of likely out-of-hours work; (b) a description of the potential work, location and duration of the out-of-hours work; (c) the noise characteristics and likely noise levels of the work; and	Section 8.6.4	Project Managers Environment Manager	DNVIS	Construction

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
	(d) likely mitigation and management measures which aim to achieve the relevant NMLs under Condition E43 (including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers). The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour work must be provided to the ER, EPA and the Planning Secretary prior to the out-of-hours work commencing. Note: Respite periods can be any combination of days or hours where out-of-hours work will not be more than 5 dB(A) above the RBL at any residence.				
E87	Appropriate equipment to monitor areas in proximity of ancillary facilities and the tunnel route must be installed during construction with particular reference to at risk buildings, structures and utilities identified in the condition surveys required by Condition E84 and / or geotechnical analysis as required. If monitoring during construction indicates exceedance of the vibration criteria identified in the DNVIS prepared under Condition E47, or levels otherwise determined as appropriate by a suitably qualified structural engineer, then all construction affecting settlement must cease immediately and must not resume until fully rectified or a revised method of construction is established that will ensure protection of affected buildings.	Annexure A (Section 3.5.2.2 and Section 4.3)	Environment Manager Environment Coordinators R&TA	Vibration monitoring reports	During construction

Revised Environmental Mitigation Measures

No.	Requirement	How will CPBG meet this Requirement?	Responsible Key Contributor	Deliverables	Timing
NV1	Where acoustic sheds are installed, the internal lining and type of material used in the construction of the sheds will be considered during design development and construction planning to ensure appropriate attenuation is provided	The requirement for acoustic sheds will be confirmed in the DNVIS for each worksite. See Section 7.3 and Section 8.2	Project Managers Environment Manager RT&A	DNVIS	Prior to commencement work requiring acoustic shed to meet noise goals outlined in Section 6.1.
NAH6	The following heritage items will be monitored for potential vibration impacts during construction: a) St Marys Railway Station Group b) Queen Street Post-War Commercial Building c) St Marys Munitions Workers Housing d) McGarvie Smith Farm e) McMaster Farm.	Monitoring will be undertaken in accordance with the Noise and Vibration Monitoring Program (Annexure A) McGarvie Smith Farm and McMaster Farm are outside the SBT scope.	Environment Manager Environment Coordinators R&TA	Vibration monitoring reports	During construction

Environmental Protection Licence

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
L3.1	The licensee must minimise noise and vibration impacts at residences and other sensitive land uses. To meet the requirements of this condition the licensee must: a) implement the guidance in the Interim Construction Noise Guideline (DEC, 2009) and the Assessing Vibration: a technical guideline (DEC, 2006); b) implement all reasonable and feasible measures to minimise noise impacts in accordance with the Interim Construction Noise Guideline (DEC, 2009); and c) implement vibration mitigation in accordance with the Assessing Vibration: a Technical Guideline (DEC, 2006). In this condition, 'reasonable' and 'feasible', in relation to noise management, have the same meaning as defined in the Interim Construction Noise Guideline (DEC, 2009).	This Sub-Plan has been developed to meet objective and performance outcomes in L3.1, as summarised in Section 1.3.	Environment Manager Environmental Coordinator Site Supervisor	This Sub-Plan DNVIS Environmental Inspection Checklist Environmental monitoring records	Construction
L3.2	When construction activities include 'High Noise Impact Activities and Works' as defined in the special dictionary in this licence, quantitative construction noise assessments must apply a +5dB correction to the measured or predicted level of construction noise at the nearest Noise Sensitive Receiver location before assessment against the Interim Construction Noise Guideline (DECC, 2009) noise management levels.	Section 6.1.5	RT&A Environmental Coordinator	DNVIS Gatewave report	Construction
L4.1	All blasting activities are prohibited on the licensed premises.	Section 6.5	Not Applicable	Not Applicable	Not Applicable
L5.1	Standard construction hours Unless permitted by another condition of this licence, works and activities must:	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites	Environment Manager Construction Managers	Environmental Inspection Checklist SWMS Work Packs	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	a) only be undertaken between the hours of 7:00 am and 6:00 pm Monday to Friday; b) only be undertaken between the hours of 8:00 am and 1:00 pm Saturday; and c) not be undertaken on Sundays or Public Holidays		Environmental Coordinators RT&A		
L5.2	High Noise Impact Activities and Works Unless permitted by another condition of this licence, any High Noise Impact Activities and Works that exceed the applicable Noise Management Level (NML) at a Noise Sensitive Receiver must only be undertaken: a) between 8:00 am and 6:00 pm Monday to Friday; b) between 8:00 am and 1:00 pm Saturday; and c) if high noise impact works are to be conducted continuously and the location of the works means that it is likely to impact the same receivers, then the works must be conducted in continuous blocks of no more than 3 hours, with at least a 1-hour respite between each block of continuous high noise impact work; except as expressly permitted by another condition of this licence. Note: For the purposes of this condition 'continuous' includes any period where there is a less than 1-hour respite between ceasing and recommencing of any work that is subject to this condition.	This Sub-Plan includes this requirement (Section 8.2 NVMM20)	Supervisor	Environmental Inspection Checklist SWMS Work Packs	Construction
L5.3	Exemptions to standard construction hours for low noise impact works Works and activities may be carried on outside of standard construction hours specified in condition L5.1 if the works and activities do not cause, when assessed at the boundary of the most affected Noise Sensitive Receiver:	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites Out of Hours Works Protocol (Section 8.6.3)	Environment Manager Construction Managers	OOHW Application	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	a) LAeq(15 minute) noise levels greater than 5dB above the day, evening and night Rating Background Level (RBL) as applicable; b) LAmax noise levels greater than 15dB above the night RBL for night works; c) the preferred continuous or impulsive vibration values greater than those for human exposure to vibration, set out for residences in Table 2.2 in Assessing Vibration: a technical guideline (DEC, 2006); and d) the preferred intermittent vibration values greater than those for human exposure to vibration, set out for residences in Table 2.4 in Assessing Vibration: a technical guideline (DEC, 2006). For the purposes of this condition, the RBLs are those contained in an environmental assessment for the activities 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 Noise Policy for Industry (EPA, 2017) and provided to the EPA prior to carrying out any works or activities under this condition. The notification requirements under condition L5.5 do not apply to this condition.		Environmental Coordinators RT&A		
L5.4	Exemptions to standard construction hours in exceptional circumstances a) The licensee may undertake works and activities outside of standard construction hours specified in condition L5.1 for: i. emergency works required to avoid the loss of life or property, or to prevent material harm to the environment; and	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites Out of Hours Works Protocol (Section 8.6.3)	Environment Manager Construction Managers Environmental Coordinators RT&A	EPA Report	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	ii. the delivery of oversized plant, structures or materials determined by the police or other authorised authorities to require special arrangements to transport along public roads. b) The licensee must, on becoming aware of the need to undertake emergency works under this condition notify the EPA's Environment Line as soon as practicable and submit a report to the EPA by 4:00 pm on the next business day after the emergency works commenced that describes: i. the cause, time and duration of the emergency; ii. action taken by or on behalf of the licensee in relation to the emergency; and iii. details of any measures taken or proposed to be taken by the licensee to prevent or mitigate against a recurrence of the emergency. For the purposes of this condition, 'material harm to the environment' has the same meaning as in section 147 of the POEO Act. Emergency works do not require a notification under condition L5.5.				
L5.5	Works outside of standard construction hours - Notification The licensee must notify potentially affected Noise Sensitive Receivers of works outside of standard construction hours unless notification under this condition is not required as specified in another condition of this licence. a) The notification must: i. be given not less than 5 calendar days and not more than 14 calendar days before those works are to be undertaken, unless otherwise agreed with the affected community and notified to the EPA;	Section 8.7.2 Out of Hours Works Protocol (Section 8.6.3)	Environment Manager Construction Managers Environmental Coordinators	Notifications	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	ii. be undertaken by letterbox drop, email, text message or other targeted and equivalent method; and iii. be detailed on the project website or other relevant website notified to the EPA. b) The notification required by this Condition must: i. clearly outline the reason that the work is required to be undertaken outside the hours specified in condition L5.1; ii. include a diagram that clearly identifies the location of the proposed works in relation to nearby cross streets and local landmarks; iii. include details of the date, timing and relevant time restrictions that apply to the proposed works; iv. clearly outline in plain English, the location, nature, scope and duration of the proposed works; v. detail the expected noise impact of the works on Noise Sensitive Receivers; vi. clearly state how complaints may be made and additional information obtained; vii. include the number of the telephone complaints line required by condition M7.1, an after hours contact phone number specific to the works undertaken outside the hours specified in condition L5.1, and the project website address; and viii. include consideration of culturally and linguistically diverse Noise Sensitive Receivers where required.				
L5.6	The licensee must make all reasonable and feasible efforts to coordinate all works outside of standard construction hours with any neighbouring concurrent construction works that have the potential to impact the same Noise Sensitive Receivers. The licensee must ensure	Section 1.4.3	Environment Manager	Consultation records Meeting minutes	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	Respite Periods are being achieved as much as is reasonably practicable.		Construction Managers Environmental Coordinators		
L5.7	Condition L5.6 does not apply to low impact noise work permitted by condition L5.3 or emergency works permitted by L5.4 of this licence.	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites Out of Hours Works Protocol (Section 8.6.3)	Environment Manager Construction Managers Environmental Coordinators	OOHW Application	Construction
L5.8	Works outside of standard construction hours Under this condition, works and activities may be undertaken outside of standard construction hours specified in condition L5.1 and L5.2, but only if they are required in relation to one or more of the following: a) carrying on those works and activities during standard construction hours will result in a high risk to construction personnel or public safety, based on a risk assessment carried out in accordance with AS/NZS ISO 31000:2018 "Risk Management"; b) the Relevant Road Network Operator has advised the licensee in writing that carrying out the works and activities during standard construction hours will result in a high risk to road network operational performance; c) a relevant utility service operator has advised the licensee in writing that carrying out the works and activities during standard construction hours will result in a high risk to the operation and integrity of the utility network;	Out of Hours Works Protocol (Section 8.6.3)	Environment Manager Construction Managers Environmental Coordinators	OOHW Application	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	d) the TfNSW Transport Management Centre (or other road authority) has refused to issue a road occupancy licence during standard construction hours; or e) Sydney Trains (or other rail authority) requires a rail possession for the activities to be performed outside of standard construction hours.				
L5.9	Works outside of standard construction hours - Regulatory Requirements In undertaking any works and activities outside of standard construction hours under condition L5.8, the licensee must comply with the following: a) Prepare a construction noise and vibration impact assessment in accordance with the Interim Construction Noise Guideline (DEC, 2009) that is to include: i. a description of the proposed works and activities outside of standard construction hours; ii. predictions of LAeq (15 minute) dB noise levels at noise sensitive receivers from these works and activities, where noise levels are predicted to be greater than those permitted under condition L5.3; and iii. a monitoring plan to validate the noise predictions, based on monitoring at the boundary of representative sensitive receivers during noise generating activities that are representative of the works and activities, including during the period/s predicted to have the highest noise level impacts. b) Undertake noise monitoring in accordance with the monitoring plan required by condition L5.9(a)(iii). c) Only undertake activities between the hours of 6:00pm on Mondays, Tuesdays, Wednesdays, Thursdays, Fridays and 7:00am the following day (unless permitted by another condition of this licence).	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites Out of Hours Works Protocol (Section 8.6.3)	Environment Manager Construction Managers Environmental Coordinators	OOHW Application Gatewave	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	d) Activities are not to be undertaken between the hours of 6:00pm on Saturdays, Sundays or Public Holidays and 7:00am the following day (unless permitted by another condition of this licence). e) Ensure that works and activities do not result in noise levels exceeding those specified in condition L5.3 at the same noise sensitive receivers (unless specified in another condition of this licence) on more than: i. 2 consecutive evenings and/or nights at any time; and ii. 3 evenings and/or nights per week; and iii. 10 evenings and/or nights per month. f) Undertake any high noise impact works before 12:00 am (midnight) where reasonable and feasible. g) Where high noise impact activities are undertaken, the respite provisions as per the requirements of condition L5.2(c) do not apply provided that all High Noise Impact Activities and Works are undertaken prior to 12:00 am (midnight). h) Where high noise impact activities are undertaken after 12:00 am (midnight), the licensee is required to submit a written report to the EPA within 2 business days of the activity outlining the justification for continuing high noise impact works after midnight and the reasonable and feasible mitigation measures that were implemented to address these night time impacts. i) Upon request of an authorised officer, the licensee must provide within 5 business day: i. the construction noise and vibration impact assessment required by condition L5.9(a);				

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	ii. noise monitoring results required by condition L5.9(b); iii. written evidence demonstrating the works are necessary and permitted under condition L5.8; and/or iv. any other relevant information or records requested by the EPA. i) the notification requirements under condition L5.5 apply to this condition.				
L5.10	24-Hour works The following works are permitted to be undertaken 24 hours a day, 7 days per week: (a) Tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunnelling); and (b) grout batching at the Orchard Hills ancillary facility; and (c) Delivery of material that is required to be delivered outside of standard construction hours in condition L5.1 to directly support tunnelling activities, except between the hours 10:00pm and 7:00am to/from the Orchard Hills ancillary facility. (d) Haulage of spoil generated through tunnelling except between the hours of 10:00pm and 7:00am to/from the Orchard Hills ancillary facility; and (e) work within an acoustic shed where there is no exceedance of noise levels under Low impact circumstances identified in condition L5.3, (f) tunnel and underground station box fit-out works Notes: 1. Tunnelling does not include station box excavation	Hours identified in this Sub-Plan (Section 2.5) and in DNVIS for worksites	Environment Manager Construction Managers Environmental Coordinators	Environmental Inspection Checklist SWMS Work Packs	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
	2. Tunnelling ancillary support activities includes logistics support and material handling and delivery.				
O2.1	All plant and equipment installed at the premises or used in connection with the licensed activity: a) must be maintained in a proper and efficient condition; and b) must be operated in a proper and efficient manner.	This Sub-Plan includes this requirement (Section 8.2 NVMM20)	Supervisor Sub-contractors	Plant and equipment inspections Noise monitoring records	Construction
M4.1	All noise and vibration monitoring for the purposes of determining compliance with the conditions of this licence must be undertaken by a Competent Person as defined in the special dictionary of this licence.	Annexure A (Noise and Vibration Monitoring Procedure)	EnvironmentManager Environmental Coordinators	CV	Construction
M4.2	All noise monitoring for the purposes of determining compliance with the conditions of this licence must consider and be generally undertaken in accordance with: (a) Australian Standard AS 1055: 2018 Acoustics - Description and measurement of environmental noise; and (b) the compliance monitoring guidance provided in the chapter 7 'Monitoring Performance' of the Noise Policy for Industry (EPA, 2017).	Annexure A (Noise and Vibration Monitoring Procedure)	EnvironmentManager Environmental Coordinators	Noise monitoring records	Construction
M4.3	All vibration monitoring must be: a) undertaken in accordance with the technical guidance provided in the Assessing Vibration: a technical guideline (DEC, 2006); and b) assessed and reported against the acceptable and maximum values of human exposure to vibration set out in Tables 2.2 and 2.4 of this guideline.	Annexure A (Noise and Vibration Monitoring Procedure)	Environment Manager Environment Coordinators	Vibration monitoring records	Construction

No.	Requirement	How will CPBG meet the Expectation?	Responsibility	Deliverables	Timing
M4.4	The licensee must undertake noise and vibration monitoring as directed by an authorised officer of the EPA. Where the monitoring is requested to take place on private land (for example a residential property) the licensee must request permission to access the premises in advance and keep a record of permission requests and responses. If a licensee is unable to obtain permission, the licensee must undertake the monitoring at an indicative location where possible and they must provide the response (including any nil response) to the EPA.	Annexure A (Noise and Vibration Monitoring Procedure)	Environment Manager Environmental Coordinators	Vibration monitoring records	Construction
G3.1	Environmental Induction a) The licensee must ensure all personnel and contractors involved in undertaking any activity subject to this licence that has the potential to impact Noise Sensitive Receivers have received environmental induction training relevant to their role prior to undertaking that activity; and b) The induction training must: i. clearly identify the location of all noise sensitive receivers likely to be affected by noise or vibration generated during the course of the work undertaken by those personnel; and ii. highlight the licence requirements to minimise noise and vibration impacts on Noise Sensitive Receivers.	Section 9.1	EnvironmentManager Environmental Coordinators	Induction Toolboxes	Construction

Part C: Annexures

Annexure A Noise and Vibration Monitoring Program

SYDNEY METRO - WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

Noise and Vibration Monitoring Program

Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works

Project number	WSA-200-SBT
Document number	
Revision date	15 August 2023
Revision	2

Document approval

Rev	Date	Prepared by	Reviewed by	Approved by	Remarks
A	17/05/2022	Renzo Tonin	D Corish	M Billings	For stakeholder consultation and review
0	24/08/2022	Renzo Tonin	S Mitchell	E Kline	Revised to address Sydney Metro, ER and stakeholder comments
2	15/08/2023	K. Branks	J Slattery	J Slattery	Annual review of CEMP and Sub-plans
Signature:					

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1. Introduction

1.1. Project overview

CPB Contractors Ghella Joint Venture (CPBG) is undertaking the design and construction of the Station Boxes and Tunnelling Works (SBT Works) of the Sydney Metro Western Sydney Airport (the Project).

The Project forms part of the broader Sydney Metro network. It involves the construction and operation of a new 23km metro rail line from the existing Sydney Trains suburban T1 Western Line (at St Marys) in the north and the Aerotropolis (at Bringelly) in the south. The alignment includes tunnels and civil structures, including a viaduct, bridges, and surface and open-cut troughs between the two tunnel sections (Figure 1).

The Project will be delivered through several works packages including the Station Boxes and Tunnelling Works (SBT Works), which includes the design and construction of:

- Two sections of twin tunnels with a combined length of approximately 9.8km, plus associated portal structures, one from Orchard Hills to St Marys and the other under Western Sydney International (WSI) airport to the new Aerotropolis Station
- Excavations at either end to enable trains to turn back, and stub tunnels to enable future extensions
- Station box excavations with temporary ground support for four stations at St Marys, Orchard Hills, Airport Terminal and Aerotropolis
- Excavations for two intermediate services facilities, one in each of the tunnel sections at Claremont and Bringelly.

1.2. Project staging

As detailed in the Staging Report, the Project will be delivered through the following stages:

- Advanced and Enabling Works – Site investigations, modification of the existing transport network, power and water supply for construction sites, utility and stormwater diversions and some demolition works.
- SBT Works – delivered through the following sub-stages:
  - Preparatory Works – Including NSW (off-airport) demolition works, site levelling/grading, site access and parking, utility and temporary services works, erection of demountable buildings and noise barriers, tunnelling preparatory works and use of ancillary facilities including onsite parking.
  - Bulk Excavation and Tunnelling Works (the subject of this Program) – Preparatory Works (works not completed prior to approval of this CEMP), bulk excavation, acoustic shed installation (where required), tunnelling and cross passage installation.
- Surface and Civil Alignment Works – Construction of bridges and viaducts to cross floodplains, watercourses and existing and proposed permanent infrastructure. Delivered through two sub-stages including preparatory works and main excavation and viaduct works.
- Stations, Systems, Trains, Operations and Maintenance – Station design and fit-out, testing and commissioning, and operation of the Western Sydney Airport metro service.
- Finalisation Auxiliary Works.

1.3. Scope

The scope of this Construction Noise and Vibration Monitoring Program (Program) is to define how the CPBG intends to monitor potential noise and vibration impacts during the Bulk Excavation and Tunnelling Works. Operational monitoring measures do not fall within the scope of the construction phase and therefore are not included in this Program.

This Program will apply for the duration of the Bulk Excavation and Tunnelling Works, unless a longer period is specified by the Secretary of the Department of Planning and Environment (DPE).

Annexure A contains a glossary of acoustic terms used in this Program.

Figure 1: Overview of SBT Works

2. Purpose and objectives

2.1. Purpose

The purpose of the Program is to describe how CPBG will monitor noise and vibration during the Bulk Excavation and Tunnelling Works.

This Program will be implemented to monitor the effectiveness of mitigation measures applied during construction and identify potential noise and vibration impacts. Monitoring will also be undertaken for modelling verification at sensitive receivers, to assess compliance in response to complaints and for equipment spot checks.

2.2. Objective

The key objective of this Program is to ensure all relevant conditions and requirements relating to noise and vibration monitoring are described, scheduled, and assigned responsibility as outlined in:

- State Significant Infrastructure (SSI) 10051 Planning Approval (dated 23 July 2021)
- Sydney Metro Western Sydney Airport – CSSI Staging Report (Staging Report)
- AS/NZS ISO 14001:2016 Environmental Management Systems – Requirements with guidance for use
- Sydney Metro Construction Environmental Management Framework (CEMF)
- Sydney Metro Construction Noise and Vibration Standard (CNVS)
- Environmental Impact Statement (EIS) and the Submissions Report, including the Revised Environmental Mitigation Measures (REMMs)
- Contractual requirements, including the SBT Design and Construction Deed and General and Particular Specifications
- Applicable legislation (NSW and Commonwealth).

2.3. Consultation

Reflecting the requirements of Conditions A6 and C13(a), this Program has been prepared in consultation with Penrith City Council and City of Liverpool Council.

While Condition C13(a) also includes consultation with WaterNSW, it is noted that this requirement is in relation to relevant assets. The Warragamba to Prospect Water Supply Pipeline is not located in the vicinity of the SBT Works and therefore consultation with WaterNSW is not triggered.

A detailed consultation report, including matters raised by stakeholders and CPBG responses is provided in Annexure F of the Construction Noise and Vibration Management Sub-Plan (CNVMP).

This Program, as approved by the Planning Secretary, including any minor amendments approved by the ER, will be implemented for the duration of Bulk Excavation and Tunnelling Works.

2.4. Compliance

The Conditions of Approval and REMMs of relevance to this Program are detailed in Table 1.

Table 1: Conditions of Approval of relevance to this Program.

<table>
<tr><th>Ref</th><th colspan="3">Detail</th><th>How addressed</th></tr>
<tr><td colspan="5">Conditions of Approval</td></tr>
<tr><td>C13(a)</td><td colspan="3">The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies (as required by Condition A6) identified for each to compare actual performance of construction of the CSSI against the performance predicted in the documents listed in Condition A1 or in the CEMP. Where a government agency(ies) request(s) is not included, the Proponent must provide the Planning Secretary / ER (whichever is applicable) justification as to why.</td><td>Section 2.3</td></tr>
<tr><td></td><td>No</td><td>Required Construction Monitoring Programs</td><td>Relevant government agencies to be consulted for each Construction Monitoring Program</td><td></td></tr>
<tr><td></td><td>(a)</td><td>Noise and vibration</td><td>Relevant Councils and WaterNSW (in relation to its assets)</td><td></td></tr>
<tr><td>C14</td><td colspan="3">Each Construction Monitoring Program must provide:</td><td></td></tr>
<tr><td></td><td colspan="3">(a) details of baseline data available including the period of baseline monitoring;</td><td>Section 3.2</td></tr>
<tr><td></td><td colspan="3">(b) details of baseline data to be obtained and when;</td><td>Section 3.2</td></tr>
<tr><td></td><td colspan="3">(c) details of all monitoring of the project to be undertaken;</td><td>Sections 3.4 and 3.5</td></tr>
<tr><td></td><td colspan="3">(d) the parameters of the project to be monitored;</td><td>Sections 3.4 and 3.5</td></tr>
<tr><td></td><td colspan="3">(e) the frequency of monitoring to be undertaken;</td><td>Sections 3.4 and 3.5</td></tr>
<tr><td></td><td colspan="3">(f) the location of monitoring;</td><td>Sections 3.4 and 3.5</td></tr>
<tr><td></td><td colspan="3">(g) the reporting of monitoring results and analysis results against relevant criteria;</td><td>Section 4.5</td></tr>
<tr><td></td><td colspan="3">(h) details of the methods that will be used to analyse the monitoring data;</td><td>Section 4.3</td></tr>
<tr><td></td><td colspan="3">(i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts;</td><td>Section 4.3</td></tr>
<tr><td></td><td colspan="3">(j) consideration of SMART principles;</td><td>Sections 3.4 and 3.5</td></tr>
<tr><td></td><td colspan="3">(k) any consultation to be undertaken in relation to the monitoring programs; and</td><td>Section 2.3</td></tr>
</table>

Ref	Detail	How addressed
	(l) any specific requirements as required by Conditions C15 to C16.	Refer to Condition C15 and C16
C15	The Noise and Vibration Construction Monitoring Program must include: (a) noise and vibration monitoring at representative residential and other locations (including at the worst- affected residences), subject to property owner approval, to confirm construction noise and vibration levels; (b) monitoring undertaken during the day, evening and night-time periods throughout the construction period and cover the range of activities being undertaken; (c) method and frequency for reporting monitoring results; and (d) a process to undertake real time noise and vibration monitoring. The results of the monitoring must be readily available to the construction team, the Proponent and ER. The Planning Secretary and EPA must be provided with access to the results on request.	Sections 3.4 and 3.5
C17	With the exception of any Construction Monitoring Programs expressly nominated by the Planning Secretary to be endorsed by the ER, all Construction Monitoring Programs must be submitted to the Planning Secretary for approval.	Section 2.3
C18	The Construction Monitoring Programs not requiring the Planning Secretary's approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all undertakings made in the documents listed in Condition A1. Any of these Construction Monitoring Programs must be submitted to the ER for endorsement at least one (1) month before the commencement of construction or where construction is staged no later than one (1) month before the commencement of that stage.	Section 2.3
C19	Any of the Construction Monitoring Programs which require Planning Secretary approval must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month before the commencement of construction or where construction is staged no later than one (1) month before the commencement of that stage.	Section 2.3
C20	Unless otherwise agreed with the Planning Secretary, construction must not commence until the Planning Secretary has approved, or the ER has endorsed (whichever is applicable), all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section 2.3
C21	The Construction Monitoring Programs, as approved by the Planning Secretary or the ER has endorsed (whichever is applicable), including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary or the ER (whichever is applicable), whichever is the greater.	Section 2.3
C22	The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, ER and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.	Section 4.5

Ref	Detail	How addressed
E54	Vibration testing must be conducted during vibration generating activities that have the potential to impact on Heritage items to verify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and attended monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures. Such measures must include, but not be limited to, review or modification of excavation techniques.	Section 3.5.2.2 Section 4.3
E55	The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring at Heritage items.	Section 3.5.2.2
E87	Appropriate equipment to monitor areas in proximity of ancillary facilities and the tunnel route must be installed during construction with particular reference to at risk buildings, structures and utilities identified in the condition surveys required by Condition E84 and / or geotechnical analysis as required. If monitoring during construction indicates exceedance of the vibration criteria identified in the DNVIS prepared under Condition E47, or levels otherwise determined as appropriate by a suitably qualified structural engineer, then all construction affecting settlement must cease immediately and must not resume until fully rectified or a revised method of construction is established that will ensure protection of affected buildings.	Section 3.5.2.2 Section 4.3
REMMs		
NAH6	The following heritage items would be monitored for potential vibration impacts during construction: a) St Marys Railway Station Group b) Queen Street Post-War Commercial Building c) St Marys Munitions Workers Housing d) McGarvie Smith Farm e) McMaster Farm.	Section 3.5.2.2

3. Noise and vibration monitoring

3.1. Relevant standards and guidelines

The main guidelines, specifications and policy documents relevant to this noise and vibration monitoring Program include:

- NSW Interim Construction Noise Guideline, Department of Environment and Climate Change 2009
- NSW Industrial Noise Policy, Environment Protection Authority 2000
- NSW Noise Policy for Industry, Environment Protection Authority 2017
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Sydney Metro Construction Noise and Vibration Standard Version 4.3 (SM-20-00098866) – 4 November 2020
- Australian Standard 1055 Acoustics – Description and Measurement of Environmental Noise
- Australian Standard AS 2187.2 Explosives - Storage and use - Part 2 Use of explosives
- Australian Standard AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites Australian Standard 2659.1 – 1998 Guide to the use of sound measuring equipment – portable sound level meters
- Australian Standard 2659.1 – 1998 Guide to the use of sound measuring equipment – portable sound level meters
- Australian Standard 2775 Mechanical Mounting of Accelerometers
- British Standard BS 6472-2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)
- British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
- German Standard DIN4150-3:2016 Vibration in buildings – Part 3: Effects on structures
- International Standard IEC 61672.1 Electroacoustic – Sound Level Meters – Specifications
- International Standard IEC 60942 'Electroacoustics - Sound calibrators
- ISO 3744 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
- ISO 3746 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane
- ISO 6393 Earth-moving machinery - Determination of sound power level - Stationary test conditions
- ISO 6395 Earth-moving machinery - Determination of sound power level - Dynamic test conditions
- NATA General Accreditation Guidance - General Equipment - Calibration and Checks, General Equipment Table 2018.

3.2. Existing environment (baseline monitoring)

As part of the EIS process, baseline noise monitoring was conducted during February and March 2020. The monitoring locations were representative of receivers that would likely be most affected by the construction and operation of the Project. The EIS noted that key noise sources in the study area include transport infrastructure, including trains using the T1 Western Line and the arterial road network.

For further information regarding baseline noise monitoring refer to Section 5.2 of the CNVMP and Section 3 of the EIS Technical Paper 2 – Noise and Vibration 2. An overview of the noise monitoring locations is provided in Figure 2 and Figure 3.

No additional baseline monitoring is anticipated as part of the SBT Works.

3.3. Sensitive receptors

Reflecting the requirements of Condition E37, a land use survey has been prepared for the areas where SBT Works could impact on sensitive receivers. The land use survey identified the existing land use within and around the SBT Works contains a mix of residential and rural, with some educational, commercial, industrial and open space uses.

To facilitate the assessment of noise impacts from the Project, receivers along the Project alignment have been divided into Noise Catchment Areas (NCAs). NCAs group individual sensitive receivers by common traits such as existing noise environment and location in relation to the Project. An overview of the NCAs of relevance to the SBT Works is provided in Figure 2 and Figure 3.

Additional details on the NCAs and land use survey are provided in Section 5.1 and in Appendix D (respectively) of the CNVMP.

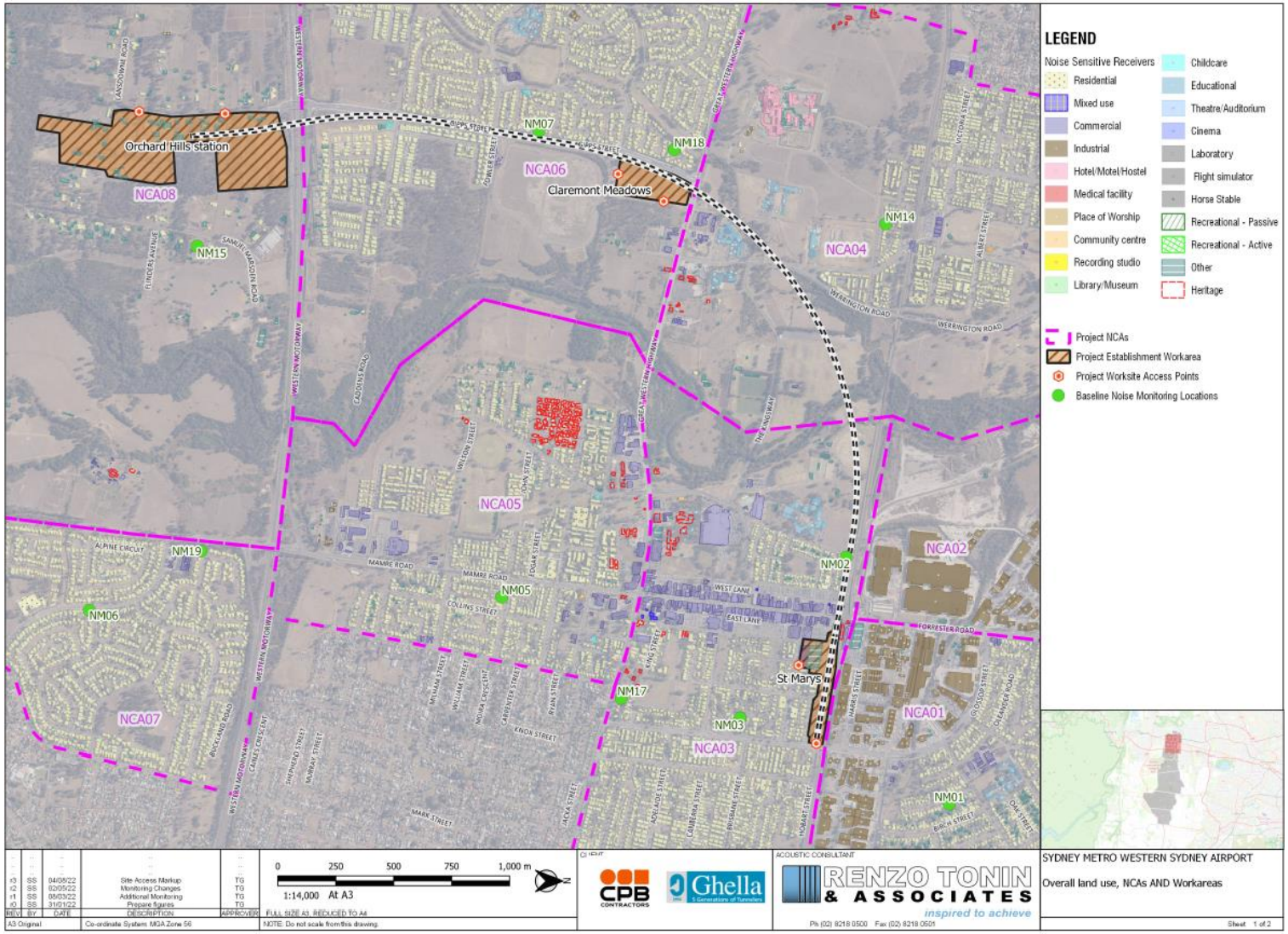


Figure 2: Baseline noise monitoring locations and Noise Catchment Areas for Project (northern sites)

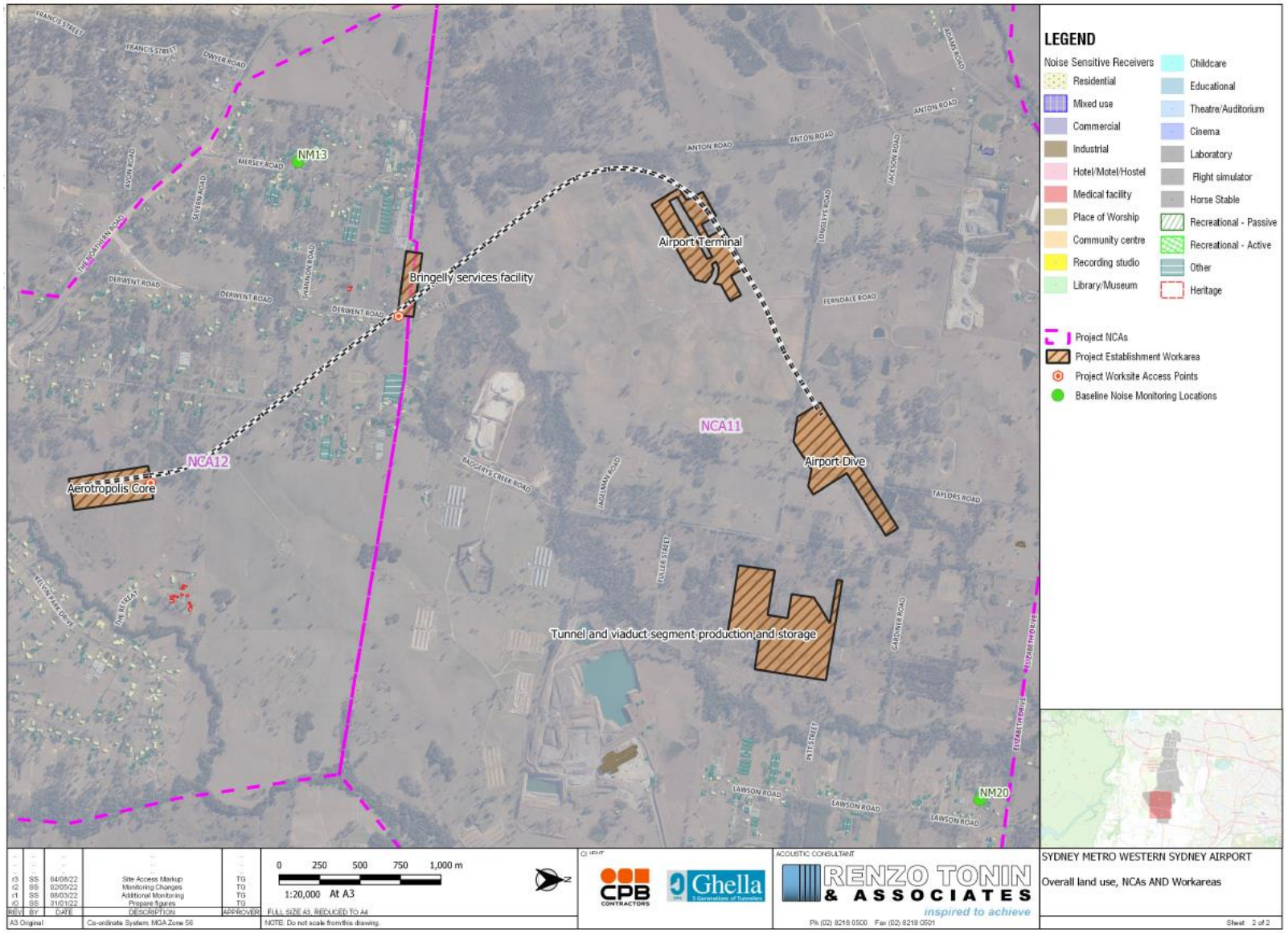


Figure 3: Baseline noise monitoring locations and Noise Catchment Areas for Project (southern sites)

3.4. Noise monitoring

3.4.1. Overview

This Program describes monitoring of noise impacts during the Bulk Excavation and Tunnelling Works, including:

- Monitoring locations
- Plant/equipment noise checks
- Monitoring frequency and method
- Noise goals.

3.4.2. Monitoring locations

3.4.2.1. Fixed station (real time) noise monitoring

To provide real time noise monitoring data to assess and confirm whether noise emissions are within the predicted noise levels identified in the Detailed Noise and Vibration Impact Statements (DNVIS), long-term, unattended noise monitoring will occur at fixed locations at construction worksites.

Indicative locations of all monitoring stations are found in Annexure B and coordinates are featured in Table 2, based on the site layout and receivers at the design phase. Other factors, including the safety and security of the monitor need to be considered in the location of the equipment on site. The monitoring locations will be confirmed, and this report will be updated once the monitoring equipment is physically installed. When changes to the location of the fixed real time monitoring stations need to occur, the ER will be consulted to prior to the change occurring.

Table 2: Indicative coordinates of fixed real-time noise monitoring stations

Fixed station monitoring location ID	Easting	Northing
Fixed Monitor STM	294165	6261900
Fixed Monitor CMF	292020	6261265
Fixed Monitor OHE-N	291735	6259350
Fixed Monitor OHE-S	292020	6258920
Fixed Monitor BSF	289625	6245750
Fixed Monitor AEC	290645	6243970

3.4.2.2. Activities based airborne noise monitoring

Attended noise monitoring locations may vary throughout the life of the Bulk Excavation and Tunnelling Works and will be undertaken where noise levels exceed the noise management levels at a noise sensitive receiver. Locations would be determined on a case-by-case basis in a DNVIS, via the noise and vibration management tool, Gatewave (refer to Section 7.4 of the CNVMP) or in response to complaints..

The identification of monitoring locations in the DNVIS or via Gatewave will consider the following:

- Most affected noise sensitive receiver location in proximity to the assessed activities (if more than one affected receiver has been identified, the nearest affected receiver will be nominated for monitoring)
- Location of previous monitoring sites
- Proximity of the receiver to a Project worksite
- Sensitivity of the receiver to noise

- Background noise levels
- Safety of personnel undertaking the measurements
- Expected duration of the impact.

Monitoring on private property will be subject to property owner approval prior to the commencement of monitoring. Where the nearest affected receiver refuses noise monitoring on their property, monitoring would be undertaken at the near point to that receiver within the site boundary. If it can be demonstrated that direct measurement of noise from the construction site is impractical, alternative means of determining construction noise levels may be adopted in accordance with Chapter 7 of the Noise Policy for Industry.

Noise monitoring should, where practicable, be in positions with unobstructed views of general site activities, whilst shielded as much as possible from non-construction site noise (e.g. road traffic, rail noise and other surrounding noise). In accordance with Australian Standard AS1055, outdoor noise monitoring is to be undertaken at least 3.5m from any reflecting structure other than the ground. The preferred measurement height is 1.2-1.5m above the ground. Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Measurements inside buildings should be at least 1m from the walls or other major reflecting surfaces, 1.2 m to 1.5m above the floor, and about 1.5m from windows.

3.4.2.3. Ground-borne noise monitoring

Ground-borne noise monitoring locations would be determined on a case-by-case basis in a DNVIS, via the Project's noise and vibration management tool Gatewave (refer to Section 7.4 of the CNVMP) or in response to complaints. The monitoring will be undertaken in the most affected habitable room of the sensitive receiver building and will be conducted in conjunction with vibration measurements whenever practicable. The room selected for noise monitoring should be well shielded from airborne noise intrusions, such as road traffic noise to allow the ground-borne noise to dominate over non-construction generated airborne noise.

There may be instances where the resident does not allow access to monitor in the most suitable habitable room. In these instances, CPBG will endeavour to monitor at the next most suitable available room or location, noting this in the monitoring form.

3.4.3. Plant/equipment noise checks

Plant/equipment noise checks are required for noise intensive plant and equipment to ensure compliance with the noise levels for construction equipment assumed in the DNVISs or the levels established in Section 8.4.2 of the CNVMP.

Plant/equipment noise checks will consider the following guidelines:

- Measurements of Sound Pressure Level (SPL) at 7 m (with plant or equipment stationary) shall be undertaken using procedures that are consistent with the requirements of Australian Standard AS2012–1990 Acoustics – Measurement of Airborne Noise Emitted by Earthmoving Machinery and Agricultural Tractors – Stationary Test Condition Part 1: Determination of Compliance with Limits for Exterior Noise.
- Measurements of Sound Power Level (SWL) shall be determined using procedures that are consistent with the requirements of International Standard ISO 9614-2 1996 Acoustics – Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning.
- If measuring the SPL at 7 m of moving plant, compliance measurements would be guided by the requirements of Australian Standard AS2012–1977 Method for Measurement of Airborne Noise from Agricultural Tractors and Earthmoving Machinery.

Plant/equipment noise checks will be carried out as required on a case-by-case basis, such as in response to a plant/equipment specific noise related complaint and during noise and vibration assessment validation monitoring when it is possible to isolate the noise from one piece of plant or equipment.

Plant/equipment noise checks will typically be carried out at a distance of 7 metres from the plant. The measurements should be undertaken at least 3.5m from any reflecting structure other than the ground. The preferred measurement height is 1.2-1.5m above the ground. Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

For measurements unable to undertaken under typical operating conditions, a stationary test at high idle will be considered. Further guidance for noise monitoring of specific plant items can be obtained from ISO 3744, ISO 3746, ISO 6393 and ISO 6395, referenced in Section 3.1.

In the case of an exceedance in SPL the item of plant would either be replaced, or the advice of an acoustic consultant would be sought to provide suitable mitigation measures, which may include:

- ensuring all bolts are tightened and no parts are loose
- cleaning and/or lubricating moving parts
- replacing old or worn parts
- implementing additional or upgrading existing muffling devices
- building enclosures around items of stationary plant (e.g. pumps or generators).

A register of measured SPL for each item of plant would be kept for reference where future noise audits are conducted. The register would be reviewed annually and corresponding revisions made to the SPL presented in Section 8.4.2 of the CNVMP to represent contemporary plant noise emission levels.

3.4.4. Monitoring frequency and method

All environmental noise monitoring equipment used must be at least Type 2 instruments as described in AS IEC 61672.1 ‘Electroacoustic - Sound Level Meters - Specifications’. Noise measurement will be taken with the following meter settings:

- Time Constant: Fast (i.e. 125 milliseconds)
- Frequency Weightings: A-weighting.

The minimum range of noise metrics to be recorded for attended noise monitoring are L_{90}, L_{eq}, and L_{max}.

Meteorological conditions during the noise monitoring period, such as wind velocity, wind direction and rainfall will be recorded from the nearest weather station to the project site, including:

- Badgerys Creek AWS (Station ID 067108)
- Horsley Park Equestrian Centre AWS (Station ID 067119).

Alternatively, local windspeed can be measured on site using a handheld anemometer.

Where the maximum wind speed exceeds 5 m/s and noise measurements are required, caution should be applied as described in the AS 1055. Measurements of noise should be disregarded during rain periods, except as described in the AS 1055. Where monitoring cannot be carried out due to adverse weather, arrangements should be made to complete the monitoring as soon as conditions allow.

Monitoring frequency and methods during construction are outlined in Table 3.

Table 3: Monitoring frequency and method

Type of noise monitoring	Timing/ Frequency	Duration
Fixed station monitoring[1]	Continuous, real time monitoring	15-minute
Activities based airborne noise monitoring	• At the first opportunity within the first month of starting Bulk Excavation and Tunnelling Works as well as throughout the construction period, during the day, evening and night-time periods, to: – ensure the range of activities being undertaken at the site are measured – confirm that actual noise levels are consistent with predicted noise impacts and that the management measures that have been implemented are appropriate • Where a change in methodology, plant or equipment is anticipated to result in a significant increase in construction noise impact than what has been assessed • In response to a noise related complaint(s) (determined on a case-by-case basis) and in accordance with EPL Conditions • As directed by an authorised officer of the EPA • As otherwise required by the DNVIS • As required by the Out of Hours Works (OOHW) Protocol or EPL • Following implementation of mitigation measures or noise attenuation because of exceedance of predicted noise levels (see Section 4.3	15-minute
Plant/ Equipment checks	• At the first opportunity within the first month of starting construction activities as well as throughout the construction period. • Spot checks would be carried out as required on a case-by-case basis, such as in response to a specific noise related complaint and during noise verification monitoring when it is possible to isolate the noise from one piece of plant or equipment.	Static/stationary plant[1]: 1 to 2-minute Dynamic plant[2]: capture a representative activity, such as one truck-and-trailer load cycle
Ground-borne noise monitoring	• At the first opportunity following commencement of works if ground-borne noise impacts identified, • Where appropriate in response to ground-borne noise related complaint(s) (determined on a case-by- case basis) and in accordance with the EPL, and • As otherwise required by a DNVIS, OOHW Protocol or EPL.	15-minute
Notes:	1. Fixed location or constant noise source (e.g. generator, fan) 2. Variable or inconstant noise source (e.g. front-end loader in spoil bin)	

3.4.5. Noise goals

The noise monitoring results will be assessed against the noise management levels (NMLs) outlined in Section 2.2 of the CNVS and Section 6 of the CNVMP.

If exceedance of the NML is identified, a review of site-specific mitigation measures will be undertaken to confirm that all reasonable and feasible mitigation and management measures have been implemented and confirm if there are any opportunities to further reduce noise levels on site.

Where, after all reasonable and feasible mitigation measures have been implemented, measured noise levels above the NMLs will be compared to the predicted noise levels in the relevant DNVIS. If, after all reasonable and feasible mitigation measures have been implemented, an exceedance of the predicted noise levels is identified, a management response will be triggered. The management response is detailed in Section 4.3.

3.5. Vibration monitoring

3.5.1. Overview

This Program describes monitoring of vibration impacts during the Bulk Excavation and Tunnelling Works.

3.5.2. Monitoring locations

3.5.2.1. Fixed station (real time) vibration monitoring

To provide real time vibration monitoring data to assess vibration generated by construction activities, long-term, unattended vibration monitoring will occur at fixed locations, where identified in the relevant DNVIS.

The final timing, duration and location of the real-time vibration monitoring equipment will be subject to the construction program, availability of mains power, safety requirements and consultation with the ER. Indicative locations of all monitoring stations are found in Annexure B and coordinates are featured in Table 4.

Table 4: Indicative coordinates of fixed real-time vibration monitoring stations

Fixed station monitoring location ID	Easting	Northing
Fixed Monitor STM Goods Shed, 63 Station Street, St Marys)	293985	6261950
Fixed Monitor CMF	Not required, no structures within recommended minimum working distance	
Fixed Monitor OHE-N	Not required, no structures within recommended minimum working distance	
Fixed Monitor OHE-S	Not required, no structures within recommended minimum working distance	
Fixed Monitor BSF	Not required, no structures within recommended minimum working distance	
Fixed Monitor AEC	Not required, no structures within recommended minimum working distance	

3.5.2.2. Building damage vibration monitoring

Attended or unattended vibration monitoring will be undertaken as outlined in Figure 4 and Appendix C of the CNVMP. Monitoring locations may vary throughout the Bulk Excavation and Tunnelling Works and will be determined on a case-by-case basis in a DNVIS or in response to complaints. The focus of monitoring will be at-risk buildings, structures and utilities identified in the pre-construction condition surveys required by Condition E84 and/or geotechnical analysis.

The identification of a suitable vibration monitoring location will consider the following:

- Whether there is a predicted exceedance of the cosmetic damage criteria and / or community concerns have been raised regarding vibration
- Vibration monitoring equipment shall be placed outside at the footings or foundations of the building of interest closest to the vibrating plant
- The surface should be solid and rigid to best represent the vibration entering the structure of the building under investigation
- The vibration sensor or transducer shall not be mounted on loose tiles, loose gravel or other resilient surfaces
- The vibration sensor or transducer shall be directly mounted to the vibrating surface using either adhesive, double sided tape or a magnetic mounting plate onto a steel washer, plate or bracket which shall be either fastened or glued to the surface of interest
- Where a suitable mounting surface is unavailable, then a metal ground spike shall be driven into solid ground adjacent to the building of interest, and the vibration sensor or transducer shall be mounted on that.

Where vibration generating activities have the potential to impact on Heritage items, vibration monitoring will be undertaken to verify minimum working distances to prevent cosmetic damage. Specific heritage items to be monitored include the St Marys Railway Station Group, the Queen Street Post-War Commercial Building and the St Marys Munitions Workers Housing. CPBG will seek the advice of a heritage specialist as early as practicable on methods and locations for installing equipment used for vibration, movement and noise monitoring at Heritage items

Vibration monitoring results will be assessed and reported against the British Standard 7385 and German Standard DIN 4150, as presented in the CNVS.

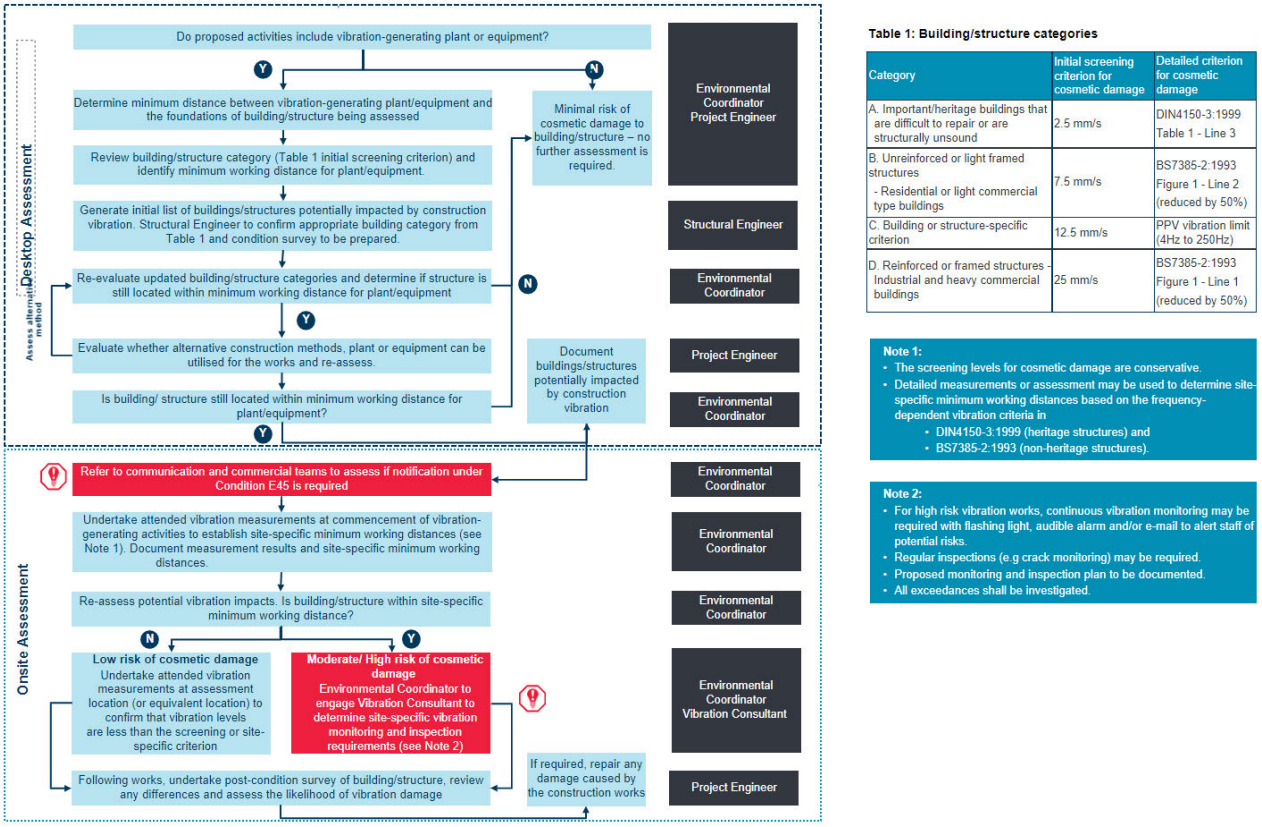


Table 1: Building/structure categories

Category	Initial screening criterion for cosmetic damage	Detailed criterion for cosmetic damage
A. Important/heritage buildings that are difficult to repair or are structurally unsound	2.5 mm/s	DIN4150-3:1999 Table 1 - Line 3
B. Unreinforced or light framed structures - Residential or light commercial type buildings	7.5 mm/s	BS7385-2:1993 Figure 1 - Line 2 (reduced by 50%)
C. Building or structure-specific criterion	12.5 mm/s	PPV vibration limit (4Hz to 250Hz)
D. Reinforced or framed structures - Industrial and heavy commercial buildings	25 mm/s	BS7385-2:1993 Figure 1 - Line 1 (reduced by 50%)

Note 1:
- The screening levels for cosmetic damage are conservative.
- Detailed measurements or assessment may be used to determine site-specific minimum working distances based on the frequency-dependent vibration criteria in
  - DIN4150-3:1999 (heritage structures) and
  - BS7385-2:1993 (non-heritage structures).

Note 2:
- For high risk vibration works, continuous vibration monitoring may be required with flashing light, audible alarm and/or e-mail to alert staff of potential risks.
- Regular inspections (e.g crack monitoring) may be required.
- Proposed monitoring and inspection plan to be documented.
- All exceedances shall be investigated.

Figure 4: Project vibration monitoring (cosmetic damage to structures) flow chart (refer to Appendix B of the CNVMP)

3.5.2.3. Plant/ equipment vibration monitoring

Attended vibration monitoring to confirm the site-specific minimum working distances for vibration intensive plant/ equipment will be determined on a case-by-case basis in the DNVIS, via the noise and vibration management tool, Gatewave (CNVMP Section 7.4). Items to consider in the identification of a suitable vibration monitoring location are noted above.

3.5.2.4. Human exposure vibration monitoring

Attended vibration monitoring to confirm human exposure to vibration will be determined on a case-by-case basis in a DNVIS, via the noise and vibration management tool, Gatewave (CNVMP Section 7.4) or in response to complaints. Reflecting the process detailed in Figure 5, the monitoring will be undertaken in the most affected habitable room of the sensitive receiver building and will be conducted in conjunction with ground-borne noise measurements where applicable. The room selected for vibration monitoring should be well shielded from extraneous vibration intrusions, such as heavy vehicle road traffic, condenser units or pumps.

There may be instances where the resident does not allow access to monitor in the most suitable habitable room. In these instances, CPBG will endeavour to monitor at the next most suitable available room or location, noting this in the monitoring form.

Vibration monitoring results will be assessed and reported against the values set out in Tables 2.2 and 2.4 of the EPA's Assessing Vibration – a technical guideline, as presented in the DNVIS (Section 4.2).

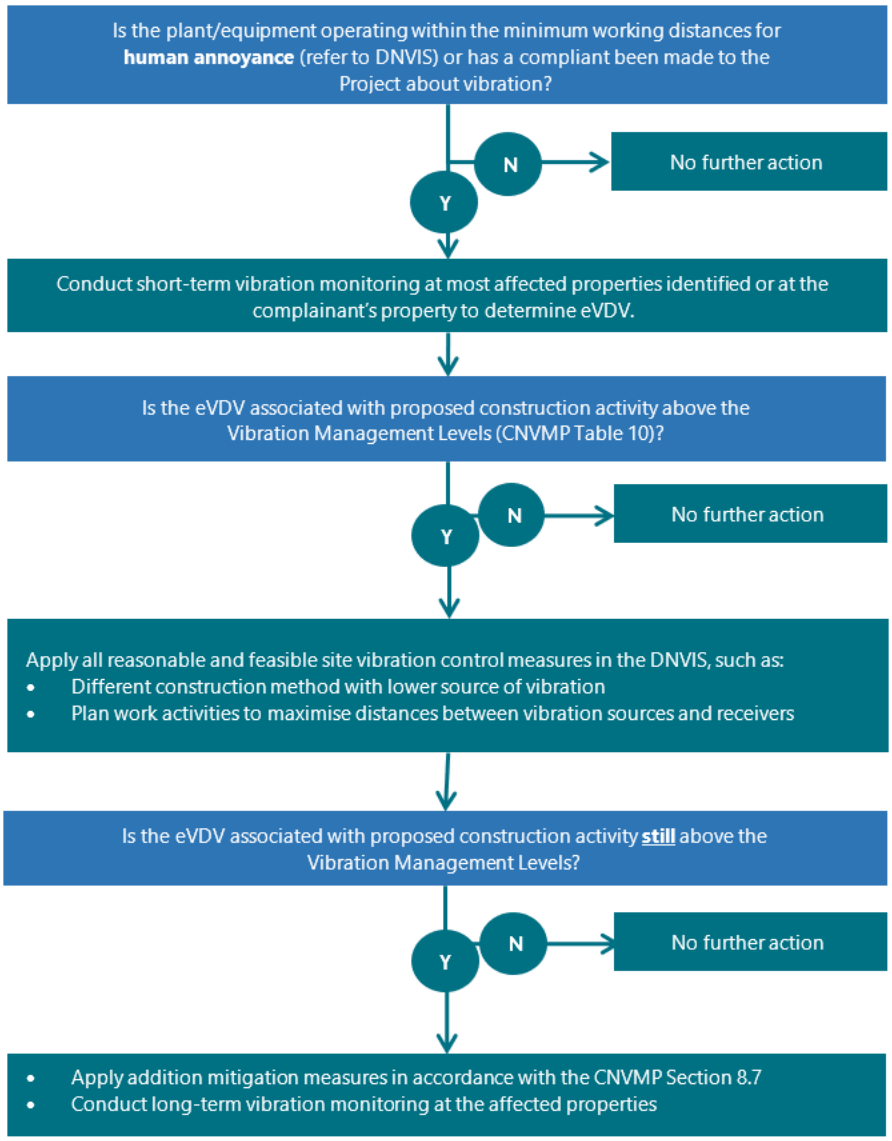


Figure 5: Project vibration monitoring (human exposure) flow chart

3.5.3. Monitoring frequency and method

The minimum range of vibration metrics to be recorded is the following:

- Root-Mean-Square acceleration (RMS)
- Peak Particle Velocity (PPV) or
- Vibration Dose Values (VDVs) (for human exposure to vibration).

Monitoring frequency and methods during construction are outlined in Table 5.

Table 5: Monitoring frequency and method

Type of noise monitoring	Timing/ Frequency	Duration
Unattended monitoring	Continuous, real-time monitoring	15-minute
Building damage vibration monitoring	At the commencement of vibration generating activities that have the potential to impact at risk buildings, structures and utilities identified in the pre-construction condition surveys, including heritage items.	Representative sample of vibration being generated
Plant/ Equipment checks	At the commencement of vibration intensive activities on site that have been identified in a DNVIS or in the noise and vibration management tool (Gatewave), as likely to exceed the vibration screening criteria	Representative sample of vibration being generated
Human exposure vibration monitoring	At the first opportunity following commencement of works, concurrent with ground-borne noise monitoring where applicable. Where appropriate in response to vibration related complaint(s) (determined on a case-by- case basis) and in accordance with the EPL. As otherwise required by a DNVIS, OOHW Procedure or EPL.	15-minute or Representative sample of vibration being generated (as required)

3.5.4. Vibration management

The vibration monitoring results will be compared to the vibration goals outlines in Section 6.5 of the CNVMP and the DNVIS. If an exceedance is identified, a management response will be triggered as detailed in Section 4.3.

3.6. Calibration, quality assurance and documentation

Attended noise monitoring equipment will be at least Type 2 instruments and calibrated in accordance with manufacturer specifications or relevant Australian Standards. Records of equipment laboratory calibration will be maintained by CPBG throughout the delivery of the Bulk Excavation and Tunnelling Works. The calibration of the monitoring equipment will be checked in the field before and after the noise measurement period.

All vibration instruments will be calibrated in accordance with manufacturers specifications or relevant Australian Standards. Records of monitoring equipment calibration will be maintained by CPBG.

Monitoring records will record:

- Date and time of measurements
- Name of person(s) undertaking the measurements
- Qualifications and/or competency/suitability of the person carrying out the monitoring
- Weather conditions during measurements
- Type and model number of monitoring equipment
- Calibration dates of monitoring equipment
- Time of day, length of measurement and measurement time intervals
- Monitoring location details including:
  - a sketched map showing the monitoring location, the location of noise/vibration generating items (construction activities and other environmental noise sources), the location and type of mitigation measures, the location of other acoustically relevant items (e.g. walls/barriers)
  - photographs clearly identifying the monitoring location
- Number of measurements at each location
- Construction activities under investigation, including load conditions of plant
- Possible extraneous noise (e.g. road traffic, aircraft, insects) or vibration influences from other sources (e.g. domestic vibrations, other mechanical plant, traffic etc.)
- For noise, the following additional items should be recorded:
  - results of field calibration checks;
  - microphone height;
  - presence (or otherwise) of reflecting surfaces (such as walls), the distance from them in
  - addition to any corrections made for the presence of reflecting surfaces;
  - Measured noise levels including the minimum descriptors required in Section 3.4.4;
  - Estimated noise level from construction activities only;
  - Presence of identified annoying characteristics and if a correction has been made to the
  - measured noise levels;
  - Estimated noise levels from environmental noise sources other than construction; and
  - Mitigation measures in place at the time of the measurement and observations on their potential effectiveness.

4. Compliance management

4.1. Roles, responsibility and training

The CPBG Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4 of the CEMP. Specific responsibilities for the implementation of environmental controls for construction noise and vibration are detailed in the DNVIS.

All noise and vibration monitoring will be carried out by an appropriately trained and competent person in the measurement and assessment of construction noise and vibration, who is familiar with the requirements of the relevant standards and procedures, detailed in the CNVMP. Training will be undertaken by the Project Noise and Vibration consultant.

All employees, contractors and utility staff working on site will undergo site induction. Further details regarding staff induction and training are outlined in Section 7.8 of the CEMP.

4.2. Monitoring and inspection

This Program details the monitoring requirements for noise and vibration. In accordance with Section 4.2 of the CEMP, the Environment Manager will be responsible for ensuring monitoring activities are undertaken with this monitoring program. Additional requirements and responsibilities in relation to inspections are documented in Section 9.2 of the CNVMP and Section 7.4 of the CEMP.

Real-time noise and vibration monitoring data will be readily available to the construction team, Sydney Metro and ER. The DPE and EPA will be provided with access to the real-time monitoring data, on request.

4.3. Data analysis and management response

Results obtained from monitoring activities will be compared against the noise and vibration goals listed in the CNVMP and the DNVIS. If an exceedance is observed, a review will be initiated to determine possible causes. The review will include the following actions:

- Cease the noise and/or vibration generating source which causes the exceeded predictions
- Confirm the monitored levels are not being impacted by other (non-SBT related) noise or vibration sources
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment
- Identify if the equipment can be swapped out for another piece of equipment or alternative equipment or plant, or if additional mitigation can be included in the site design
- Confirm that the modelling reflects the actual activity being undertaken
- Confirm that the noise and vibration management and mitigation measures (Section 8 of the CNVMP and specific mitigation and management measures identified in the relevant DNVIS) have been implemented
- Implement other feasible and reasonable measures which may include reducing plant size, modifying time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilising alternative construction methodology or a combination of these
- Review work practices to ensure compliance with the management levels set out in this CNVMP
- Ensure that the learnings from the above are fed back into the noise modelling assessment process for fine-tuning
- Continue work where impacts can be reduced
- Communicate lessons learnt to relevant personnel

If the exceedance is determined to be attributable to Project works, the event will be treated as an environmental incident and managed in accordance with the requirements of the CEMP. If monitoring during construction indicates exceedance of the vibration criteria identified in the DNVIS, or levels otherwise determined as appropriate by a suitably qualified structural engineer, then all construction affecting settlement will cease immediately and will not resume until fully rectified or a revised method of construction is established that will ensure protection of affected buildings.

4.4. Compliance and Auditing

Compliance monitoring and auditing (both internal and external) will be undertaken to assess the effectiveness of environmental controls, and verify compliance with this Program, the SSI 10051 Planning Approval, and other relevant approvals, licenses and guidelines. Compliance and auditing requirements are detailed in Section 7.13.1 of the CEMP.

4.5. Reporting

During construction, noise and vibration monitoring data will be collected, tabulated and assessed against the criterion identified in the DNVIS. A Noise and Vibration Monitoring Report will be submitted to the ER, Sydney Metro and DPE within 60 days of the end of the reporting period (unless otherwise agreed with DPE) and will be made publicly available.

Reporting requirements associated with the Program are presented in Table 6.

Table 6: Construction Noise and Vibration Reporting Requirements

Report	Frequency	Content	When	Reporting Authority
Noise and Vibration Monitoring Report	Every 6 months	Data summary tables from monitoring undertaken in reporting period Exceedances Management responses to any exceedances which may have occurred during reporting period	Within 60 days of end of reporting period	ER, DPE, Sydney Metro

5. Review and improvement

5.1. Continual improvement

Monitoring data will be reviewed throughout the Bulk Excavation and Tunnelling Works to identify opportunities for continual improvement. The continual improvement process will be undertaken in accordance with the CEMP with a view to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

6. References

1. Sydney Metro Construction Noise and Vibration Standard Version 4.3 (SM-20-00098866) – 4 November 2020
2. M2A Joint Venture 2020 Sydney Metro - Western Sydney Airport - Technical Paper 2: Noise and Vibration October 2020
3. M2A Joint Venture 2020 Sydney Metro - Western Sydney Airport – Submissions Report
4. NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
5. NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
6. NSW Industrial Noise Policy (INP), Environment Protection Authority 2000
7. NSW Noise Policy for Industry (NPfI), Environment Protection Authority 2017
8. NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
9. Sydney Airport Master Plan 2039 and Environment Strategy 2019-2039
10. Australian Standard AS/NZS 1055 Acoustics - Description and Measurement of Environmental Noise
11. Australian Standard AS/NZS 2012.1 Acoustics - Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors - Stationary test condition - Determination of compliance with limits for exterior noise
12. Australian Standard AS/NZS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors
13. Australian Standard AS 2187.2 Explosives - Storage and use - Part 2 Use of explosives
14. Australian Standard AS2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites
15. Australian Standard 2775 Mechanical Mounting of Accelerometers
16. Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
17. British Standard BS 6472-2008, ‘Evaluation of human exposure to vibration in buildings (1-80Hz)
18. British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
19. German Standard DIN4150- 2016 Structural vibration Part 3: Effects of vibration on Structures
20. ISO 3746 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane

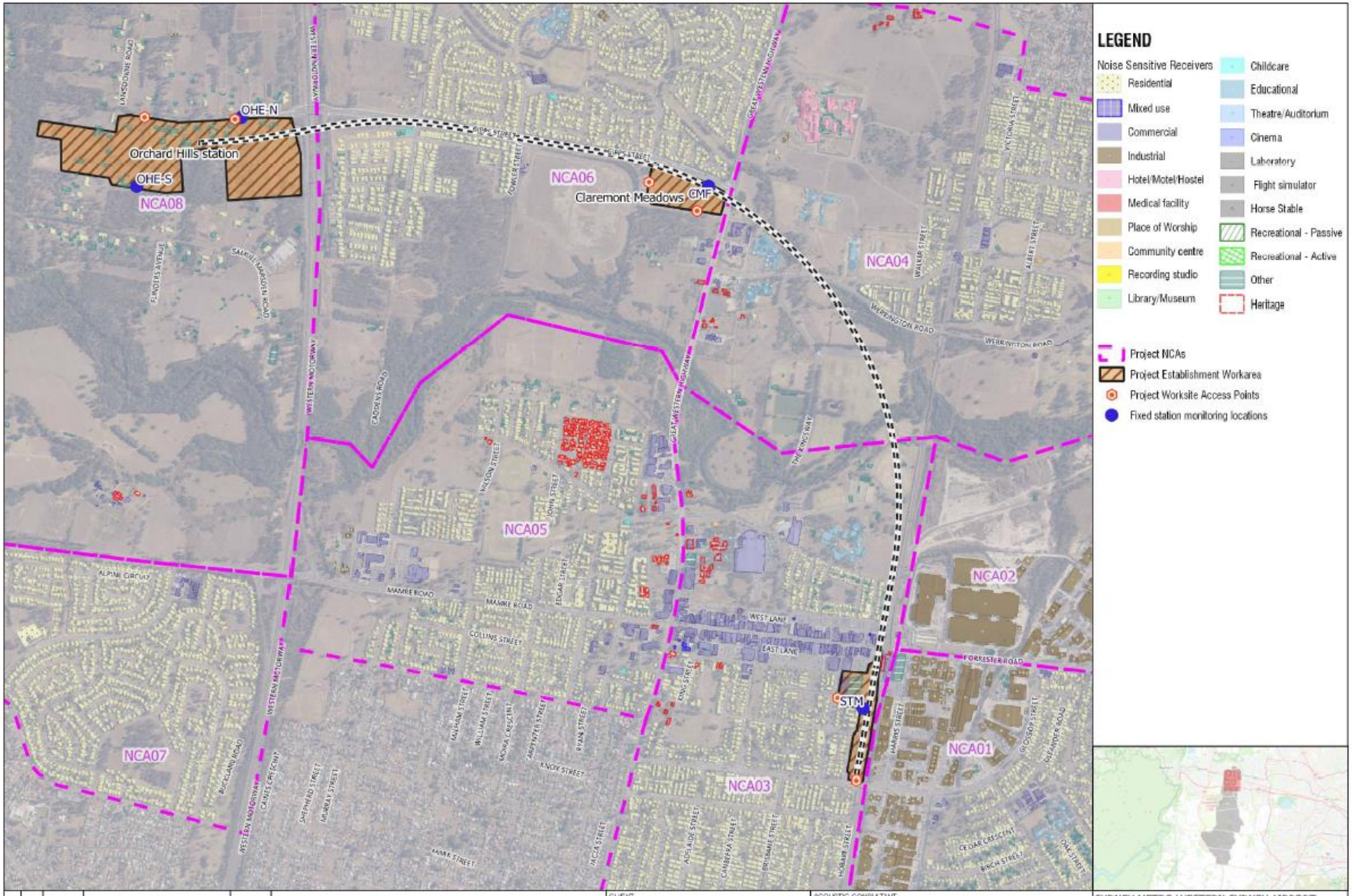
Annexure A Glossary of terminology

Reference	Definition
Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Standard (Sydney Metro 2021)
CoA	Condition of Approval
CSSI	Critical State Significant Infrastructure
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
DPIE	NSW Department of Planning, Industry and Environment
DNVIS	Detailed Noise and Vibration Impact Statement
EIS	Environmental Impact Statement
EMM	Environmental Management Measure
EPA	NSW Environment Protection Authority
ER	Environmental Representative
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into

Reference	Definition
	account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
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.
ICNG	Interim Construction Noise Guideline (DECC, 2009)
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
INP	NSW Industrial Noise Policy (EPA 2000)
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
LA(max)	The A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
Leq(15min)	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
NCA	Noise catchment areas
NML	Noise Management Level
OEH	Office of Environment and Heritage
OOHW	Out-of-hours works
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.

Reference	Definition
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
SSI	State Significant Infrastructure
TfNSW	Transport for NSW
VDV	Vibration Dose Value

Annexure B Fixed monitoring locations (INDICATIVE)



LEGEND

Noise Sensitive Receivers

- Residential
- Mixed use
- Commercial
- Industrial
- Hotel/Motel/Hostel
- Medical facility
- Place of Worship
- Community centre
- Recording studio
- Library/Museum
- Childcare
- Educational
- Theatre/Auditorium
- Cinema
- Laboratory
- Flight simulator
- Horse Stable
- Recreational - Passive
- Recreational - Active
- Other
- Heritage

- Project NCAs
- Project Establishment Workarea
- Project Worksite Access Points
- Fixed station monitoring locations

REV	BY	DATE	DESCRIPTION	APPROVED
r3	SS	04/08/22	Site Access Markup	TG
r2	SS	02/06/22	Monitoring Changes	TG
r1	SS	06/05/22	Additional Monitoring	TG
r0	SS	31/01/22	Prepare figures	TG

A3 Original

Co-ordinate System: MGA Zone 56

0 250 500 750 1,000 m

1:14,000 At A3

FULL SIZE A3. REDUCED TO A4

NOTE: Do not scale from this drawing.

CLIENT

CPB CONTRACTORS

Ghella

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES

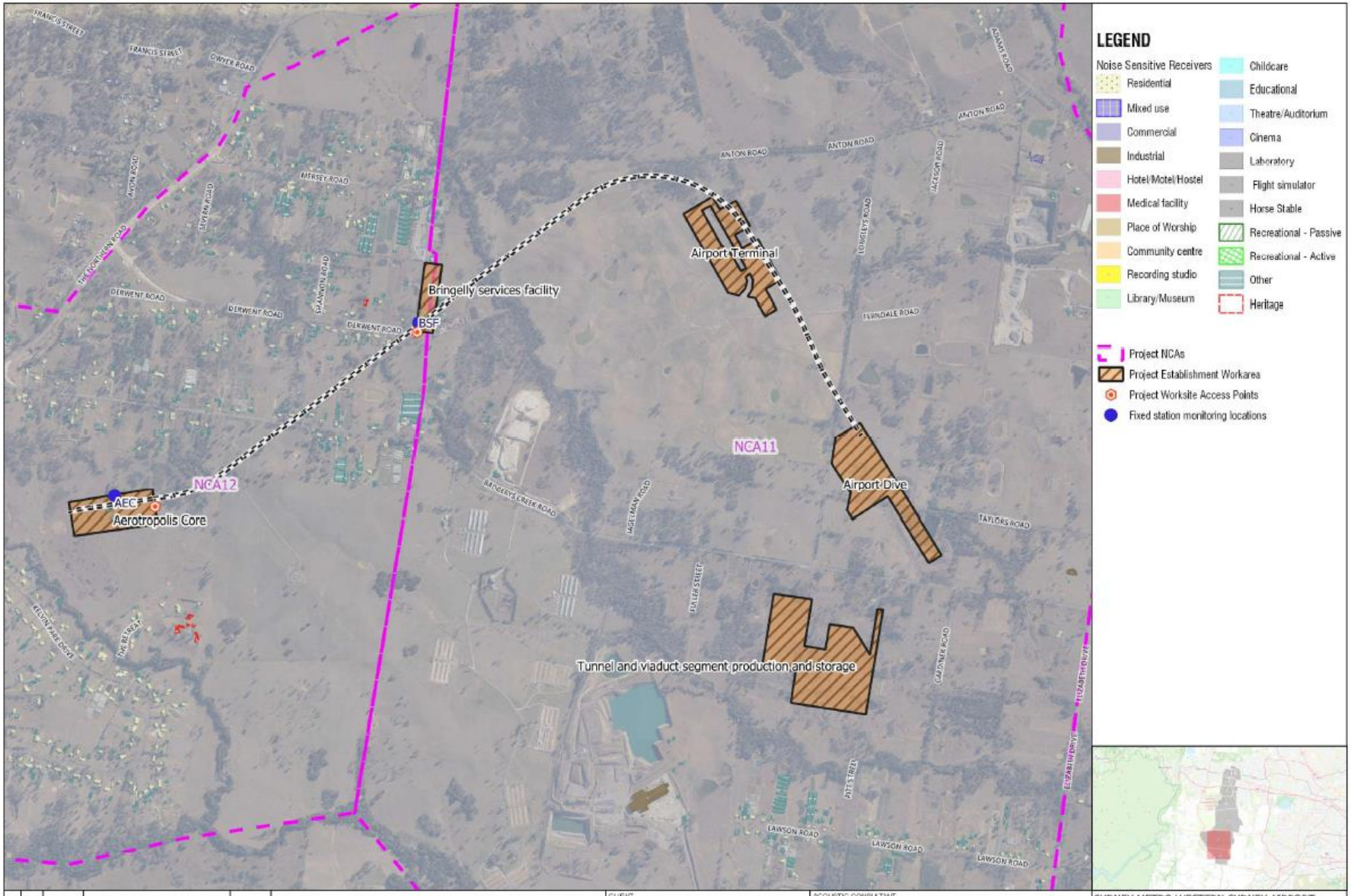
inspired to achieve

Ph (02) 8218 0500 Fax (02) 8218 0501

SYDNEY METRO WESTERN SYDNEY AIRPORT

Overall land use, NCAs AND Workareas

Sheet 1 of 2



LEGEND

Noise Sensitive Receivers
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1:20,000 At A3

FULL SIZE AS REDUCED TO A4

NOTE: Do not scale from this drawing

CLIENT: CPB CONTRACTORS | Ghella

ACOUSTIC CONSULTANT: RENZO TONIN & ASSOCIATES
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SYDNEY METRO WESTERN SYDNEY AIRPORT

Overall land use, NCAs AND Workareas

Sheet 2 of 2

Annexure B Out of Hours Works Management

B.1 Out of Hours Works Management Procedure

OUT OF HOURS WORKS MANAGEMENT PROCEDURE

HOLD POINT
Any work to be undertaken outside of standard construction hours require an approved Out of Hours Work (OOHW) Application Form.

Site Supervisor
Project Engineer

Are the OOHW within the scope of DNVIS?

Environmental Coordinator

Y

Prepare an OOHW Application Form

N

Prepare an OOHW Application Form and a DNVIS for any work that may exceed the NMLs, vibration criteria and/or ground-borne noise levels at any residence.

Environmental Coordinator

Place Manager to review and endorse subject to consultation requirements of Condition E57 being satisfied (Section 7.7.2 of the CEMP)

Place Manager

Are the OOHW subject to an EPL?

Environmental Coordinator

Y

Environment Manager to approve OOWH Application.

Undertake OOHW in accordance with EPL requirements or seek variation to EPL from EPA if required.

N

ER to review OOHW Application and identify risk level for proposed OOHW (as per OOHW Protocol)

Environment Manager ER

Has ER identified high risk work?

Environment Manager ER

N

ER approves OOHW Application

Y

ER endorses OOHW Application

ER

Sydney Metro formally submits application to Planning Secretary for approval.

Sydney Metro

If community notification is required, Place Manager issues community notification within 5 days (and not more than 14 days) prior to commencement of OOHW

Place Manager

Acronyms
DNVIS: Detailed Noise and Vibration Impact Statement
EPA: Environment Protection Authority
EPL: Environment Protection Licence
ER: Environmental Representative
OOHW: Out of Hours Work
Planning Secretary: Delegate appointed by the NSW Department of Planning, Infrastructure and Environment

B.2 Sydney Metro Western Sydney Airport Out-of-hours Work Protocol

Sydney Metro Western Sydney Airport Out-of-hours Work Protocol

SM-21-00306108

Sydney Metro Integrated Management System (IMS)

Applicable to:	Sydney Metro Western Sydney Airport
Document Owner:	Environment Manager
System Owner:	Director Environment, Sustainability & Planning – Sydney Metro - Western Sydney Airport
Status:	Final
Version:	2.0
Date of issue:	8 November 2021
Review date:	

Table of contents

1. Definitions and acronyms

All terminology in this document is taken to mean the generally accepted or dictionary definition. Other terms and jargon specific to this document are defined within the SM-17-00000203 Sydney Metro glossary. Acronyms and terminology specifically used throughout this document are listed below.

	Definitions
CEMF	Construction Environment Management Framework https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272123288
CNVS	Construction and Noise Standard https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272123288
CNVMP	Construction Noise and Vibration Management Plan
CoA	Conditions of Approval
CSSI	Critical State Significant Infrastructure
DNVIS	Detailed Noise and Vibration Impact Statement
DPIE	Department of Planning, Industry and Environment (formerly DPE)
EIS	Environmental Impact Statement
EPA	Environment Protection Authority (of New South Wales)
EPL	Environment Protection Licence
ER	Environmental Representative
ICNG	*Interim Construction Noise Guideline* (DECC, 2009)
MOD	Modification (to a planning approval)
OOH	Out-of-hours (i.e. outside of the standard construction hours stipulated in planning approval conditions)
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
REMM	Revised Environmental Mitigation Measure
SBOEP	Small Business Owners Engagement Plan
Secretary	The Secretary of the New South Wales Department of Planning, Industry and Environment
SM-WSA	Sydney Metro - Western Sydney Airport

2. Introduction

This document outlines the process for preparing, considering, assessing, managing and approving work on the Sydney Metro - Western Sydney Airport project that is undertaken outside of standard construction hours (i.e. Out-of-hours) that are subject to the following Critical State SignificantInfrastructure (CSSI) planning approvals:

- Sydney Metro - Western Sydney Airport (SSI_10051)

2.1. Purpose

This document has been developed to comply with various CSSI Conditions of Approval (CoAs)). Table 1 indicates where these requirements have been addressed.

Table 1: Out-of-hours Work CSSI CoAs

Condition Number	Condition	Where this condition is addressed
E37	A detailed land use survey must be undertaken to confirm sensitive land use(s) (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration and construction ground-borne noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area before the commencement of work which generates construction noise, vibration or ground-borne noise in that area. The results of the survey must be included in the Detailed Noise and Vibration Impact Statements required under Condition E47.	Section 2.3.2.3 Detailed Noise and Vibration Impact Statement Construction Noise and Vibration Standard
E38	Work must only be undertaken during the following hours: (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 1:00pm Saturdays; and (c) at no time on Sundays or public holidays.	Section 3.0 Standard hours
E39	Except as permitted by an EPL or approved in accordance with the Out-of-Hours Works Protocol required by Condition E42, highly noise intensive work that result in an exceedance of the applicable NML at the same receiver must only be undertaken: (a) between the hours of 8:00 am to 6:00 pm Monday to Friday; (b) between the hours of 8:00 am to 1:00 pm Saturday; and (c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour. For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.	Construction Noise and Vibration Standard
E40	This approval does not permit blasting.	Section 4.0 OOH Work
E41	Notwithstanding Conditions E38 and E39 work may be undertaken outside the hours specified in the following circumstances: (a) Safety and Emergencies, including: (i) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or (ii) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or	Section 4.0 OOH Work Construction Noise and Vibration standard

	(b) Low impact, including: (i) construction that causes LAeq(15 minute) noise levels: • no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and • no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and (ii) construction that causes: • continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or • intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006); or (c) By Approval, including: (i) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or (ii) works which are not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E42; or (iii) negotiated agreements with directly affected residents and sensitive land user(s); or (d) By Prescribed Activity, including: (i) tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunneling) are permitted 24 hours a day, seven days a week; or (ii) grout batching at the Orchard Hills construction site is permitted 24 hours per day, seven days per week; or (iii) delivery of material that is required to be delivered outside of standard construction hours in Condition E38 to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Orchard Hills ancillary facility; or (iv) haulage of spoil generated through tunnelling is permitted 24 hours per day, seven days per week except between the hours of 10:00 pm and 7:00 am to / from the Orchard Hills construction site; or (v) works within an acoustic enclosure are permitted 24 hours a day, seven days a week where there is no exceedance of noise evels or intermittent vibration levels under Low impact circumstances identified in Condition E41(b), unless otherwise agreed with the Planning Secretary; or (vi) tunnel and underground station box fit out works are permitted 24 hours per day, seven days per week. On becoming aware of the need for emergency work in accordance with (a)(ii) above, the ER, the Planning Secretary and the EPA must be notified of the reasons for such work. The Proponent must use best endeavours to notify as soon as practicable all noise and/or vibration affected sensitive land user(s) of the likely impact and duration of those work. Notes: 1. Tunnelling does not include station box excavation. 2. Tunnelling ancillary support activities includes logistics support and material handling and delivery	
E42	An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of work (not subject to an EPL) that is outside the hours defined in Conditions E38 and E39. The Protocol must be approved by the Planning Secretary before commencement of the out-of-hours	This document Section 4.0 OOH Work Construction Noise and Vibration Standard

	work. The Protocol must be prepared in consultation with the ER. The Protocol must provide: (a) justification for why out-of-hours work need to occur; (b) identification of low and high-risk activities and an approval process and the section within this protocol ss that considers the risk of activities, proposed mitigation, management, and coordination, including where: (i) the ER reviews all proposed out-of-hours activities and confirms their risk levels; (ii) low risk activities that can be approved by the ER; and (iii) high risk activities that are approved by the Planning Secretary; (c) a process for the consideration of out-of-hours work against the relevant NML and vibration criteria; (d) a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition E56. The measures must take into account the predicted noise levels and the likely frequency and duration of the out-of-hours works that sensitive land user(s) would be exposed to, including the number of noise awakening events; (e) procedures to facilitate the coordination of out-of-hours work including those approved by an EPL or undertaken by a third party, to ensure appropriate respite is provided; and (f) notification arrangements for affected receivers for all approved out-of-hours works and notification to the Planning Secretary of approved low risk out-of-hours works. This condition does not apply if the requirements of Condition E41 are met ***Note:*** *Out-of-hours work is any work that occurs outside the construction hours identified in Condition E38 and E39.*	4.2.2.6 Approval Notification Arrangements
E44	All reasonable and feasible mitigation measures must be applied when the following residential ground-borne noise levels are exceeded: (a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and (b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A). The mitigation measures must be outlined in the **Noise and Vibration CEMP Sub-plan**, including in any **Out-of-Hours Work Protocol**, required by **Condition E42.**	Section 2.3 Governance Section 4.5 Ground-borne noise level exceedance Construction Noise and Vibration Standard
E45	Noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise evels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected nstitutions are made at no cost to the affected institution.	Section 2.3 Governance Construction Noise and Vibration Standard
E47	Detailed Noise and Vibration Impact Statements (DNVIS) must be prepared for any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in Conditions E43 and E44 at any residence outside construction hours identified in Condition E38, or where receivers will be highly noise affected or subject to vibration levels above those otherwise determined as appropriate by a suitably qualified structural engineer under Condition E87. The DNVIS must include specific mitigation measures identified through consultation with affected sensitive and user(s) and the mitigation measures must be implemented for	Section 2.3.2.3 Detailed Noise and Vibration Impact Statements Construction Noise and Vibration Standard

	the duration of the works. A copy of the DNVIS must be provided to the ER before the commencement of the associated works. The Planning Secretary and the EPA may request a copy (ies) of the DNVIS.	
E49	Where sensitive land use(s) are identified in Appendix B as exceeding the highly noise affected criteria during typical case construction, mitigation measures must be implemented with the objective of reducing typical case construction noise below the highly noise affected criteria at each relevant sensitive landuse(s). Activities that would exceed highly noise affected criteria during typical case construction must not commerce until the measures dentified in this condition have been implemented, unless otherwise agreed with the Planning Secretary. Note: Mitigation measures may include path barrier controls such as acoustic sheds and/or noise walls, at-property treatment, or a combination of path and at-property treatment.	Section 2.3 Governance Construction Noise and Vibration Standard
E57	In order to undertake out-of-hours work outside the work hours specified under Condition E38, appropriate respite periods for the out-of-hours work must be identified in consultation with the community at each affected location on a regular basis. This consultation must include (but not be limited to) providing the community with: (a) a progressive schedule for periods no less than three (3) months, of likely out-of-hours work; (b) a description of the potential work, location and duration of the out-of-hours work; (c) the noise characteristics and likely noise levels of the work; and (d) likely mitigation and management measures which aim to achieve the relevant NMLs under **Condition E43** (including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers). The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour work must be provided to the ER, EPA and the Planning Secretary prior to the out-of-hours work commencing. **Note:** Respite periods can be any combination of days or hours where out-of-hours work would not be more than 5 dB(A) above the RBL at any residence.	Section 4.2.2 and 4.3 Communications Construction Noise and Vibration Standard

2.2. Document Requirements

The Out-of-hours Work Protocol needs to meet the following consultation, endorsement and approval requirements in accordance with the Sydney Metro - Western Sydney Airport CoAs

- Be prepared in consultation with the Environmental Representative (ER); and
- Be approved by the Planning Secretary of the NSW Department of Planning, Industry and Environment (the Secretary).

These requirements were complied with as demonstrated in Sections 2.2.1.

2.2.1. ER Endorsements and Approval

This document has been prepared in consultation with and reviewed and endorsed by the ER. Copies of the ER endorsements are provided in Appendix A.

2.2.2. Secretary Approval

In accordance with CSSI 10051 CoA E42, construction will not commence for OOH works that are not subject to an EPL prior to this document's preparation and submission to the Secretary for approval.

2.3. Governance

This document should be used in conjunction with the Construction Environmental Management Framework, https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272116977 Construction Noise and Vibration Strategy and any applicable EPLs. These documents establish minimum requirements for managing noise and vibration impacts on the SM-WSA project.

2.3.1. Construction Environment Management Framework

The CSSI planning approval includes SM-21-00279320 Construction Environment Management Framework https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272116977 in its documentation. The CEMF represents Sydney Metro's minimum requirements for environmental management and specifies a standard framework that each contractor must establish and document in their Construction Environmental Management Plan and sub-plans. These requirements, including those relating to construction noise and vibration management, are specified in Chapter 9.

2.3.2. Construction Noise and Vibration Standard

The Construction Noise and Vibration Standard (CNVS) https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272123288 establishes a framework for managing construction noise and vibration impacts andadopting appropriate mitigation measures (including minimum requirements);

- Is included in the CSSI planning approval documentation;
- Forms part of the contract requirements that contractors must comply with;

- Defines a minimum standard for managing noise and vibration impacts that considers current best practice guidelines and other regulatory requirements; and
- Sets minimum requirements for all OOH work, including the need for and development of Construction Noise and Vibration Management Plans, Construction Noise and Vibration Impact Statements and Detailed Noise and Vibration Impact Statements.

2.3.2.1. Construction Noise and Vibration Management Plans

A Construction Noise and Vibration Management Plan (CNVMP) sets out how noise and vibration impacts will be mitigated and managed. These may also include a Noise & Vibration Monitoring Program, which typically outlines how noise and vibration monitoring will be undertaken, how the results of monitoring will be reported and procedures to identify and implement additional mitigation measures as necessary.

2.3.2.2. Detailed Noise and Vibration Impact Statement

A Detailed Noise and Vibration Impact Statement (DNVIS) is a document developed by Contractors which assesses and documents the anticipated noise and vibration impacts at receivers of proposed construction activities. In accordance with the CSSI planning approvals, a DNVIS is to be prepared for each construction site before construction noise and vibration impacts commence for any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in Conditions E43 and E44 at any residence outside construction hours identified in Condition E38, or where receivers will be highly noise affected or subject to vibration levels above those otherwise determined as appropriate by a suitably qualified structural engineer under Condition E87.

The DNVIS must include specific mitigation measures identified through consultation with affected sensitive receivers. It also clarifies assumptions made in the EIS and allowsthe Contractor to provide more detailed quantitative assessments of the EIS due to their better understanding of the exact equipment list and construction methodology they will be using to complete the scope of works.

2.3.3. Environment Protection Licence

An Environment Protection Licence (EPL) is a regulatory approval issued to strategically control the localised, cumulative and acute impacts of pollution. The NSW Environment Protection Authority (EPA) is responsible for issuing EPLs for ‘scheduled activities’ under the Protection of the Environment Operations (POEO) Act 1997 (NSW).

Some aspects of the SM-WSA construction and operation works will constitute ‘scheduled activities’ under the POEO Act and therefore need to be subject to an EPL. SM-WSA contractors are required to either comply with Sydney Trains’ EPL or obtain and comply with any EPLs as applicable to their scope of works.

The process for approving OOH work outside of those already permitted in accordance with an EPL, is governed by the conditions of the EPL. In order for these types of OOH work to be approved, an application to vary the EPL is to be prepared and submitted to the EPA for approval. The application is to be in accordance with the CNVS and EPL requirements.

OOH work that is subject to an EPL does not require an ‘OOH approval’ prior to the

commencement of the proposed OOH works in accordance with the CSSI planning approval conditions.

2.4. Roles and Responsibilities

2.4.1. Sydney Metro - Western Sydney Airport Director of Sustainability, Environment& Planning

The Sydney Metro - Western Sydney Airport Director of Sustainability, Environment & Planning is accountable for this document. Accountability includes authorising the document, monitoring its effectiveness and performing a formal document review.

Roles reporting to the Director are accountable for ensuring the requirements of this document are implemented within their area of responsibility. The roles that are accountable for specific projects/programs are accountable for ensuring associated contractors comply with the requirements of this document.

2.4.2. Sydney Metro Environment Manager

A Sydney Metro Environment Manager will be allocated to each contract package on the Sydney Metro - Western Sydney Airport project. The Environment Manager is responsible for ensuring that all environmental management requirements associated with their contract package are being complied with.

2.4.3. Place manager

Either a Sydney Metro or contractor Place Manager will be allocated to each site on the Sydney Metro - Western Sydney Airport project. The Place Manager is responsible for ensuring that all project communication requirements with the surrounding community are being complied with.

2.4.4. Independent Environmental Representative

The CSSI planning approval conditions under CoA A32 requires an Environmental Representative (ER) to be appointed to the project prior to work commencing. The ER is to act as an independent point of contact for all environmental and planning approval compliance matters. Refer to A32 for a comprehensive list of the ER's responsibilities under CSSI 10051.

Section 4.2.2 includes descriptions of the ER's responsibilities with respect to reviewing and approving OOH work.

3. Standard Hours

The SM-WSA CSSI planning approval conditions define standard construction hoursas:

- 7:00am to 6:00pm Mondays to Fridays, inclusive;
- 8:00am to 1:00pm Saturdays for works and
- At no time on Sundays or public holidays.

Construction activity on the SM-WSA project must only be undertaken within these standard hours, unless otherwise permitted in accordance with this document or the conditionsof an applicable EPL.

3.1. Covid Health Orders

Due to the Covid-19 pandemic affecting Sydney, the NSW Government has issued a number of Health Orders to assist in the population living through Covid. In order to assist infrastructure projects, the Government has issued the COVID Infrastructure Construction Work Days Order (2020-2020-75). This Order allows an infrastructure Project to work the following hours as Normal Hours:

- 7:00am to 6:00pm, Saturdays, Sundays or public holidays for works inclusive.

These Orders are subject to updates, with the latest update being:

Environmental Planning and Assessment (COVID-19 Development—Infrastructure Construction Work Days No. 2) Order 2020.

Condition 6 of this Order specifies the following for Infrastructure construction work days:

(1) The carrying out of any building work or work, or the demolition of a building or work, on a Saturday, Sunday or public holidays is development specified for this Order.

(2) The conditions specified for the development are that the development must—

(a) be the subject of an approval, and

(b) comply with all conditions of the approval other than any condition that restricts the hours of work or operation on a Saturday, Sunday or public holiday, and

(c) for work or operation on a Saturday, Sunday or public holiday—

(i) comply with the conditions of the approval that restrict the hours of work or operation on any other day as if the conditions applied to work or operation on a Saturday, Sunday or public holiday, and

(ii) not involve the carrying out of rock breaking, rock hammering, sheet piling, pile driving or similar activities during the hours of work or operation that would not be permitted but for this Order, and

(iii) take all feasible and reasonable measures to minimise noise.

These orders are for a finite time and may be updated again. The Project is to work to the conditions of any updates as they are issued.

4. OOH Work

Out-of-hours (OOH) work is defined as any work that is undertaken outside of standard construction hours.

CoA E40 applies to OOH work and is not allowed during normal or OOH.

In accordance with CoA E41 any type of OOH work is permittedto be undertaken on the SM-WSA project provided that it is subject to this document.

A list of work activities that may typically be undertaken OOH is provided below:

(a) Work which could result in a high risk to construction personnel or public safety, based on a risk assessment carried out in accordance with AS/NZS ISO 31000:2009 “Risk Management Principles and Guidelines”; or

(b) where the relevant road authority has advised the Proponent in writing that carrying out the activities could result in a high risk to road network operational performance; or

(c) where the relevant utility service operator has advised the Proponent in writing that carrying out the activities could result in a high risk to the operation and integrity of the utility network; or

(d) where the Transport for NSW Transport Management Centre (or other road authority) has advised the Proponent in writing that a road occupancy licence is required and will not be issued for the activities during the hours specified in Conditions E19 and E20; or

(e) where Sydney Trains (or other rail authority) has advised the Proponent in writing that a Rail Possession is required.

Allworks that are proposed to be undertaken OOH and are subject to this document must be supported by a clear statement justifying the reason(s) why the work is being proposed to be undertaken OOH. Furthermore, this statement must demonstrate how the works are being scheduled in accordance with the following OOH work period prioritisation list:

1. Standard Hours.
2. Daytime OOH.
3. Evening OOH.
4. Night Time OOH.

Further guidance on the provision of justification is provided in the Out-of-hours application form (refer to Section 4.2.2). Normally, program acceleration is normally not a justifiable reason to undertake works OOH, however in these times of Covid, with health restrictions, program acceleration may be acceptable.

4.1. OOH Work Endorsement and Approval

In accordance with CoA E42 and with the exception of OOH work that is subject to an EPL, all OOH work subject to the planning approval requires approval by either the ER, or in the case of ‘high risk’ works approval by the Secretary.

In accordance with CoA E42(b) OOH work that is subject to the planning approval and not subject to an EPL only require approval from the ER, or in the case of ‘high risk’ works approval by the Secretary.

4.2. OOH Work Approval Process

Figure 1 provides the OOH work approval process for the Sydney Metro - Western Sydney Airport project. This includes a requirement to prepare an application that covers the assessment of noise and vibration impacts, mitigation measures (including community notification requirements) and review and approval for all proposed OOH work.

All OOH work applications that are not subject to an EPL will be submitted to the Place Manager, Sydney Metro Environment Manager and ER for review and comment. These reviews will take into consideration a range of aspects,including reviewer experience and expert understanding, local knowledge of the area, current understanding of sensitive receiver requirements and other relevant documents (for example,the applicable SBOEP Plan detailing predicted impacts to affected businesses,key issues and appropriate mitigation measures for implementation). This review process is further explained in Section 4.2.2.

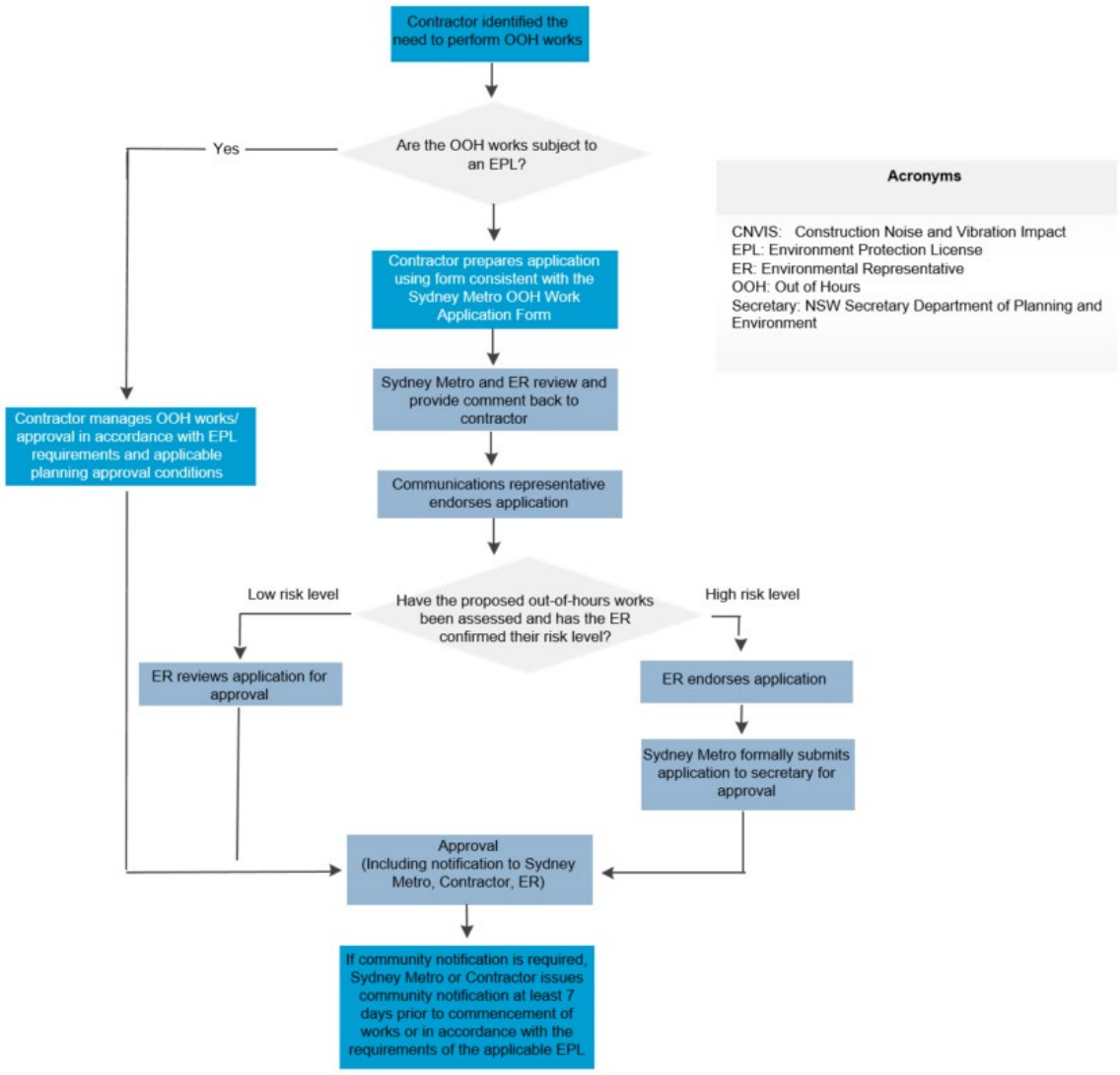


Figure 1: OOH Work Approval Process

4.2.1. OOH Work subject to an EPL

For OOH work that is subject to an EPL, the EPL conditions will dictate the approval process. As a minimum however, for proposed OOH work that is not approved within the EPL and a license variation is required, the contractor is expected to:

- Prepare an application to the EPA in accordance with the CNVS and EPL requirements;
- Submit the revised application to the EPA for approval and submit the application to the Place Manager, Sydney Metro Environment Manager and the ER for information;
- Notify Sydney Metro and ER upon receiving EPA approval; and
- Ensure any required community notifications have been issued (by either Sydney Metro or the contractor directly) within the timeframe(s) specified and in accordance with any relevant conditions of the EPL.

For individual OOH work applications that are subject to an EPL (including Sydney Trains' EPL), endorsement/approval from the ER is not required. However, Sydney Metro may request the ER's endorsement prior to approval and commencement of the proposed OOH works (at Sydney Metro's discretion).

4.2.2. OOH Work not subject to an EPL

For OOH work that is not subject to an EPL, the approval process is dictated by CoA E42.

Contractors are required to prepare an OOH application using a form consistent with Out-of-hours Work application form. This form requires a noise and vibration impact assessment to be undertaken and contains a consolidated and conservative version of Table 14 from the CNVS. This facilitates simpler consideration of applicable additional mitigation measures to implement. The form also requires demonstration of how a range of additional noise and vibration mitigation measures have been considered for implementation,including community notifications and respite offers. The applicant is also required to indicateits risk level for the proposed OOH work within the application.

Where Third Party permits (e.g. Road Occupancy Licences and/or rail possessions) require works to be undertaken OOH, these works will be exempt from classification as 'high risk' (described under section 4.2.2.3) and will be subject to approval by ER as required under CoA E42 in accordance with the 'Low Risk' approval pathway. Evidence of Third Party approval applicable to the works, specifying the time that the works must be undertaken must be included as partof application.

4.2.2.1. Respite

Respite offers for impacted receivers will be considered in accordance with the CNVS. Respite may be offered in the form of a reduction or absence of noise emissions for a period of time, or by removing the affected receiver from the noise emission point source (e.g. dinner/movie tickets and/or alternative accommodation offers).

The CNVS requires respite offers to be considered for all OOH works that are predicted to generate impacts higher than the applicable exceedance criteria for the applicable OOH period. Proposed OOH works must be coordinated to avoid the same receiver being affected over consecutive nights as much as is reasonable. OOH works must be staggered as much as is reasonable in order to maximise the respite period between OOH works.

If consideration of respite offers is required, a decision to implement respite offers will be determined on a case-by-case basis and considering, but not limited to, the following factors:

- The predicted maximum exceedance level;
- The predicted exceedance levels and associated duration and timings of those exceedance levels;
- The overall duration of the predicted exceedance levels;
- Surrounding land uses;
- Community feedback provided by Place Managers; and
- Any other OOH works (Sydney Metro or otherwise) that have affected or will affect the same receivers concurrently or within three days of either the start or end of the proposed OOH works.

In the event that respite is determined to be implemented for works that are subject to the planning approval, respite will be implemented to meet the intent of CoA E39 as applicable and so far is reasonable and practicable.

4.2.2.2. Review

Once the contractor has prepared an OOH work application, the application is submitted to the Place Manager, Sydney Metro Environment Manager, and ER for review. Any of the reviewers may provide comments on the application,which need to be adequately addressed by the contractor in a resubmitted application to the satisfaction of the comment provider(s).

4.2.2.3. Communications Endorsement and Default Risk Level Identification

The first endorsement of an OOH application is from the applicable communications representative (from Sydney Metro). This endorsement represents an agreement from the communications representative that the OOH works have been proposed in accordance with the relevant communications requirements and that the community's interests have been addressed as much as is reasonable (including appropriate consideration and implementation of additional mitigation measures, such as respite). This person may also add any comments and/or conditions that need to be complied with.

Following this person's endorsement, the ER is required to consider the applicant's risk level for the proposed OOH work and determine whether this risk level is appropriate. Once the ER has considered the applicant's risk level, the ER indicates the risk level of the proposed OOH work in its own professional judgement in accordance with CoA E42. This risk level will be categorised as either 'Low risk' or 'High risk'.

As a default risk level, OOH work will be categorised as 'high risk' if all of the following three criteria apply:

- The type and sensitivity of the affected noise sensitive receivers is categorised as either Moderate Impact receivers (e.g. standard residential/typical density) or High Impact receivers (e.g. elderly/high density/persistent complainers/residents experiencing construction noise fatigue); and
- The predicted noise level of the OOH work has a likelihood for potential sleep disturbance (i.e. Rating Background Level + 15 dB or more); and
- The type of and intensity of noise emitted from the OOH work is categorised as High Impact (e.g. prolonged high noise and/or vibration intensive activities), and

These criteria are based on Section 3.1 of the CNVS.

For non-residential receivers, OOH work may be considered as 'high risk' if undertaken during trading hours and in close proximity to their place of business (for example, during Saturday evening trading hours). Since each non-residential receiver has different business needs, it is imperative that the Place Manager and ER discuss each OOH work application to better understand how the proposed OOH work would impact the business.

4.2.2.4. Modification of Default Risk Level

Using the default risk level as a 'starting point', the ER will consider all other relevant factors in order to identify a final risk level. These relevant factors include:

- Those identified in Section 3.1 of the CNVS (noting that the reference to 'impact levels' is different from the 'risk level' with respect to CoA E42(b));
- Those listed in Table 2 of this document;
- Third Party permits; and
- Any other factors the ER considers relevant in their professional opinion.

These factors may cause the default risk level to be modified from either 'high risk' to 'low risk' (or vice-versa), as the ER deems appropriate in their professional opinion.

Once the ER has identified a final risk level for the OOH work application, the ER indicates the risk level on the application (including any risk identification commentary). Depending on the risk level that has been determined, the ER either signs and dates the OOHs application if works are determined to be low risk, or endorses the OOH application for Sydney Metro to formally submit the OOH application to the Planning secretary for approval.

4.2.2.5. Other Endorsements and Approval

Following the identification of risk level by the ER, the ER endorses the OOH work application and provides any conditions or comments. This endorsement represents an agreement from the ER that the OOH works have been proposed in accordance with the relevant requirements (as applicable to their respective roles) and that additional mitigation measures (including respite) have been appropriately considered and proposed for implementation.

If the ER identifies that the OOH work application is high risk, the application is forwarded to the Secretary for approval. This endorsement represents an agreement from the ER that the OOH works have been proposed in accordance with the relevant requirements and that additional mitigation measures (including respite) have been appropriately considered and proposed for implementation. Following the ER's endorsement, the application is then formally submitted by Sydney Metro to the Secretary for approval in accordance with CoA E42.

For all other applications, the ER indicates their approval (or otherwise) on the application, including any conditions or comments, and forwards directly to Sydney Metro and the contractor.).

4.2.2.6. Approval Notification Arrangements

Community notifications for approved OOH applications (which include low risk OOHW) will be made available to the Secretary, the EPA and the community through the Sydney Metro website within five (5) daysand not more than fourteen (14) days of the works commencing. The community will also be issued with hard-copy community notifications.

Table 2: Risk Level Considerations

	Risk Level Considerations
Predicted Noise Exceedance	Degree of predicted noise level exceedance above the Rating Background Level or Noise Management Level as appropriate
Certainty	Rating background levels, noise management levels or predicted noise impactsare not well understood
Past Experience	Nature of works are new, in a new location or have not been undertaken by thecontractor on the project already
Negotiated Agreement with Sensitive Receivers	No negotiated agreement with sensitive receivers has been obtained in accordance with CoA E41
Exceeding residential ground-borne noise levels	Addressing potential evening and night-time exceedance levels of 40 and 35 dB (A) respectively
Potential Sleep Disturbance	Likely to generate potential sleep disturbance (Rating Background Level +15dB or greater)
Non-Residential Receivers	Impacted non-residential receivers operating during the same period of proposed OOH work
Special Events	The timing and location of special events in the area of the proposed OOH workmay be scheduled at the same time or immediately before or after the special event (e.g. festivals, public gatherings, etc.)

Place Manager Feedback	Feedback from the Place Manager for the area will provide the AA and ER an understanding of the types and requirements of surrounding sensitive receivers.
Sensitive Receivers	Moderate impact sensitive receivers (e.g. standard residential, medium density receivers) or high impact sensitive receivers (e.g. residential home for the elderly, high density unit blocks, persistent complainers, residents deemed to have 'construction noise fatigue')
Timetabling noisy activities	Timetabling works with high noise levels to avoid sensitive times for receptors such as hospitals, community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas
High Impact Works	Prolonged high noise or vibration intensive activities
Other Impacts	Impacts other than noise and vibration impacts are likely to be generated (e.g. lighting, traffic, etc.)

4.3. Community Notifications

Community notifications are used as a mitigation measure for receivers of noise and vibration impacts from OOH work.

Community notifications usually comprise of letterbox-dropped or hand-distributed notification letters to identified stakeholders prior to the commencement of works. Communities are more likely to understand and accept the impacts from noise and vibration if they are provided with honest detailed information and commitments on mitigation measures to be implemented that are adhered to by the project prior to the works commencing.

Community notification requirements are included in the CNVS and outlined in the Community Communications Strategy for the SM-WSA project.

Community notification is an example of an additional mitigation measure that may be considered for implementation in accordance with the CNVS and the additional mitigation measure tables contained in SM-21-00306108 Out-of-hours work application form.

4.3.1. Negotiated Agreements with Sensitive Receivers

A negotiated agreement for particular OOH work may be formed with the potentially affected sensitive receivers in accordance with CoA E41 (c) (iii). These negotiated agreements would be undertaken and documented by either the contractor or Sydney Metro as part of an OOH application.

The negotiated agreement needs to reach a minimum 65% acceptance rate of those sensitive receivers that are contactable. 'Contactable' is defined as having received correspondence (either verbal or written) from receivers within a two week timeframe. The preparation of a DNVIS and the Place Manager will advise of potentially affected sensitive receivers to be contacted.

Upon ER approval of any OOH applications containing negotiated agreements, Sydney Metro will forward the negotiated agreement documentation to the Secretary for information at least one week prior to the OOH work commencing. In the event that community notification is required as a mitigation measure prior to the OOH work commencing, this would be undertaken at the same time (i.e. at least five days and not more than fourteen days prior to the works commencing).

4.4. Emergency Works

Occasionally there may be a need to undertake emergency works outside of standard work hours. In this situation, the works are permitted to proceed without prior approval, provided that the works were:

- Unforeseen, and
- Required to avoid injury or the loss of life, damage or loss of property or to prevent environmental harm.

Work 'over-runs' (i.e. work activities that have taken longer to complete than expected) are not emergency works, unless the continuation of the activity is required to 'avoid injury or theloss of life, damage or loss of property or to prevent environmental harm'.

Figure 2 outlines the emergency work process.

On becoming aware of the need to undertake emergency works, contractors must notify Sydney Metro, the Planning Secretary, the ER and the EPA (if it is required under an EPL if relevant) of the need to undertake the works. This notification should be in the form of a written email or text message to Sydney Metro and the ER. The requirements for notifying the EPA will be dictated in the conditions of the EPL if relevant.

As a form of mitigation, community notification is to be undertaken within two hours of the commencement of emergency works. These notifications will generally be prepared by the contractor using a small hand-written Sydney Metro template card for distribution to the immediate surrounding community. These cards will include the following details as a minimum:

- Scope;
- Location;
- Hours;
- Duration;
- Types of equipment to be used; and
- Likely impacts.

Within 24 hours of any emergency works commencing, the applicant is to provide a written emergency works report to Sydney Metro. The emergency works report is to include as a minimum:

- Date, time, duration and cause of the emergency;
- Description of emergency works undertaken;
- Mitigation measures implemented to address the impacts of the emergency works; and
- Actions/Measures taken or to be taken to prevent or mitigate recurrence of the emergency. If there are no appropriate actions/measures to be taken, explanation is to be provided as to why.

The emergency works report will be used by Sydney Metro to determine whether the works qualified as emergency works under the applicable planning approval. If Sydney Metro determines that the works did not qualify as emergency works, the works may be considered an incident and/or non-compliant dependent on the applicable planning approval conditions.

ACRONYMS	
EPA:	Environment Protection Authority (NSW)
EPL:	Environment Protection Licence
ER:	Environmental Representative
OOH:	Out of Hours

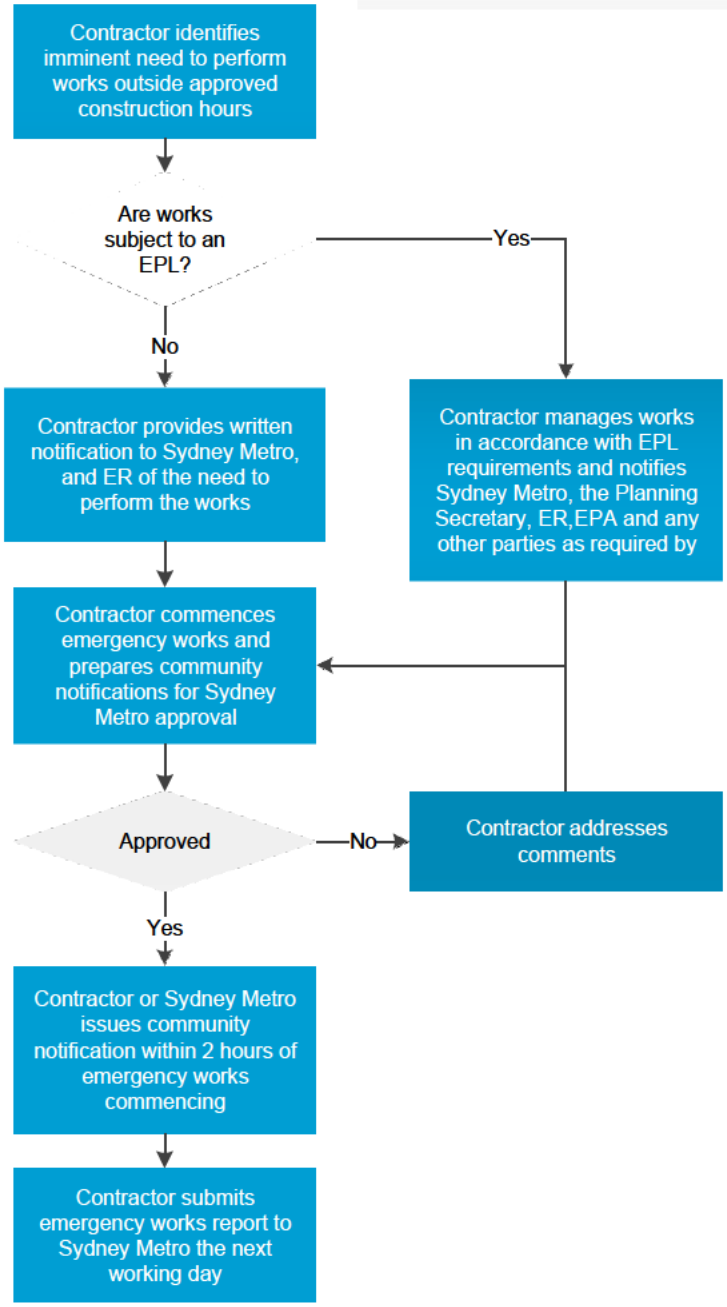


Figure 2: Emergency Works Process

4.5. Ground-borne noise level exceedance

4.5.1. Ground-borne regenerated noise condition

All reasonable and feasible mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:

(a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and

(b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A).

4.5.2. Ground-borne regenerated noise condition assessment

The evening and night-time criteria are only applicable to residential receivers.

The internal noise levels are to be assessed at the centre of the most-affected habitable room. For a limited number of discrete, ongoing ground-borne noise events, such as drilling or rock-hammering, The LAmax noise descriptor using a slow response on the sound level meter may be better than the LAeq noise descriptor (15 min) in describing the noise impacts. The level of mitigation of ground-borne noise would depend on the extent of impacts and also on the scale and duration of works. Any restriction on the days when construction work is allowed would take into account whether the community:

- Has identified times of day when they are more sensitive to noise (for example Sundays or public holidays).
- Is prepared to accept a longer construction duration in exchange for days of respite.

4.5.3. Mitigation measures

Due to the highly variable nature of construction activities and the likelihood of work outside the standard construction hours on Sydney Metro projects, some exceedances of the construction noise and vibration management levels are likely to be unavoidable. Where there is a potential exceedance of the construction noise and vibration management levels, a number of additional measures to mitigate such exceedances – primarily aimed at pro-active engagement with affected sensitive receivers – would be explored and have been included in below. The additional mitigation measures to be applied are outlined in Table 3 below.

Table 3: Additional Mitigation Measures

Measure	Description	Abbreviation
Alternative accommodation	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts over an extended period of time. Alternative accommodation will be determined on a case-by-case basis.	AA
Monitoring	Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals, noise or vibration monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the noise or vibration goal has been exceeded so that additional management measures may be implemented.	M
Individual briefings	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at	IB

	least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.	
Letter box drops	For each Sydney Metro project, a newsletter is produced and distributed to the local community via letterbox drop and the project mailing list. These newsletters provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage and inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on the community. Content and newsletter length is determined on a project-by-project basis. Most projects distribute notifications on a monthly basis. Each newsletter is graphically designed within a branded template.	LB
Project specific respite offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact.	RO
Phone calls and emails	Phone calls and/or emails detailing relevant information would be made to identified/affected stakeholders within 7 days of proposed work. Phone calls and/or emails provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs etc.	PC
Specific notifications	Specific notifications would be letterbox dropped or hand distributed to identified stakeholders no later than 7 days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications, or to advertise unscheduled works.	SN

4.5.4. Applying additional mitigation measures

Prior to the commencement of OOHW a detailed noise impact assessment shall be carried out. Mitigation measures shall be determined based on potential exceedances of the relevant NML.

In circumstances where following application of the standard mitigation measures, the LAeq(15minute) construction noise and vibration levels are still predicted to exceed the Noise Management Level, including ground-borne noise levels, the relevant Additional Mitigation Measures (AMM) are considered to determine any offset strategies for these impacts (Tables 4-6).

The following steps need to be carried out to determine the Additional Mitigation Measures to be implemented:

- Determine the duration (time period) when the work is to be undertaken.
- Determine the level of exceedance above the NML.

From the AMM table, identify the additional mitigation measures to be implemented (abbreviation codes are explained in Table 3).

Table 4: Additional Mitigation Measures – Airborne Construction Noise

Mitigation Measures					
Time Period		Predicted LAeq (15minute) noise level Above NML			
		0 to 10 dB	10 to 20 dB	20 to 30 dB	> 30 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	-	LB	LB, M, SN	LB, M, SN
	Sat (8.00 am - 1.00 pm)				
	Sun/Pub Hol (Nil)				
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M	LB, M, SN, RO	LB, M, SN, IB, PC, RO
	Sat (1.00 pm - 10.00 pm)				
	Sun/Pub Hol (8.00 am - 6.00 pm)				
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB	LB, M, SN, RO	LB, M, SN, IB, PC, RO, AA	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)				
	Sun/Pub Hol (6.00 pm - 7.00 am)				

Table 5: Additional Mitigation Measures – Ground Borne Construction Noise

Time Period		Mitigation Measures Predicted LAeq (15minute) noise level Above NML		
		0 to 10 dB	10 to 20 dB	> 20 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	No NML for GBN during standard hours, refer to Table 18		
	Sat (8.00 am - 1.00 pm)			
	Sun/Pub Hol (Nil)			
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M, SN	LB, M, SN, IB, PC, RO
	Sat (1.00 pm - 10.00 pm)			
	Sun/Pub Hol (8.00 am - 6.00 pm)			
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB, M, SN	LB, M, SN, IB, PC, RO, AA	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)			
	Sun/Pub Hol (6.00 pm - 7.00 am)			

Table 6: Additional Mitigation Measures - Ground-borne Vibration

Time Period		Mitigation Measures Predicted Vibration Levels Exceed Maximum Levels
Standard	Mon-Fri (7.00 am - 6.00 pm)	LB, M, RO
	Sat (8.00 am - 1.00 pm)	
	Sun/Pub Hol (Nil)	
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB, M, IB, PC, RO, SN
	Sat (1.00 pm - 10.00 pm)	
	Sun/Pub Hol (8.00 am - 6.00 pm)	
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB, M, IB, PC, RO, SN, AA
	Sat (10.00 pm - 8.00 am)	
	Sun/Pub Hol (6.00 pm - 7.00 am)	

5. Related documents and references

Related documents and references
• SM-17-00000022 Environment & Sustainability Management Manual • SM-21-00279320 Construction Environmental Management Framework https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272116977 • SM-21-00279321 Construction Noise and Vibration Standard https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272123288 • SM-21-00306108 Out-of-hours Work Application Form • Overarching Community Communications Strategy https://www.sydneymetro.info/sites/default/files/document-library/Sydney_Metro_Overarching_Community_Communication_Strategy.pdf • EPA Interim Construction Noise Guideline

6. Superseded documents

Superseded documents
There are no documents superseded as a result of this document.

7. Document history

Version	Date of approval	Notes
1.0	14 October 2021	New document
2.0	8 November 2021	DPIE RFI Review

5. Appendix A: OOH Work Strategy/Protocol Endorsements and Approval(s)

Out-of-hours work application form- SM-WSA

This form is to be used for formal review and approval of Out-of-hours (OOH) work as it may affect residential and non-residential receivers. This form can be used in accordance with the Sydney Metro - Western Sydney Airport out-of-hours works protocol. Each OOH application and all applicable appendices must be submitted to Sydney Metro as one PDF file at least 15 business days prior to the commencement of the proposed OOH work.

1. OOH Application	
Sydney Metro Project: Western Sydney Airport	
Contract:	
Contractor:	
Application Title: E.g. 'Smith St service relocation works'.	
Application Number: E.g. 1, 2, 3, etc.	
Application Date: Original submission date (resubmission date in parentheses if applicable).	
Relevant Planning Approval:	
Environment Protection Licence (EPL): If subject to an EPL, state title and number.	

2. Proposed OOH Work Details	
Description of works, including: • Work methodologies. • List of plant/equipment to be used (worst case scenario). • Location Map (and/or Environmental Control Map) attached as Appendix 1, indicating location of works, plant/equipment locations and receivers (including distance to nearest receiver for noisiest plant/equipment). • Traffic Management Plan and/or Traffic Control Plan if applicable as Appendix 2.	
Timing of works: Including proposed dates/times works are planned to be undertaken outside standard hours.*	
Worst-case number of consecutive occasions affecting the same receiver: Refer to Section 4 for definition of 'occasion'.	
Justification: Demonstrate how the proposed OOH work has been scheduled in accordance with the OOH work period prioritisation list.* Program acceleration is generally not accepted as a justifica ion.	

* Unless specified otherwise in project-specific documentation, the prioritisa ion of work time periods is as follows:
- **Standard Hours:** 7am to 6pm weekdays and 8am to 1pm Saturdays.
- **Daytime OOH:** 1pm to 6pm Saturdays and 8am to 6pm Sundays and Public Holidays.
- **Evening OOH:** 6pm to 10pm every day.
- **Night Time OOH:** 10pm to 7am weekday mornings and 9pm to 8am weekend and Public Holiday mornings.

3. Assessed Noise and Vibration Impacts and Standard Mitigation Measures	
Are the proposed works consistent with a prepared Detailed Noise & Vibration Impact Statement (DNVIS)? (Y/N)	
If 'N', skip this section and move to Section 4.	
State the title of the DNVIS and attach the section(s) describing the noise and vibration impacts of the proposed works as Appendix 3.	
Quantitatively summarise the worst-case predicted noise and vibration impacts specific to the proposed OOH work for each OOH period on the nearest receivers and compare these against the respective management levels. **For Night Time OOH Period works, include a review of potential sleep disturbance impacts in accordance with Section 4.3 of the ICNG.**	Worst-case predicted noise impact summary: • • • Worst-case predicted vibration impact summary: • Potential sleep disturbance summary (for night time OOH periods only): •
Using Table 4 and Table 5, indicate in Table 6: • Which Additional Mitigation Measures (AMMs) are applicable for consideration, • Which of those applicable for consideration are planned to be implemented, • For AMMs that are applicable for consideration but not being implemented, justify why the AMM is not being implemented. • For AMMs that are being implemented, provide details on how the AMM is being implemented (e.g. which receivers being offered respite, alternative accommodation, etc.).	

4. Non-Assessed Noise and Vibration Impacts

Skip this section if Section 3 has been completed in full.

A quantitative noise assessment for OOH work is to be carried out in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). This section allows applicants to address these requirements through the following steps:

1) Establishing Rating Background Levels (RBLs) and Noise Management Levels (NMLs).
2) Predicting the anticipated noise levels using a quantitative noise assessment:
   a. Works that are not l kely to generate high noise impacts for a significant duration may use a preliminary quantitative noise assessment (facilitated within this form). This ensures that all applications, as a minimum, include a preliminary quantitative noise assessment in accordance with the *Interim Construction Noise Guideline* (ICNG).
   b. Works that are likely to generate high noise impacts for a significant duration may require a detailed quantitative noise assessment (e.g. Construction Noise and V bration Impact Statement) to be undertaken.
   c. Works that are likely to generate ground-borne or structure-borne vibration and/or noise require specialist advice and assessment.
3) Comparing predicted noise levels against RBLs/NMLs and applying standard mitigation measures as appropriate (i.e. implementing 'all feasible and reasonable' mitigation measures in accordance with the ICNG).
4) Considering additional mitigation measures when predicted noise levels exceed RBLs/NMLs.

The need for a detailed quantitative noise and vibration assessment will be considered by Sydney Metro, the contractor and the Environmental Representative (if applicable) collectively when the predicted noise levels are anticipated to:

- Exceed an RBL at a residential receiver or an NML at a non-residential receiver by more than 10dBA, **AND**
- Affect the same receiver on 10 or more consecutive **occasions**. An occasion is anytime works are carried out:
  - Between 6pm on a weekday and the start of standard hours the next day, **OR**
  - Between 1pm on a Saturday and 8am on a Sunday), **OR**
  - Between 8am on a Sunday or public holiday and the start of standard hours the next day.

A detailed quantitative noise and vibration assessment should generally include:

- Derivation of RBLs for residential receivers and/or derivation of NMLs for non-residential receivers based on noise monitoring at representative locations and local sensitivities.
- Detailed noise predictions for daytime, evening and night time OOH periods (as applicable) in accordance with Section 4.5 of the ICNG (including an outline of timing, duration and predicted noise levels for each OOH period).
- For Night Time OOH Period works, a review of potential sleep disturbance impacts in accordance with Section 4.3 of the ICNG.
- Detailed predictions of vibration levels for sensitive receivers.

Please complete the following Steps 1 to 4.

Step 1: RBLs/NMLs	If RBLs for residential receivers or NMLs for non-residential receivers have already been established (e.g. in an Environmental Impact Statement, Review of Environmental Factors, detailed quantitative noise assessment or Construction Noise and Vibration Impact Statement for other work activities), enter into Table 3 and attach the supporting evidence as Appendix 3. If no RBLs/NMLs have been established, use Table 1 to estimate and enter into Table 3.
Step 2: Predicted Anticipated Noise Levels	If predicted anticipated noise levels have already been established (e.g. in an Environmental Impact Statement, Review of Environmental Factors, detailed quantitative noise assessment), enter the predicted anticipated noise levels into Table 3 and attach the supporting evidence as Appendix 3. If predicted anticipated noise levels have not already been established, use Table 2 to estimate anticipated noise aspects for the noisiest plant/equipment and enter into Table 3. In Table 3, use these values to calculate the anticipated predicted noise levels.
Step 3: Exceedances and Mitigation Measures	Compare the anticipated predicted noise levels to the applicable RBLs/NMLs, calculate the exceedances and enter into Table 3. In Section 5, provide a description of the standard mitigation measures that are planned to be implemented in order to mitigate the noise impacts (and vibration impacts if relevant) as much as 'feasible and reasonable' in accordance with the ICNG.
Step 4: Consideration of Additional Mitigation Measures	Use Table 4 and the exceedances in Table 3 to determine the applicable Additional Mitigation Measures for consideration. Use Table 6 to indicate which of these measures are applicable for consideration, which will be implemented and provide justification/details accordingly.

5. Standard Mitigation Measures	
Outline the standard noise mitigation measures that will be implemented during the proposed OOH work: I.e. Implementation of all 'feasible and reasonable' mitigation measures in accordance with the ICNG):	•
Outline the standard vibration mitigation measures that will be implemented during the proposed OOH work: I.e. Implementation of all 'feasible and reasonable' mitigation measures in accordance with the ICNG):	•

Table 1: Noise RBLs and NMLs

Skip this section RBLs and NMLs have already been established in other documentation.			
Sensitive Receiver Category	**Estimated RBLs (dBA)**		
Residential	**Daytime OOH**	**Evening OOH**	**Night Time OOH**
Urban (e.g. city hubs, near busy roads, near industrial activity)	**55**	**50**	**45**
Suburban	**45**	**40**	**35**
Quiet, rural or isolated	**40**	**35**	**30**
Non-Residential	**ICNG NMLs (dBA)**		
Industrial facilities	**75** (only applicable when in use)		
Offices or retail	**70** (only applicable when in use)		
Health and educational facilities	**55** (only applicable when in use)		

Table 2: Predicted Noise Level Aspects

Skip this section if predicted noise levels have already been established in other documentation.		
Noise Aspect	**Select the most applicable value for each noise aspect below and enter into Table 3.**	**dBA**
1. Plant/Equipment Noise Level at 10m Including non-continuous use reduction (-5dBA) and annoying activity penalty (+5dBA) for as per ICNG (refer to ICNG Appendix B for predicted noise level data) Underline indicates v bratory generating plant/equipment	Impact sheet piling rig	100
	Hand-held tamper, excavator with hammer, rock-breaker, driven/vibratory piling, concrete saw, diamond saw, air track drill, large dozer, hand-held rail grinder	95
	Jackhammer, rock crusher, angle grinder, pneumatic hammer, medium dozer, tracked loader, impact wrench	90
	Mainline tamper, ballast regulator, dynamic track stabiliser, vibratory roller, mainline rail grinder, ballast train (pour/fill ballast), chainsaw, tub grinder/large mulcher, scraper, grader, super-sucker/vacuum truck, large backhoe/wheeled front-end loader, bored piling, pavement profiler, fixed crane, tracked excavator	85
	Small bulldozer, small excavator, tower crane, truck-mounted crane, forklift, bobcat, skid-steer front-end loader, road truck/truck and dog, dump truck, concrete truck/pump/mixer, compressor, non-vibratory/large pad foot roller, whacker packer/compactor, water cart, pavement laying machine, asphalt truck and sprayer, line marking truck, standard penetration testing, welder, pin puller	80
	Concrete v brator, cherry-picker scissor lift/elevated work platform/Franna crane, small backhoe, front end loader, fence post driver, electric drill rig, hand held rattle gun, generator (diesel/petrol), spreader	75
	Lighting tower, medium-rigid truck/semi-trailer, welding equipment, small front end loader	70
	Light vehicle, hand-tools (no impact), small cement mixer, attenuated generator (inside housing)	65

2. Multiple Plant	More than one of the noisiest plant being used simultaneously at roughly the same location	+5
3. Local Screening	Existing screening between site and receiver (buildings, cuttings, canopies, etc.)	- 5
	Temporary screening to be implemented near work site	- 10
	Acoustic shed or enclosure	- 25
4. Distance Attenuation	< 10 metres	0
	10 to 20 metres	- 5
	20 to 35 metres	- 10
	35 to 60 metres	- 15
	60 to 100 metres	- 20
	100 to 180 metres	- 25
	180 to 350 metres	- 30
	350 to 1,000 metres	- 40

Table 3: Predicted Noise Levels and Exceedances of RBLs and/or NMLs (dBA)

Skip this section if Section 3 has been completed in full.

Period (only complete as applicable for each period)	**Noisiest Plant/Equipment** (state the noisiest plant/equipment to be used during each applicable OOH period)	**Receiver Type** (state 'Res' or 'Non-Res' as applicable for closest receiver to noisiest plant/equipment)	Enter the most applicable values from Table 2, then add to determine the Predicted Noise Level				**Predicted Noise Level (1 + 2 + 3 + 4)**	**RBL (for Res)**	**NML (for Non-Res)**	**Exceedance** (Predicted Noise Level minus RBL for Res or NML for Non-Res)
			1. Plant/Equipment Noise Level	**2. Multiple Plant/Equipment**	**3. Local Screening**	**4. Distance Attenuation**				
Daytime OOH *										
Evening OOH *										
Night Time OOH *										

* Refer to OOH period timings under Section 2 of this form.

Table 4: Additional Mitigation Measures (AMM) requiring Consideration for Implementation

OOH Period	**AMMs that must be considered for implementation** (apply the exceedances from Table 3 to the two OOH period categories below as applicable)			
	0 to 10 dBA Exceedance	**>10 to 20 dBA Exceedance**	**>20 to 30 dBA Exceedance**	**>30 dBA Exceedance**
Daytime OOH Period	–	LB	M, LB	M, IB, LB, PC, RO, SN
Evening and Night Time OOH Periods	–	M, LB	M, IB, LB, PC, SN, RO	M, IB, LB, PC, SN, RO, AA*

* AA is only applicable to Night Time OOH periods.

Table 5: List of Additional Mitigation Measures (AMM)

AMM Abbrev.	AMM	AMM Descriptions and Guidance
LB	Letterbox-drop (generic to the project)	A newsletter is generally produced and distr buted to the local community via letterbox-drop and the project mailing list. These newsletters provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. The geographic extent of letterbox-drops is generally centred on the immediate surrounding community within 200 metres from the works site.
M	Monitoring	Where it has been identified that specific construction activities are likely to exceed the relevant Rating Background Levels (RBL) and/or Noise Management Levels (NMLs), monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the RBL/NML has been exceeded so that additional management measures may be implemented.
IB	Individual Briefings	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.
PC	Phone calls (and/or emails)	Phone calls and/or emails (with specific notifications attached) detailing relevant information would be made to identified/affected stakeholders within seven days of proposed work. The objective of the phone calls and/or emails is to support letterbox-drop and specific notifications. Phone calls and/or emails provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs.
SN	Specific Notifications (specific to the OOH work)	Specific notifications are letterbox-dropped to identified stakeholders no later than 7 days prior to out of hour construction activities commencing that are likely to exceed the RBLs/NMLs. Specific notifications may be produced by Sydney Trains or by Sydney Metro (or on behalf of Sydney Metro by a contractor as approved by Sydney Metro): - Sydney Trains specific notifications cover all works being undertaken by various parties (including Sydney Metro) during designated rail possession periods. These specific notifications are delivered 14 days prior to works commencing and are delivered to all properties located within 250m of the proposed works. - Sydney Metro specific notifications focus on proposed Sydney Metro works being undertaken outside of designated rail possession periods and are only produced in the absence of any Sydney Trains notifications covering the proposed works. These notifications are delivered 7 days prior to works commencing and are delivered to all properties located within 100m of day works and within 200m of night works. All notifications are emailed to all registered stakeholders on site-specific email distribution lists.
RO	Respite Offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise and/or vibration impacts respite during OOH periods. Respite offers are offers made to affected receivers to provide a period of either no or limited noise impacts. This can be in the form of stopping or limiting works onsite or offering affected receivers dinner/movie vouchers. The first priority is to implement a period of no or limited noise impacts. If this cannot be achieved, dinner/movie vouchers may be offered on a case-by-case basis.
AA	Alternative Accommodation *(residential only)*	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts during night time OOH periods. Alternative accommodation will be considered on a case-by-case basis.

Table 6: Consideration of Additional Mitigation Measures (AMM)

Additional Mitigation Measures	Applicable for Consideration? Y/N (refer to Table 4)	To be Implemented? Y/N	Justification/Details For AMMs that are applicable for consideration but not being implemented, justify why the AMM is not being implemented. For AMMs that are being implemented, provide details on how the AMM is being implemented (e.g. which receivers being offered RO, AA, etc.).
LB			
M			
IB			
PC			
SN			
RO *			
AA			

*If RO is being implemented, include how community consultation influenced the manner in which RO is being implemented.

6. Consideration Against Relevant Vibration Criteria		
Using Table 2, indicate whether any vibratory plant/equipment is planned to be used for the proposed works (Y/N)		
If 'N', skip this section and move to Section 7.		
'People' Criterion	Are the proposed works anticipated to have any perceptible sleep disturbance impacts? (Y/N)	
'Structures' Criterion	Are the proposed works anticipated to generate greater than 7.5mm/s vibration impacts on surrounding structures (generally within 25 metres of works)? (Y/N)	
'Sensitive Equipment' Criterion	Are the proposed works anticipated to impact sensitive equipment located in surrounding non-residential receivers? (Y/N)	
If 'Y' is answered to ANY of the above criteria AND the impacts affect the same receiver for more than one consecutive occasion (refer to Section 4 for 'occasion' definition), the need to prepare a detailed quantitative assessment will be considered collectively by Sydney Metro, the contractor and the Environmental Representative (if applicable).		

7. Cumulative Impacts	
Document the relevant details of any other OOH work (Sydney Metro or otherwise) that will impact the same receivers as those being impacted by these proposed works either concurrently or within 3 days of the start or end of these proposed works.	
If other works have been identified in the row above, how have the proposed works been coordinated to ensure appropriate respite is provided?	

8. Community Consultation	
What community consultation has been undertaken already?	
What community consultation is planned to be undertaken?	
If drafted already, attach applicable Community Notification as Appendix 4.	

9. Contractor's Signature				
Contractor's Identification of Risk Level: If subject to Western Sydney Airport Sydney Metro planning approval and not subject to an EPL, provide Contractor's Identification of Risk Level (refer to the *Western Sydney Airport Sydney Metro Protocol* for guidance).	Circle:	LOW	or	HIGH
Contractor's Signature:				
Name:				
Title:				
Contact Number:				
Date:				

10. Contractor's Contact Details		
Contractor Personnel	**Name**	**Mobile**
Manager Environment:		
Manager Communications:		
Contractor's Representative:		
Contractor's 24hr contact person:		

Planning Approval Determination Page

	Step 1 – Endorsement from Sydney Metro Director Project Communications or Contractor's Communications Manager	Step 2 – Risk Identification/Endorsement from ER under the Planning Approval	Step 3 – If works are under Sydney Trains EPL, approval from Sydney Metro Director of Planning, Environment and Sustainability. If works are not under an EPL, approval from either the ER or the Secretary of the NSW Department of Planning & Environment
Risk Level:	*N/A*	*If not subject to an EPL, circle Risk Level as:* ***LOW*** *or* ***HIGH*** *If works are HIGH Risk Level Sydney Metro submits application to the Secretary of the NSW Department of Planning & Environment for approval.*	*N/A*
Signature:	*Approved Road Occupancy Licence/Road Opening Permit (if applicable) must be sighted prior to endorsement.*		
Name:			
Role:			
Date:			
Comments: (including ER Risk Level comments if applicable)			
Conditions:			

Generic Determination Page (i.e. not subject to SM-WSA planning approvals)

	Step 1 – Sydney Metro Director of Project Communications	Step 2 – Environmental Representative (may be optional depending on planning approval or contract requirements)	Step 3 –Sydney Metro Director of Planning, Environment & Sustainability (only required if not approved already)
Action:	Endorsement	Circle: Endorsement or Approval	Approval
Signature:	*Approved Road Occupancy Licence/Road Opening Permit (if applicable) must be sighted prior to endorsement.*		
Name:			
Date:			
Comments:			
Conditions:			

Appendix 1: Location Map (and/or Environmental Control Map)

Appendix 2: Traffic Management Plan and/or Traffic Control Plan

(if applicable)

Appendix 3: Supporting Evidence for Noise & Vibration Impacts (e.g. Construction Noise & Vibration Impact Statement, noise assessment, etc.)

(if applicable)

Appendix 4: Community Notification

(if applicable and already drafted)

Annexure C Vibration Assessment Procedure

VIBRATION ASSESSMENT PROCEDURE

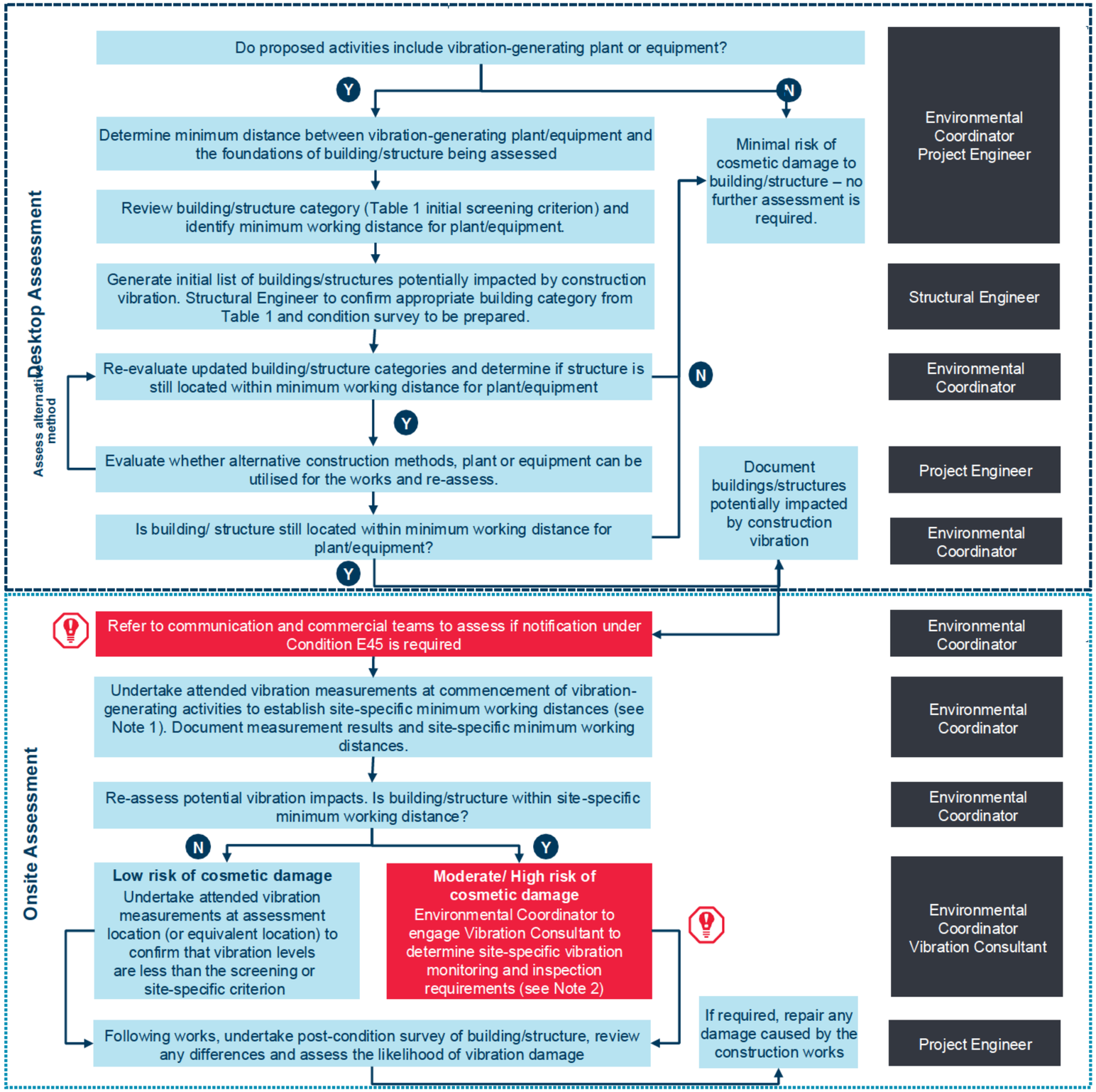


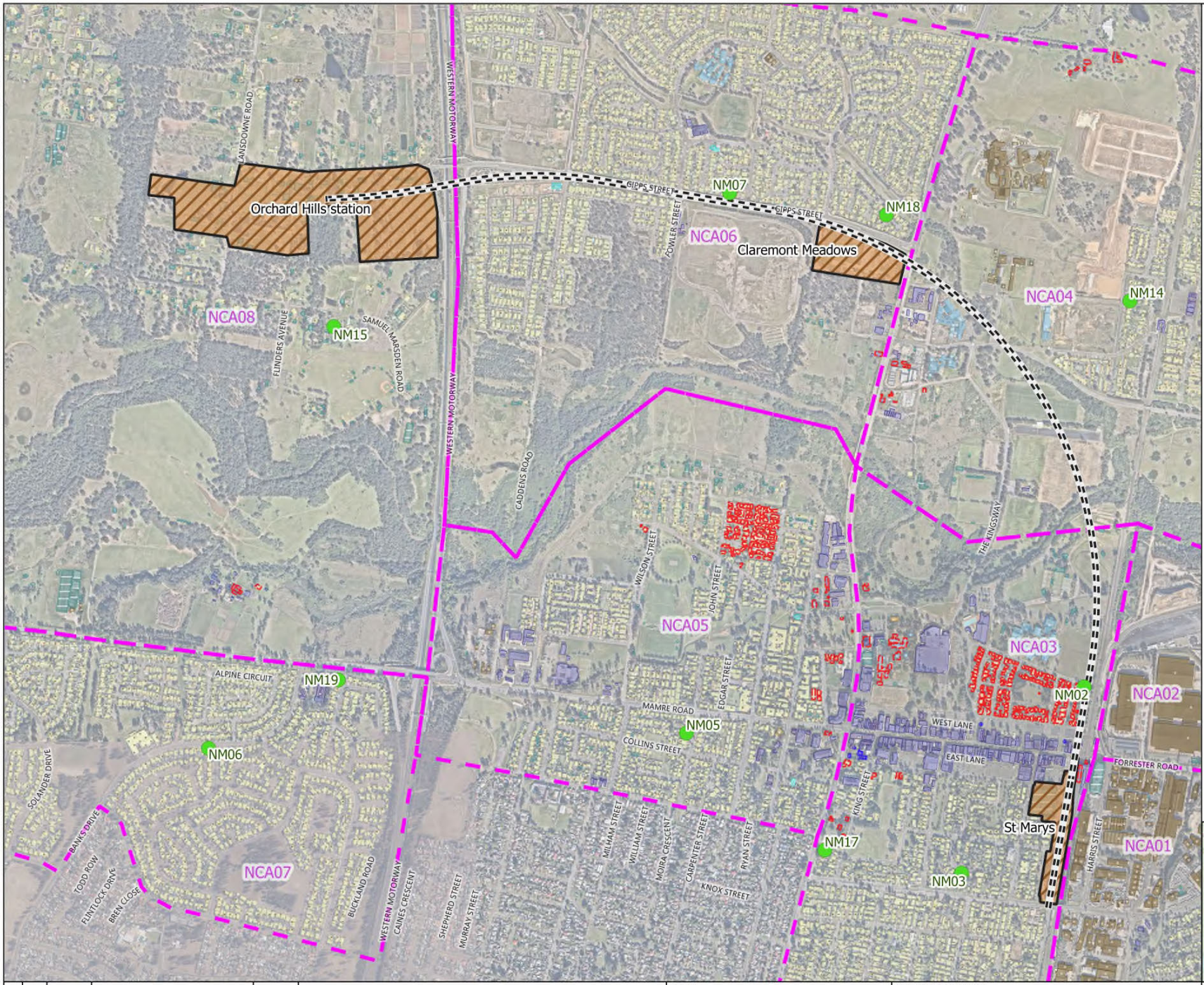
Table 1: Building/structure categories

Category	Initial screening criterion for cosmetic damage	Detailed criterion for cosmetic damage
A. Important/heritage buildings that are difficult to repair or are structurally unsound	2.5 mm/s	DIN4150-3:1999 Table 1 - Line 3
B. Unreinforced or light framed structures - Residential or light commercial type buildings	7.5 mm/s	BS7385-2:1993 Figure 1 - Line 2 (reduced by 50%)
C. Building or structure-specific criterion	12.5 mm/s	PPV vibration limit (4Hz to 250Hz)
D. Reinforced or framed structures - Industrial and heavy commercial buildings	25 mm/s	BS7385-2:1993 Figure 1 - Line 1 (reduced by 50%)

Note 1:
- The screening levels for cosmetic damage are conservative.
- Detailed measurements or assessment may be used to determine site-specific minimum working distances based on the frequency-dependent vibration criteria in
  - DIN4150-3:1999 (heritage structures) and
  - BS7385-2:1993 (non-heritage structures).

Note 2:
- For high risk vibration works, continuous vibration monitoring may be required with flashing light, audible alarm and/or e-mail to alert staff of potential risks.
- Regular inspections (e.g crack monitoring) may be required.
- Proposed monitoring and inspection plan to be documented.
- All exceedances shall be investigated.

Annexure D Land Use Survey



LEGEND

Noise Sensitive Receivers

- Residential
- Mixed use
- Commercial
- Industrial
- Hotel/Motel/Hostel
- Medical facility
- Place of Worship
- Community centre
- Recording studio
- Library/Museum
- Childcare
- Educational
- Theatre/Auditorium
- Cinema
- Laboratory
- Flight simulator
- Horse Stable
- Recreational - Passive
- Recreational - Active
- Other
- Heritage

- Project NCAs
- Project Construction Sites
- Noise Monitoring Locations

REV	BY	DATE	DESCRIPTION	APPROVER
r1	SS	29/03/22	Monitoring Loc Addition	TG
r0	SS	31/01/22	Prepare figures	TG

A3 Original

Co-ordinate System: MGA Zone 56

0 200 400 600 800 1,000 m

1:14,000

FULL SIZE A3, REDUCED TO A4

NOTE: Do not scale from this drawing.

CLIENT

CPB CONTRACTORS

Ghella 5 Generations of Tunnelers

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES

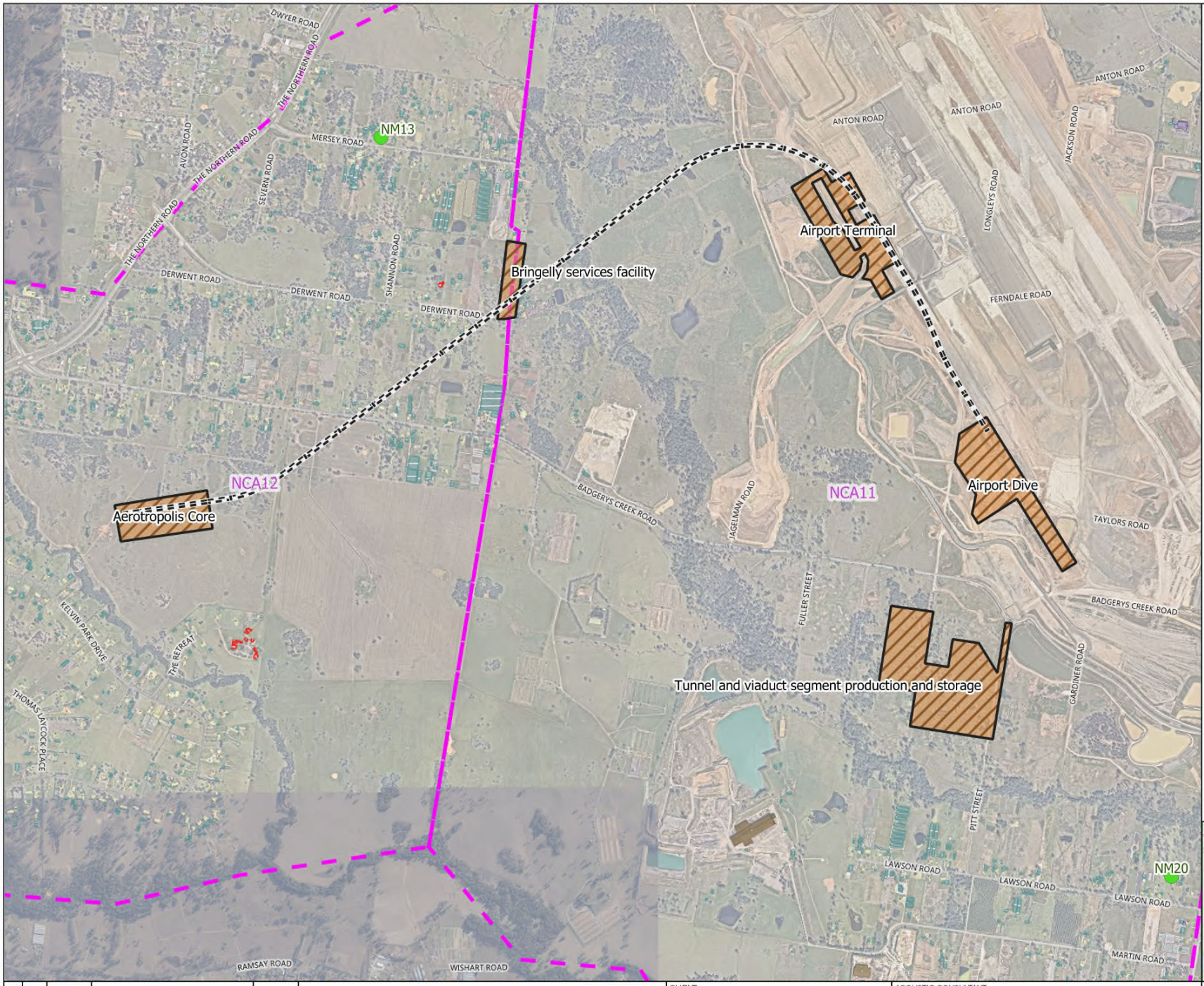
inspired to achieve

Ph (02) 8218 0500 Fax (02) 8218 0501

Sydney Metro West

Overall Land Use, NCAs and Work Areas

Land use Revision date: 27/01/2022 Plot Date: 29/03/22 - 13:45 Layout: TM008 Gen Template
GIS File: R:\Assoc\Syd\Projects\TM001-TM050\TM008 mt Sydney Metro WSA SBTLS Calcs\00 GENERAL\01 GIS\TM008-SS (r0).qgz



LEGEND

Noise Sensitive Receivers

- Residential
- Mixed use
- Commercial
- Industrial
- Hotel/Motel/Hostel
- Medical facility
- Place of Worship
- Community centre
- Recording studio
- Library/Museum
- Childcare
- Educational
- Theatre/Auditorium
- Cinema
- Laboratory
- Flight simulator
- Horse Stable
- Recreational - Passive
- Recreational - Active
- Other
- Heritage

- Project NCAs
- Project Construction Sites
- Noise Monitoring Locations

0 250 500 750 1,000 1,250 1,500 m

0 200 400 600 800 1,000 m

1:20,000

REV	BY	DATE	DESCRIPTION	APPROVER
r1	SS	29/03/22	Monitoring Loc Addition	TG
r0	SS	31/01/22	Prepare figures	TG

A3 Original | Co-ordinate System: MGA Zone 56 | FULL SIZE A3, REDUCED TO A4 | NOTE: Do not scale from this drawing.

CLIENT: CPB CONTRACTORS, Ghella 5 Generations of Tunnelers

ACOUSTIC CONSULTANT: RENZO TONIN & ASSOCIATES inspired to achieve

Ph (02) 8218 0500 Fax (02) 8218 0501

Sydney Metro West

Overall Land Use, NCAs and Work Areas

Sheet 2 of 2

Land use Revision date: 27/01/2022 Layout: TM008 Gen Template
Plot Date: 29/03/22 - 13:47
GIS File: R:\AssocSydProjects\TM001-TM050\TM008 mt Sydney Metro WSA SBT\5 Calcs\00 GENERAL\01 GIS\TM008-SS (r0).qgz

Annexure E Indicative Noise and Vibration Mitigation

SBT worksite	Construction activity		Airborne noise management			Ground-borne noise management		Vibration management (risk of impact)	
	Civil excavation	Tunnelling	Noise barriers?	Acoustic shed?	Trucks per hour on site N1	Civil excavation	Tunnelling	Structural damage2	Human disturbance DE/N1, 2
N: St Marys	Station box	TBM retrieval Mined stub tunnels	3-5m	No (OOHW managed)	4 per hour	N/A	Managed OOH	L	LM/LM
N: Claremont Meadows	Shaft + nozzles	N/A	3m	No	Nil4	N/A	N/A	L	L/L
N: Orchard Hills	Temporary shaft, station box + dive	24-hour support (TBM tunnelling) TBM launch x 2	3-5m	No. Acoustic enclosures for specific plant (OOHW managed)	Nil4	Managed OOH	N/A	L	L/L
S: Bringelly Services Shaft	Shaft + nozzles	N/A	3m	No	Nil4	N/A	N/A	L	L/L
S: Bradfield / Aerotropolis	Station box	TBM retrieval	4m	No	4 per hour	N/A	N/A	L	L/L
N/S: mainline tunnels	N/A	24-hour tunnelling	N/A	N/A	N/A	N/A	Yes	L	L/L
N/S: cross passages	N/A	Managed OOH tunnelling	N/A	N/A	N/A	N/A	Managed OOH	L	LM/L

NOTES:
N = Night period (10.00pm to 7.00am)
L = Low Risk; LM = Low to Medium Risk; M = Medium Risk; MH = Medium to High Risk; H = High Risk
() refers to number of concrete trucks over the entire night period for essential ground support
Except where oversized deliveries are required

Annexure F Consultation Report

Annexure G Environmental Representative Endorsement

HBI Healthy Buildings International Pty Ltd
A.C.N. 003 270 693 A.B.N. 39 003 270 693

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Sydney Metro
Transport for NSW
PO Box K659
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26 September 2022

Ref: 201209(b)_CNVMP&CSWMP_R1

Dear Hugh

RE: Endorsement of Construction Noise and Vibration and Soil and Water Management Sub-Plans - Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works

Thank you for providing the following documents for Environmental Representative (ER) review and approval prior to commencement of Construction, as required by Conditions of Approval C1, C5/6 and C13 of the Sydney Metro Western Sydney Airport project (SSI 10051 July 23, 2021):

- NSW (Off-airport) Construction Noise and Vibration Management Sub-plan - Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works, Revision 1 of 23/09/2022 (Doc No. SMWSASBT-CPG-1NL-NL000-NV-PLN-000001)
- NSW (Off-Airport) Soil and Water Management Sub-Plan - Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works, Revision 1 of 21/09/2022 (SMWSASBT-CPG-1NL-NL000-WA-PLN-000002)

The Construction Noise and Vibration Management Sub-Plan and the Soil and Water Management Sub-Plan contain the Construction Monitoring Program – Noise and Vibration, and Construction Monitoring Program – Surface Water Quality and Construction Monitoring Program – Groundwater, respectively. Therefore, those Construction Monitoring Programs form part of this review and endorsement.

It is noted that:

- Previous versions of the documents have been reviewed and updated following comments from the ER
- Sydney Metro have also reviewed and commented on the relevant documents
- Evidence of consultation records has been provided to the ER
- Following the above reviews, the documents are considered to contain information and consultation required

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Accordingly, as an approved ER for the Sydney Metro Western Sydney Airport project, I now consider the subject CEMP Sub-Plans and Construction Monitoring Programs consistent with the requirements in or under the Infrastructure Approval and the undertakings made in the documents listed in Condition A1.

Yours sincerely

Rui Henriques
Environmental Representative

Alex Gale
Environmental Representative

Leaders in Environmental Consulting

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