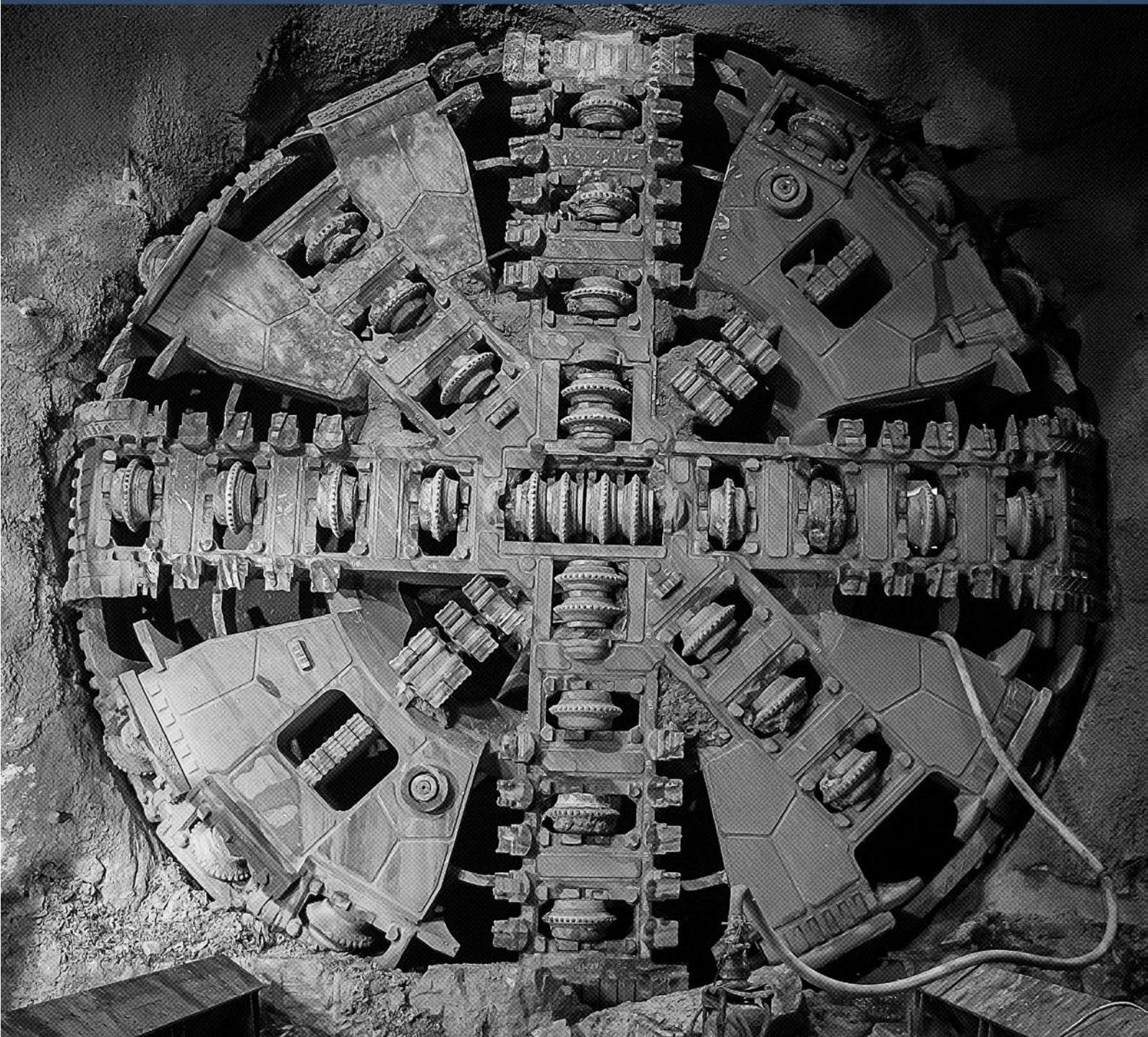


Noise and Vibration Management

Sub-Plan



SYDNEY METRO WEST EASTERN TUNNELLING PACKAGE

Noise and Vibration Management Sub-Plan

22 March 2023

John Holland CPB Ghella Joint Venture

Document number: SMWSTETP-JCG-SWD-SW000-EN-PLN-002019

NOISE AND VIBRATION MANAGEMENT SUB-PLAN

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Document approval

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Signature:					

Draft issues of this document shall be identified as Revision A, B, C, etc. Upon initial issue for use this shall be changed to a number commencing at Revision 0, with subsequent revision numbers following sequentially (e.g. 1, 2, etc).

This Sub-plan was previously issued to Sydney Metro as SMWSTETP-JCG-1NL-NL000-EN-PLN-000001 (Revision B). The document number of this Sub-plan has been updated to SMWSTETP-JCG-SWD-SW000-EM-PLN-002012 to comply with both the Sydney Metro ECM schema and the JCG file numbering convention (FNC). Previous comments against SMWSTETP-JCG-1NL-NL000-EN-PLN-000001 have been addressed in this version of the Sub-plan.

Compliance

Table 1: Compliance matrix

ID	Requirement ¹	Reference
C1	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.	This Sub-plan Section 1.1 Table 29 Table 30 Table 31 Table 32
C5	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 must be included in the relevant CEMP Sub-plan, including copies of all correspondence from those government agencies as required by Condition A6. 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: (a) Noise and vibration: Place Management NSW (in respect of The Bays) and Relevant Council(s) (b) Flora and fauna: DPE Environment and Heritage Group, DPI Fisheries, and Relevant Council(s) (c) Heritage (Non-Aboriginal and Aboriginal): Heritage NSW, Place Management NSW (in respect of The Bays) and Relevant Council(s) (d) Spoil: Relevant council(s) (e) Soil and water: DPE Water and Relevant Council(s)	Section 1.4
C6	The CEMP Sub-plans must state how:	Sections 1.2 and Section 6
	(a) the environmental performance outcomes identified in the documents listed in Condition A1 will be achieved;	
	(b) the mitigation measures identified in the documents listed in Condition A1 will be implemented;	Section 8 Element 4
	(c) the relevant conditions of this approval will be complied with; and	Section 9 Element 4
	(d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed through SMART principles	Section 7.3, Section 7.4, Section 8 and Appendix A
C7	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.	Section 1.4.1
C8	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 phased no later than one (1) month before the commencement of that phase.	Section 1.4.1
C9	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 phased no later than one (1) month before the commencement of that phase.	Section 1.4.1

ID	Requirement ¹	Reference
C10	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. Where construction of the CSSI is phased, construction of a phase must not commence until the CEMP and CEMP Sub-plans for that phase have been approved by the Planning Secretary or endorsed by the ER upon nomination by the Planning Secretary (whichever is applicable).	Section 1.4.1
C14	The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies 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: (a) Noise and vibration: EPA, Place Management NSW (in respect of The Bays) and Relevant Council(s) (a) Surface water quality: DPE Water, Relevant Council(s) and Sydney Water (if any Sydney Water assets are impacted) (b) Groundwater: DPE Water	Appendix A (Section 1.4) Appendix F
C15	Each Construction Monitoring Program must provide:	Appendix A (Section 4)
	(a) details of baseline data available including the period of baseline monitoring;	
	(b) details of baseline data to be obtained and when;	Appendix A (Section 4)
	(c) details of all monitoring of the project to be undertaken;	Appendix A (Section 5 and 6)
	(d) the parameters of the project to be monitored;	Appendix A (Section 3.4 and 3.5)
	(e) the frequency of monitoring to be undertaken;	Appendix A (Section 5 and 6)
	(f) the location of monitoring;	Appendix A (Section 5 and 6)
	(g) the reporting of monitoring results and analysis results against relevant criteria;	Appendix A (Section 8.3 and 8.5)
	(h) details of the methods that will be used to analyse the monitoring data;	Appendix A (Section 8.3)
	(i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts;	Appendix A (Section 8.3)
	(j) a consideration of SMART principles; and	Appendix A (Section 5 and 6)
C16	(k) any consultation to be undertaken in relation to the monitoring programs; and	Section 1.4 Appendix A (Section 1.4)
	(l) any specific requirements as required by Conditions C16 and C17.	Refer to Condition C16
	The Noise and Vibration Construction Monitoring Program must include:	Appendix A (Section 1 and Section 4)
	(a) noise and vibration monitoring determined in consultation with the AA to confirm the best-achievable construction noise and vibration levels	

ID	Requirement ¹	Reference
	with consideration of all reasonable and feasible mitigation and management measures that will be implemented;	
	(b) for the purposes of (a), noise monitoring must be undertaken during the day, evening and night-time periods and within the first month of work as well as throughout the construction period and cover the range of activities being undertaken at the sites; and	Appendix A (Table 6)
	(c) 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, ER and AA. The Planning Secretary and EPA must be provided with access to the results on request.	Appendix A (Table 6 and Table 8, Section 8.2)
	(d) noise monitoring methods must be developed and carried out to meet the requirements of the EPA's Approved Methods for the Measurement and Analysis of Environmental Noise (EPA, 2022).	Appendix A (Section 5)
C18	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 1.4.1 Appendix A (Section 1.4)
C19	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 phased no later than one (1) month before the commencement of that phase.	Section 1.4.1 Appendix A (Section 1.4)
C20	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 phased no later than one (1) month before the commencement of that phase.	Section 1.4.1 Appendix A (Section 1.4)
C21	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 1.4.1 Appendix A (Section 1.4)
C22	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 1.4.1 Appendix A (Section 1.4)
C23	The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, ER, AA (where relevant) and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Notes: - Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan. - Data must be provided in an acceptable format for relevant regulatory agencies. - With regards to monitoring data to be provided to DPE Water, the format of the dataset must be both in a tabulated and electronic quality-controlled data (.csv, Excel) ready to use format.	Appendix A (Section 8.5)

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Acronyms and definitions

Abbreviation	Meaning
AA	The Acoustic Advisor for the CSSI approved by the Planning Secretary
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 and underfloor areas as described in Appendix B of At Receiver Noise Treatment Guideline (Roads and Maritime Services, 2017) and other treatments including, but not limited to, noise curtains, shutters and secondary glazing.
AVTG	NSW Assessing Vibration – a technical guideline
CEMP	Construction Environmental Management Plan
CNVS	Construction Noise and Vibration Standard
DNVIS	Detailed Noise and Vibration Impact Statement(s)
DPE	Department of Planning and Environment
EIS	The Environmental Impact Statement referred to in Condition A1, submitted to the Planning Secretary seeking approval to carry out the development described in it, as revised if required by the Planning Secretary under the EP&A Act, and including any additional information provided by the Proponent in support of the application for approval of the project.
ENMM	Environmental Noise Management Manual
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment.
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve.
Environmental target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ER	The Environmental Representative(s) for the CSSI approved by the Planning Secretary.
ETP	Eastern Tunnelling Project
eVDV	Estimated Vibration Dose Value
GBN	Ground-borne noise
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
Highly noise intensive works	Works which are defined as annoying under the ICNG, including: (a) use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work (b) grinding metal, concrete or masonry (c) rock drilling (d) line drilling (e) vibratory rolling (f) bitumen milling or profiling (g) jackhammering, rock hammering or rock breaking

Abbreviation	Meaning
	(h) rail tamping and regulating (i) impact piling.
IC	Independent Certifier
ICNG	NSW Interim Construction Noise Guideline (DECC, 2009)
JCG	John Holland CPB Ghella Joint Venture
LGA	Local government area
NCA	Noise Catchment Area
NML	Noise Management Level as defined in the ICNG
NPfI	Noise Policy for Industry
NV Program	Noise and Vibration Monitoring Program
NVMP	Noise and Vibration Management Sub-plan
OOHW	Out-of-hours work
POEO Act	Protection of the Environment Operations Act 1997
Project, the	Eastern Tunnelling Package
RBL	Rating Background noise Level
REMM	Revised Environmental Mitigation Measure
RNP	NSW Road Noise Policy
RT&A	Renzo Tonin & Associates
Sensitive land use(s)	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. Note: For the purpose of determining appropriate mitigation, a multi-storey residential flat building must not be counted as a single sensitive receiver.
Sleep disturbance event	Where the subject development / premises night-time noise levels at a residential location exceed: (a) $L_{Aeq, 15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and / or (b) L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.
SWL	Sound Power Level
SPL	Sound Pressure Level
TBM	Tunnel boring machine
VC	Vibration criterion
VDV	Vibration Dose Values

Part A: Overview

1. Introduction

1.1. Context

This Noise and Vibration Management Sub-plan (NVMP or Sub-plan) is applicable to the construction of the Sydney Metro West - Eastern Tunnelling Package (ETP Works or the Project). This Sub-plan describes how John Holland CPB Ghella Joint Venture (JCG) will minimise and manage the construction noise and vibration impacts of the Project.

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

- State Significant Infrastructure (SSI) 19238057 Planning Approval (dated 24 August 2022) and relevant conditions of the Sydney Metro West Concept Schedule 2 of SSI 10038 Planning Approval (dated 11 March 2021) (Planning Approvals)
- Environment Protection Licence (EPL) (details to be added on receipt of the EPL)
- Sydney Metro West – Stage 2 – Phasing Report
- AS/NZS ISO 14001:2016 Environmental Management Systems – Requirements with guidance for use
- Sydney Metro Construction Environmental Management Framework (CEMF) Version 4.3
- 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 ETP Deed and General and Particular Specifications
- Applicable legislation.

1.2. Objectives, targets and key performance indicators

The objectives, targets and key performance indicators for noise and vibration management are detailed in Table 2.

Table 2: Objectives, targets and key performance indicators

Objectives	Targets	Key Performance Indicators
Ensure the requirements of the Planning Approval, REMMs, performance outcomes, EPL (on receipt) 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
Minimise noise and vibration impacts on residents and businesses	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) and the Interim Construction Noise Guideline (ICNG)	Number of avoidable noise or vibration complaints
	100% compliance with the respite requirements of the Planning Approval and this Sub-plan	Number of breaches of respite requirements
Avoid structural damage to buildings or heritage items as a result of construction vibration	No verified property structural damage complaints (attributed to ETP Works)	Number of verified property structural damage complaints
	100% notification of owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage before works that	Number of avoidable complaints associated with notifications

Objectives	Targets	Key Performance Indicators
	generate vibration commence in the vicinity of those properties	
Undertake active community consultation	100% notification of potentially affected noise sensitive receivers of works outside standard construction hours not less than 5 calendar days and not more than 14 calendar days before those works are to be undertaken	Number of avoidable complaints associated with notifications
Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners	100% avoidance of noise levels above the NMLs in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas, unless other reasonable arrangements with the affected institutions are made.	Number of avoidable noise or vibration complaints in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas

1.3. Context and interface with other plans

To achieve the intended environmental performance outcomes of the Project, JCG have established an Environment and Sustainability Management System (E&SMS) in accordance with the requirements of ISO 14001:2016. Guided by the Environment and Sustainability Policy, the E&SMS consists of a Construction Environmental Management Plan (CEMP), issue-specific procedures, Sub-plans and monitoring programs as illustrated in Figure 1. Implementation of the E&SMS is achieved through tools, checklists and forms as detailed in the CEMP.

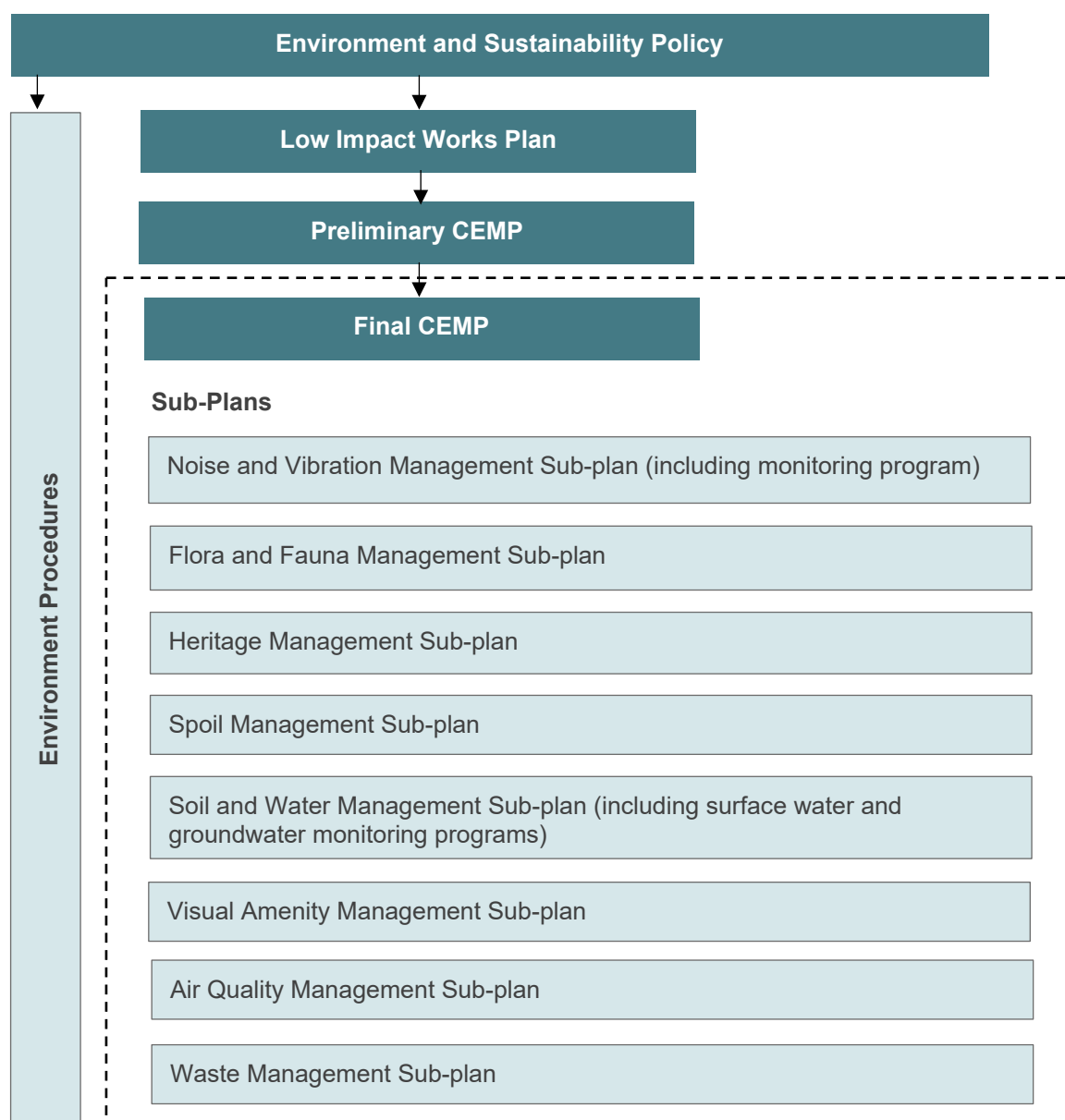


Figure 1: CEMP Framework

1.4. Consultation and approval

1.4.1. Agency and stakeholder consultation and approval

Reflecting the requirements of Conditions A6, C5 and C14, this Sub-plan and the Noise and Vibration Monitoring Program (NV Program) (Appendix A) will be prepared in consultation with Place Management NSW (in respect of The Bays), City of Sydney Council, Inner West Council and the Environment Protection Authority (EPA) (NV Program only). A detailed consultation report, including matters raised by stakeholders and JCG responses is provided in Appendix F.

In accordance with the Phasing Report, the NVMP and NV Program will be endorsed by the Environmental Representative (ER) and then submitted to the Planning Secretary for approval at least one month before the commencement of the Tunnelling, Excavation and Associated Works phase (refer to Section 2.3).

The CEMPs, Sub-plans and monitoring programs not requiring the Planning Secretary's approval will be endorsed by the AA and ER as being in accordance with the conditions of approval and all relevant undertakings made in the EIS and Submissions Report. The CEMP, Sub-plans and monitoring

programs will be submitted to the ER no later than one month before construction or where construction is phased no later than one month before the commencement of that phase.

The Tunnelling, Excavation and Associated Works phase (refer to Section 2.3) will not commence until the CEMPs, Sub-plans and monitoring programs have been approved by the Planning Secretary or endorsed by the ER (whichever is applicable). The CEMPs, Sub-plans and monitoring programs, as approved by the Planning Secretary or endorsed by the ER (whichever is applicable), including any minor amendments approved by the ER, will be implemented for the duration of the Project. In accordance with the Sydney Metro Phasing Report, construction of a phase will not commence until the CEMP and CEMP Sub-plans for that phase have been approved by the Planning Secretary or endorsed by the ER upon nomination by the Planning Secretary (whichever is applicable).

1.4.2. Community consultation

Consultation will be undertaken with the community affected by out of hours works (OOHW), in accordance with Condition D37 (refer to Section 8.5.4). Ongoing consultation with the community will be carried out for issues pertaining to the Project's noise and vibration impacts, including the identification of appropriate respite periods for OOHWs. The outcomes of the community consultation will be provided to the ER, EPA and the Planning Secretary.

To comply with Condition D29, affected sensitive land users near construction works that exceed the noise and vibration objectives for NSW (Section 6) will be consulted on mitigation measures during the development of the DNVIS for these sites. 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 or vibration generating works are predicted above the noise and vibration objectives for NSW (Condition D27).

Residential receivers affected by construction noise or vibration from the Project will be determined through the assessment included in the DNVIS and Gateway (see Section 7.4). Community notification and consultation requirements for these works are identified and described in the DNVIS. Community feedback, complaints and consultation regarding construction noise and vibration will be undertaken in accordance with the Community Communications Strategy.

1.4.3. Cumulative and consecutive noise impact

Ongoing consultation will include regular coordination with Place Management NSW (in respect of The Bays), State significant developments, infrastructure projects and other construction works that may result in cumulative impacts. 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), D36 and the EPL.

1.5. Sub-plan structure

Table 3: Plan structure

Part	Details
Part A: Overview	▪ Project overview ▪ Legal and other requirements ▪ People and collaboration ▪ Existing environment ▪ Environmental aspects and impacts ▪ Environmental control measures ▪ Compliance management ▪ Review and improvement
Part B: Implementation Systems and Tools	This section summarises the systems and tools that will be implemented to achieve compliance with the Planning Approval, REMMs, CEMF and EPL.
Part C: Annexure	Further documents and information that support this Sub-plan include: ▪ Appendix A Noise and Vibration Monitoring Program (NV Program) ▪ Appendix B Land Use Survey ▪ Appendix C Surface Worksites: Indicative Mitigation Measures ▪ Appendix D Tunnelling Works: Ground-borne noise and vibration predictions ▪ Appendix E Noise and Vibration Management Procedures ▪ Appendix F Consultation Report ▪ Appendix G Environmental Representative and Acoustic Advisor Endorsements

2. Project overview

2.1. Background

Sydney Metro West is a new 24-kilometre metro line that will connect Greater Parramatta with the Sydney CBD via stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD).

The planning process for Sydney Metro West was assessed as a staged infrastructure application under section 5.20 of the *Environment Planning and Assessment Act 1979* (EP&A Act).

Stage 1 of the development, the Sydney Metro West Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (SSI-10038 Schedule 2), was approved on 11 March 2021 and includes:

- Construction of a new passenger rail infrastructure between Westmead and The Bays, including:
 - Tunnels, stations (including surrounding areas) and associated rail facilities
 - Stabling and maintenance facilities (including associated underground and overground connections to tunnels)
- Modification of existing rail infrastructure, including stations and surrounding areas
- Ancillary development.

Stage 2 of the planning approval process, the ETP Works, includes all major civil construction work including station excavation (Pyrmont Station and Hunter Street Station (Sydney CBD) and tunnelling between The Bays and Sydney CBD (Figure 2).

It is noted that the existing Sydney Metro West precast facility at Eastern Creek will be utilised in the delivery of the ETP Works. The facility, which was assessed by Sydney Metro in a Review of Environmental Factors (REF) and approved on 11 March 2021, is outside of the scope of the NVMP.

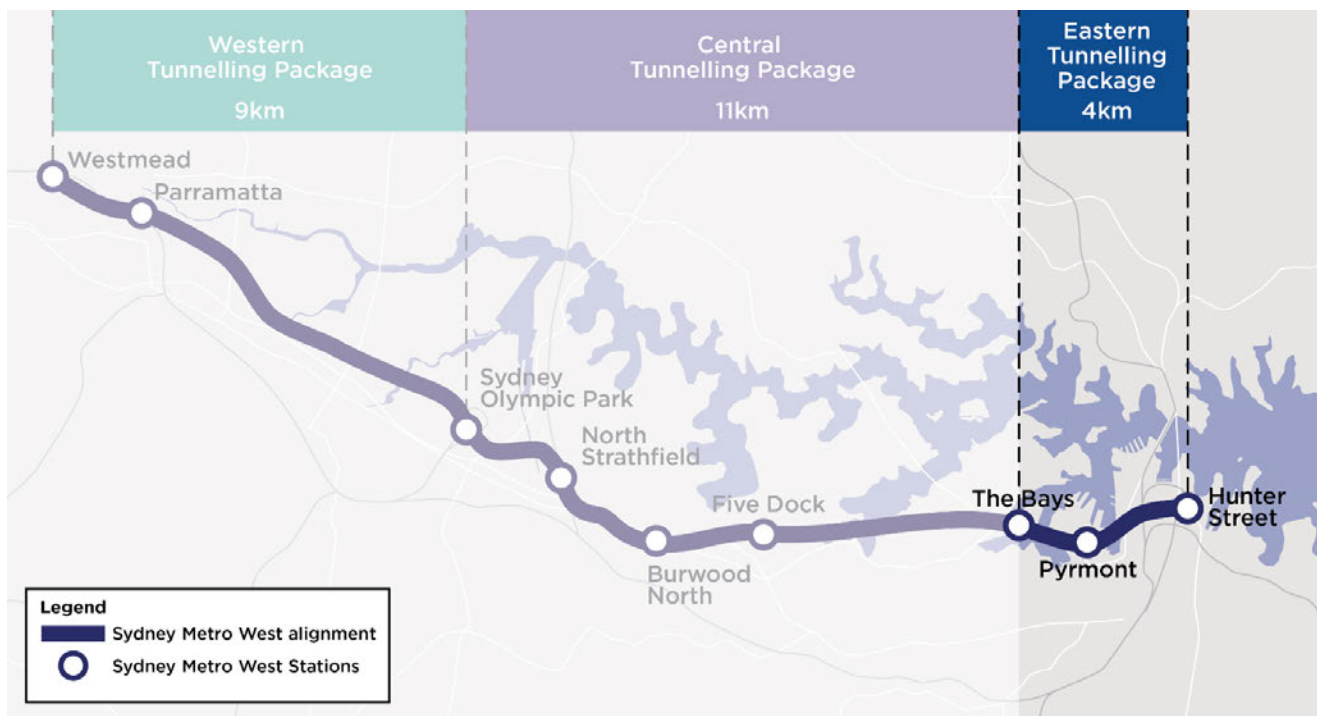


Figure 2: Overview of the Sydney Metro West between The Bays and Sydney CBD (Source: EIS)

2.2. Project scope

The ETP Works (construction) involves the delivery of:

- Enabling works such as demolition, utility supply to construction sites, utility adjustments and modifications to the existing transport network
- Mined crossover cavern construction
- 4.2 km of TBM tunnel excavation, 650m of mined tunnels and 7 cross passage excavation, from The Bays to Sydney CBD
- Excavation for two new underground metro stations at Pyrmont and Hunter Street
- Construction of a turnback, crossover tunnels and caverns at the eastern end of the tunnel section
- A concrete segment facility for use during construction located at Eastern Creek (outside of the scope of this Sub-plan).

2.3. Project phasing

Reflecting the outcomes of a detailed environmental risk assessment, the ETP Works will be delivered through a phased approach. This approach, detailed in the Phasing Report, includes Low Impact Works as defined under the SSI 19238057 Planning Approval and the activity-based phases for construction (Table 4). Additional details on the phasing of construction activities at each worksite is provided in Table 5.

Table 4: Overview of ETP Works phasing

Phase	Description	Indicative timing	Environmental documentation	Consultation and approvals
Low Impact Works	Activities defined as Low Impact Works under SSI 19238057 Planning Approval, including survey work, investigations, utility relocations, installation of environmental controls and initial demolition works	Project award to May 2023	▪ Low Impact Works Plan ▪ Low Impact Works DNVIS	▪ ER endorsement
Preliminary Works	Including works within the existing Hunter Street East acoustic shed, and critical enabling works which are required to be conducted outside of standard hours	March to May 2023	▪ Preliminary CEMP ▪ Environmental Procedures ▪ Hunter Street East acoustic shed works DNVIS ▪ Project-wide Out of Hours Works DNVIS	▪ Stakeholder consultation (refer to Section 1.4) ▪ ER endorsement
Tunnelling, Excavation and Associated Works (addressed in this Sub-plan)	Including the Preliminary Works (not completed prior to approval of the final CEMP), demolition of existing industrial premises, site establishment, piling and shaft excavation, tunnelling, and decommissioning	May 2023 onward	▪ CEMP ▪ Sub-plans ▪ Environmental Procedures ▪ DNVISs (TBA)	▪ Stakeholder consultation ▪ ER endorsement ▪ DPE approval (as determined by the Phasing Report)

Table 5: Overview of construction activities by worksite and work phase

Worksite	Site condition at handover to JCG	Low Impact Works	Preliminary Works	Final CEMP
Project wide design survey and investigations	N/A	- Survey control, instrumentation and monitoring including installation of benchmarks and installation of optical survey targets - Geotechnical drilling (locations to be confirmed in Environmental Control Maps)	- Survey control, instrumentation and monitoring including installation of extensometers and piezometers (outside of standard construction hours) - Geotechnical drilling (OOHW)	N/A
The Bays	- Existing Central Tunnelling Package (CTP) Worksite - Existing shaft (30 metres in depth) - Existing high voltage construction power supply conduits - Existing temporary buildings	- Installation of environmental controls - Use of existing offices and amenities for start-up - Secure site - Establishment of pedestrian bridge over site access road	N/A	- Establishment of additional temporary offices amenities and car parking - Establish high voltage construction power supply and water supply from existing Central Tunnelling Package substation - Nozzle enlargements and TBM launch stub tunnels - TBM assembly, launch and tunnelling support works from an existing shaft - Cross passage construction - Segment storage, temporary Water Treatment Plant (WTP) and Slurry Treatment Plant (STP) - Principal spoil handling facility for ETP Works
Pymont West	- Existing buildings: 26-32 Pymont Bridge Road, Pymont (five stories including two basement levels)	- Establish portable amenities - Initial demolition works including: - Hazmat investigation and structural investigation - Establishment of site security and hoardings - Establishment of truck access - Demolition work (soft strip only)	- Utility adjustment works, including: - Appropriately 20m of trenching in the northern footpath of Pymont Bridge Road (day shift) - Approximately 50m of trenching in Paternoster Row (day shift)	- Establish site including new construction access driveways, site hoardings, instrumentation and monitoring - Utility works, including establishment of temporary construction services, investigation and protection of existing assets, and

Worksite	Site condition at handover to JCG	Low Impact Works	Preliminary Works	Final CEMP
		- Five archaeological test trenches and, if triggered, salvage excavations - Prepare archival recordings (subject to access)	- Removal of overhead cabling from the northern footpath of Pymont Bridge Road (one OOHV shift) - Adjustment of property utility connections	- decommissioning of redundant assets - Demolition of existing buildings - Archaeological monitoring during basement slab removal and investigations (if required) - Establishment and use of temporary offices and amenities - Excavation of temporary shaft within the station shaft footprint - Installation of acoustic shed with gantry crane and steel bridging deck for excavation of station shaft, pedestrian and service adits and spoil handling for cross over cavern - Permanent concrete lining of cavern and adit connections - Installation of acoustic shed will support material handling outside standard hours of work
Pymont East	- Existing buildings 37-69 Union St, Pymont (four stories with no basement)	- Establish portable amenities - Initial demolition works including: - Hazmat investigation and structural investigation - Establishment of site security and hoardings - Establishment of truck access - Demolition work (soft strip only) - Detailed Site Investigation - Street tree removal	- Detailed Site Investigation - Adjustment of property utility connections	- Establish site including new construction access driveways, site hoardings, instrumentation and monitoring - Decommissioning of existing electricity kiosk - Utility works, including establishment of temporary construction services, investigation and protection of existing assets, and decommissioning of redundant assets - Establishment of high voltage construction power supply - Demolition of existing buildings

Worksite	Site condition at handover to JCG	Low Impact Works	Preliminary Works	Final CEMP
				- Contamination management based on DSI - Establishment of high voltage construction power supply - Establishment and use of temporary offices and amenities - Excavation of temporary shaft within the station shaft footprint - Installation of acoustic shed with gantry crane and steel bridging deck for excavation of station shaft and cavern - Permanent concrete lining of station cavern and nozzle enlargements - Installation of acoustic shed will support material handling outside standard hours of work
Hunter Street West	- Existing buildings 7-13 Hunter St, Sydney (9 Hunter St) (21 stories including one basement level) 5 Hunter St, Sydney (304-408 George St, Sydney) (16 stories, including two basement levels) 298-302 George St, Sydney (16 stories, including one basement level) 312 George St, Sydney (one story with no basement) 314-318 George St, Sydney (nine stories, including one basement level) - Heritage building at 296 George St directly (adjacent to Hunter Street West site)	- Establish portable amenities - Archaeological investigations of DeMestre Place (if access dates allow) - Initial demolition works including: - Hazmat investigation and structural investigation - Establishment of site security and hoardings - Establishment of truck access - Demolition work (soft strip only) - Demolition soft strip - Prepare archival recordings (subject to access)	- Establish construction access driveways at the Hunter Street East site and the Hunter Street West site - Utility investigation potholes - Adjustment of property utility connections	- Protection, adjustment and decommissioning of utility services - Temporary services investigation and installation at DeMestre Place - Relocate street lighting pole to allow site access - Establish site including new construction access driveways, site hoardings, instrumentation and monitoring - Demolition of existing buildings - Archaeological monitoring during basement slab removal and investigations (if required) - Establishment and use of temporary offices and amenities

Worksite	Site condition at handover to JCG	Low Impact Works	Preliminary Works	Final CEMP
Hunter Street East	- Site hoarding - Existing acoustic shed, spoil handling facilities and truck access - Existing excavation within acoustic shed (approximately 5 metres below road level) - Existing temporary WTP and high voltage power supply - Existing temporary office and amenities - Existing buildings: 28-34 O'Connell St, Sydney (19 stories, including three basement levels) 44-48 Hunter St, Sydney (16 stories, including one basement level) 37 Bligh St, Sydney (16 stories, including one basement level) 33 Bligh St, Sydney (steel shed, appropriately 20m in height)	- Use of existing offices and amenities - Maintenance of existing temporary WTP - Internal temporary fit-out within the existing Hunter St East acoustic shed: - Reticulate high voltage power supply ready for decline excavation - Site adjustments within the acoustic shed to facilitate the high voltage construction power reconfiguration - Establish (including assembly) road header, dust scrubber, shotcrete and bolting equipment - Site establishment within existing offices and amenities - Initial demolition works including: - Hazmat investigation and structural investigation - Establishment of site security and hoardings - Establishment of truck access - Demolition work (soft strip only) - Street tree trimming/removal - Prepare archival recordings (subject to access)	- Preliminary excavation within the existing acoustic shed (works to be conducted 24 hours each day and 7 days each week) - Temporary declines using a road header - Ventilation-duct bores - Ventilation adits using a Brock excavator - Approximately 50 truck movements per day (conducted in accordance with a Construction Traffic Management Plan) - Use of existing WTP (subject to the inclusion of alternative discharge criteria in the EPL) - Load-out of excavated spoil - Utility investigation potholes - Adjustment of property utility connections	- Excavation of station access shaft - Upgrade of high voltage construction power supply - Excavation of station cavern, nozzle enlargements and turnbacks from within an existing acoustic shed - Establish site including new construction access driveways, site hoardings, instrumentation and monitoring - Tree trimming and removal - Demolition of existing high-rise buildings and excavation of stage 1 of station access shaft - Archaeological monitoring during basement slab removal and investigations (if required) - Backfill of temporary decline prior to decommissioning - Demolition of existing acoustic shed and amenities and excavation of stage 2 of station access shaft - Concrete lining of station cavern and turnbacks - TBM disassembly and retrieval
Eastern Creek	Existing temporary precast facility	N/A (site is not within the scope of SSI 19238057)	N/A (site is not within the scope of SSI 19238057)	N/A (site is not within the scope of SSI 19238057)

3. Legal and other requirements

3.1. Legislation

This Sub-plan is prepared in accordance with the:

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

Additional details on legislative requirements are provided in Section 3.3 of the CEMP.

3.2. Guidelines

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

- Sydney Metro CNVS SM-20-00098866 v4.3, Sydney Metro 4 November 2020
- Interim Construction Noise Guideline (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
- NSW Approved Methods for the Measurement and Analysis of Environmental Noise, Environment Protection Authority 2022
- Australian Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS 2187.2-2006 Explosives – Storage and use – Part 2 Use of explosives
- Australian Standard AS2436-2010 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 DIN4150-2016 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 Sydney Metro West projects. It defines a minimum standard for managing noise and vibration impacts that considers current best practice guidelines and other regulatory requirements.

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

3.4. Other requirements

Other environmental requirements relevant to managing noise and vibration impacts include:

- SSI 19238057 Planning Approval (dated 24 August 2022) and relevant conditions of the Sydney Metro West Concept Schedule 2 of SSI 10038 Planning Approval (dated 11 March 2021) (Planning Approvals)
- EPL (details to be added on receipt of the EPL)
- Sydney Metro West Stage 2 – Phasing Report, Rev 1.0
- Sydney Metro CEMF
- EIS and the Submissions Report, including the REMMs
- Contractual requirements including the ETP Deed and General and Particular Specifications.

In addition, the ETP works will be assessed by the Infrastructure Sustainability Council (ISC) IS V1.2 Rating. Noise and vibration requirements of the relevant credits (DIS-2 Noise and DIS-3 Vibration) are

summarised in Table 6, including cross-references to where the requirement is addressed in this NVMP. Additional details on the ISC requirements and the credit objectives are provided in the Sustainability Management Plan.

Table 6: ISC Noise and Vibration Credits

ISC Credit	Level	Criteria	Reference
DIS-2 Noise	1	Measures to mitigate noise during construction and operation have been identified and implemented.	Section 8
	1	Monitoring of noise is undertaken at appropriate intervals and in response to complaints during construction.	Appendix A
	2	For construction, modelling and monitoring demonstrates no recurring or major divergences from the noise management process in ISCA approved noise guidelines.	Appendix A
	3	For construction, modelling and monitoring demonstrates no divergence from the noise management process in ISCA approved noise guidelines.	Appendix A
DIS-3 Vibration	1	Measures to mitigate vibration during construction and operation have been identified and implemented.	Section 8
	1	Monitoring of vibration is undertaken at appropriate intervals and in response to complaints during construction and operation.	Appendix A
	2	For construction, modelling and monitoring demonstrates no exceedances of vibration goals for structural damage to buildings and structures.	Appendix A

4. People and collaboration

4.1. Our team

The roles and responsibilities of key JCG personnel with respect to noise and vibration management are detailed in Table 7.

Table 7: Key roles, authority and responsibility

Element	Description
Project Director	
Role	Manage the delivery of the Project in accordance with the ETP Deed
Authority	- Hold the authority to direct personnel or subcontractors to carry out actions to avoid or minimise unintended environmental impacts - Act as the Contractor's Representative
Responsibility	- Accountable for the environmental and sustainability performance of the Project - Allocate sufficient resources to achieve noise and vibration management compliance
Minimum Skill Level	- Tertiary qualification in Engineering or other associated disciplines - Relevant experience on similar projects and significant project delivery experience
Project Interface	Lead the JCG Senior Leadership Team and interface with Sydney Metro team
Environment, Approvals and Sustainability Director	
Role	Manage the delivery of environment and sustainability requirements
Authority	- Authority to produce any correspondence and documentation necessary for approvals, and environmental and sustainability management - Authority to take all reasonable steps to achieve environmental compliance
Responsibility	- Accountable for noise and vibration management performance - Oversee the implementation of all noise and vibration management initiatives, including coordinating responses to noise and vibration complaints - Lead the creation of a consultative and proactive culture that ensures environmental compliance and 'No Harm' as a driver of work behaviour - Lead and manage the development and implementation of a risk-based EMS - Ensure environmental and sustainability participation at Value Engineering Workshops - Provide specialist noise and vibration management advice to the Project Director and other functional managers to facilitate design and construction - Oversee the preparation of environmental assessments on design changes and obtain any necessary planning approvals - Oversee the reporting, investigation and response to environmental incidents or complaints - Liaise with Sydney Metro and external stakeholders on performance and continual improvement - Engage with the Environment Protection Authority (EPA) to obtain an EPL
Minimum Skill Level	- Tertiary qualification in Environmental Engineering, Science, Sustainability or other associated discipline - Recent relevant experience in environmental management on a similar project - Minimum of 15 years' environmental management experience and 5 years' sustainability management
Project Interface	Member of the JCG Senior Leadership Team and interface with Sydney Metro West Environment and Sustainability team
Environment Manager	
Role	Manage day-to-day environmental compliance, including noise and vibration management
Authority	Authority to stop works where a Hold Point has not been adequately released
Responsibility	- Assist the Environment, Approvals and Sustainability Director in the creation of a consultative and proactive culture - Manage the implementation of the CEMP, including noise and vibration management

Element	Description
	- Deliver the environmental induction and training program - Undertake environmental site monitoring and inspections - Facilitate site inspections with Sydney Metro, the ER and the Acoustic Advisor (AA) - Report and assist in incident management
Minimum Skill Level	- Tertiary qualification in Environmental Engineering, Science, Sustainability or other associated disciplines - Minimum of 8 years' relevant experience
Project Interface	Attend environment, sustainability, design and construction meetings
Environmental Advisor	
Role	Support day-to-day environmental compliance, including noise and vibration management
Authority	Authority to stop works where a Hold Point has not been adequately released
Responsibility	- Assist the Environment Manager in the creation of a consultative and proactive culture - Support the implementation of the CEMP, including noise and vibration management - Deliver the environmental induction and training program - Undertake environmental site monitoring and inspections - Facilitate site inspections with Sydney Metro, the ER and the Acoustic Advisor (AA) - Report and assist in incident management
Minimum Skill Level	- Tertiary qualification in Environmental Engineering, Science, Sustainability or other associated disciplines - Minimum of 2 years' relevant experience
Project Interface	Attend environment, sustainability, design and construction meetings
Site Supervisor	
Role	Assist the Project Director in implementing the requirements of this Sub-plan
Authority	Authority to stop works where a Hold Point has not been adequately released
Responsibility	- Support the implementation of the CEMP, including noise and vibration controls - Deliver the environmental inductions where required - Undertake environmental inspections - Report and assist in incident management
Minimum Skill Level	- Qualification in relevant trade - Minimum of 5 years' relevant experience
Project Interface	Attend construction meetings
Stakeholder and Community Engagement Director	
Role	Manage the delivery of stakeholder and community engagement requirements
Authority	- Authority to produce any correspondence and documentation necessary for stakeholder and community engagement - Authority to take all reasonable steps to achieve the stakeholder and community engagement elements of this Sub-plan
Responsibility	- Accountable for stakeholder and community engagement - Oversee the implementation of all stakeholder and community engagement requirements detailed in this Sub-plan - Liaise with Sydney Metro and external stakeholders on noise and vibration management
Minimum Skill Level	- Tertiary qualification in relevant discipline - Recent relevant experience in stakeholder and community engagement on a similar project - Minimum of 15 years' stakeholder and community engagement experience
Project Interface	Member of the JCG Senior Leadership Team and interface with Sydney Metro West

4.2. Specialist consultants

Renzo Tonin & Associates (RT&A) has been engaged to undertake 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 Detailed Noise and Vibration Impact Statements (DNVISOs) 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, Acoustic Advisor and ER

The Acoustic Advisor (AA) and the ER, as appointed by Sydney Metro, have roles that include overseeing noise and vibration management. The Environment, Approvals and Sustainability team will openly communicate and consult with Sydney Metro, the AA and the ER. This will include:

- Working collaboratively to ensure appropriate strategies are identified and implemented
- Holding regular meetings with the Sydney Metro Environment Team to provide updates on the construction process and receive any feedback
- Facilitating regular inspections with Sydney Metro, and the ER
- Providing all noise and vibration documents required to be prepared under the conditions of approval and access to monitoring activities and data
- Recording and responding appropriately to environmental complaints and enquiries and reporting them to Sydney Metro and other stakeholders including the ER and the EPA in a timely manner
- Providing comprehensive information to manage incidents including details on preventative actions to avoid re-occurrence.

5. Existing environment

5.1. Surrounding communities

The Project is located within the City of Sydney and Inner West Local Government Areas (LGAs) and traverses from The Bays to Hunter Street in the Sydney Central Business District (CBD).

Building on the land use survey presented in the EIS, an updated land use survey is provided in Appendix B to satisfy Condition D20. 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 (GBN) impacts to be easily identified and updated as land uses change during the delivery of the ETP Works. The data can be readily included into the ETP Works noise and vibration modelling and impact management system, to allow effective identification and management of identified sensitive receivers.

To facilitate the assessment of noise impacts from the ETP 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 ETP Works. The EIS assessment process identified a total of 7 NCAs between The Bays and Hunter Street.

5.2. Existing acoustic environment

Existing noise levels vary across the ETP Works. The surface worksites are in mixed residential and commercial areas, with some industrial areas around The Bays. The noise environment is typically characterised by urban sounds, road traffic noise, mechanical plant noise (especially in the CBD near Hunter Street) and other transport noise, including the Light Rail and harbour traffic.

As part of the EIS process, baseline noise monitoring was conducted at six locations between The Bays and Hunter Street. At The Bays, further review of the NCAs identified in the EIS has been completed; NCA2 has been subdivided into three NCAs to better represent the existing acoustic environment and to provide consistency with the EIS for the Western Harbour Tunnel (WHT) and Warringah Freeway Upgrade (WU) project (Renzo Tonin & Associates 2020).

The ambient noise monitoring locations were selected with reference to the procedures outlined in the Noise Policy for Industry (NPfI). The rating background level (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 and ambient noise levels (L_{Aeq}) for the day, evening and night assessment periods is described in detail within the NPfI. The appropriate RBLs and ambient noise levels (L_{Aeq}) for each NCA, as summarised in Table 8, were determined through noise monitoring.

Table 8: Summary of baseline noise monitoring data from EIS

NCA	Nearest construction worksite	Monitor ID	RBL ¹			Ambient noise level (L_{Aeq}) ¹		
			Day ²	Eve ²	Ngt ²	Day ²	Eve ²	Ngt ²
NCA01	The Bays	B.02	51	51	45	57	57	54
NCA02A	The Bays	B.01	43	43	35	56	54	47
NCA02B	The Bays	B.40 ³	42	44	38	54	53	48
NCA02C	The Bays	B.34 ³	49	49	46	54	51	49
NCA03	They Bays	B.03	48	47	39	59	58	51
NCA04	Pymont	B.04	50	47	45	56	50	47
NCA05	Pymont	B.05	52	49	46	61	59	56
NCA06	Hunter Street	B.06	61	56	52	66	62	63
NCA07								

NOTES:

1. RBL and L_{Aeq} noise levels determined with reference to NPfI procedures
2. Day is 07:00 to 18:00; Eve (evening) is 18:00 to 22:00; Ngt (night) is 22:00 to 07:00
3. Noise monitoring data from Renzo Tonin & Associates 2020.

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. The relevant goals, standards and guidelines are outlined in Table 9.

Table 9: Standards and guidelines applicable to construction noise and vibration management

Environmental impact	Standard/ guideline used to establish noise and vibration objectives
Construction hours	- Planning Approvals - EPL (when granted)
Airborne noise	- Planning Approvals - ICNG
Sleep disturbance and maximum noise events	- Construction noise – NPfl - Road traffic noise – RNP and the RMS Environmental Noise Management Manual (ENMM) Practice Note 3
GBN	- Planning Approvals - ICNG - Australian Standard AS/NZS 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors
Construction-related road traffic noise	No specific guidelines, but guidance taken from the ICNG and the RNP
Vibration (disturbance to building occupants)	- Planning Approvals - AVTG, which incorporates British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz)
Vibration (structural damage to buildings)	- Planning Approvals - 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
Vibration (structural damage to buried services)	German Standard DIN 4150:2016 – Part 3 Structural vibration in buildings – Effects on structures
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-hour equivalent continuous A-weighted sound pressure level of LAeq,8h of 85dB(A)

6.1. Hours of work

6.1.1. Construction hours

Construction hours are set out in Conditions D21, D22 and D23 and are summarised in Table 10.

Table 10: Construction hours

Condition of Approval	Construction activity	Monday to Friday	Saturday	Sunday and public holidays
D21	Standard construction hours	7.00am to 6.00pm	8.00am to 6.00pm	No work ¹
D22	Highly noise intensive work (+ respite) ²	8.00am to 6.00pm	8.00am to 1.00pm	No work ¹
D39 and D40	Rock breaking and other particularly highly noise intensive activities for station shaft or cut and cover stations at:			

Condition of Approval	Construction activity	Monday to Friday	Saturday	Sunday and public holidays
	Hunter Street	07:00pm to 8:00pm ³	07:00pm to 8:00pm ³	07:00pm to 8:00pm ³
	Pymont.	7.00am to 6.00pm ³	8.00am to 6.00pm ³	No work ¹
D23(a)	Safety and emergency work ⁴	6:00pm to 7:00am	6:00pm to 8:00am	8:00 am to 7:00am
D23(b) and D40	Low noise impact work ⁵	6:00pm to 7:00am	6:00pm to 8:00am	8:00am to 7:00am
D23(c)	Works approved under and EPL or Out-of-Hours Work Protocol	6:00pm to 7:00am	6:00pm to 8:00am	8:00am to 7:00am
D23(d)	Prescribed activity: (i) Tunnelling and associated surface support works ⁶ (ii) delivery of material to directly support tunnelling activities ⁷ (iii) Haulage of spoil ⁸ (iv) Work within an acoustic shed or enclosure ⁹	24 hours	24 hours	24 hours

NOTES:

- No work unless permitted and approved.
- 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).
- Respite provided by ensuring noise levels are less than $L_{Aeq}(15 \text{ minute})$ 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below $L_{Aeq}(15 \text{ minute})$ 55 dB(A). Noise equal to or above $L_{Aeq}(15 \text{ minute})$ 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm.
- 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.
- Construction that causes $L_{Aeq}(15 \text{ minute})$ noise levels no more than 5dB(A) above the Rating Background Level (RBL) at any residence; and no more than the 'noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s). Construction that causes $L_{AFmax}(15 \text{ minute})$ noise levels no more than 15 dB(A) above the RBL at any residence. 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.
- Tunnelling does not include cut and cover tunnelling and surface works
- Except between the hours of 22:00 and 07:00 to or from the Pymont construction sites where a sleep disturbance event is triggered for receivers in the proximity of Pymont Street, Edward Street, Union Street, Paternoster Row and Pymont Bridge Road
- Except between the hours of 10:00 pm and 7:00 am to / from the Pymont construction sites
- Where there is no exceedance of noise levels under Low Noise Impact Work circumstances identified in D23(b), unless otherwise agreed by the Planning Secretary

Condition D23 (d) lists Prescribed Activities permitted to occur outside of the standard work hours set out in Condition D21. Approval from the EPA via the EPL will be obtained for other required out of hours works in accordance with Condition D23(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.

6.2. Airborne construction noise objectives

Construction noise management levels have been determined using the ICNG and the Planning Approvals, in accordance with the CNVS. The ICNG provides guidelines for the assessment and management of airborne construction noise. It encourages 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, unless approval is given for works that cannot be undertaken during these hours
- 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.

6.2.1. Residential receivers

Construction noise management levels (NMLs) have been determined using the ICNG as required by Condition D25(a), and in accordance with the Sydney Metro CNVS. These levels are outlined below in Table 11.

Table 11: ICNG construction noise management levels

Time of day	NML LAeq(15min)	How to apply
Standard hours: Monday to Friday 07:00 to 18:00 Saturday 08:00 to 18:00 (as permitted by Condition D21)	RBL + 10dB(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 minute) is greater than the noise affected level, we will apply all feasible and reasonable work practices to minimise noise. We will also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, and contact details.
Standard hours	Highly noise affected 75dB(A)	The highly noise affected level represents the point above where there may be strong community reaction to noise. Where noise is above this level, we will consider other feasible and reasonable ways to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, we will communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	A strong justification will be required for works outside the recommended standard hours. We will apply all feasible and reasonable work practices to meet the noise affected level.

Maximum noise level events from construction activities during the night period can trigger both awakenings and disturbance to sleep stages. The approach to managing events that cause sleep disturbance will be consistent with the NPfl and in accordance with the Sydney Metro CNVS. A detailed maximum noise level event assessment will be undertaken where night noise levels at a residential location exceed the:

- $L_{Aeq,15min}$ 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater
- L_{AFmax} 52dB(A) or the prevailing RBL plus 15dB, whichever is the greater.

The detailed assessment will cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, the number of awakening events during the night period and additional event specific noise mitigation measures that are not included in the DNVIS.

Table 12 details the NMLs for residential receivers for each of the NCAs described in Section 5 of this Sub-plan. NMLs apply at the most noise-affected affected locations within the property boundary and at a height of 1.5 m above floor level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence.

Table 12: Noise Management Levels (NMLs) for residential receivers (external)

NCA	Nearest construction worksite	Monitor ID	NML $L_{Aeq}(15min)$					Sleep disturbance	
			Standard hours ¹	OOH Day ²	OOH Eve ²	OOH Ngt ²	OOH MS ²	$L_{Aeq}(15min)$	L_{AFmax}
NCA01	The Bays	B.02	61	56	56	50	53	50	60
NCA02A	The Bays	B.01	53	48	48	40	44	40	50
NCA02B	The Bays	B.40	52	47	47	43	45	43	53
NCA02C	The Bays	B.35	59	54	54	51	53	51	61
NCA03	They Bays	B.03	58	53	52	44	49	44	54
NCA04	Pymont	B.04	60	55	52	50	53	50	60
NCA05	Pymont	B.05	62	57	54	51	54	51	61
NCA06	Hunter Street	B.06	71	66	61	57	61	57	67
NCA07									

NOTES:

- Standard construction hours from 07:00 to 18:00 Monday to Friday and from 08:00 to 18:00 Saturday
- OOH Day (Out-of-hours Day): 08:00 to 18:00 Sunday and Public holidays (OOHW P1); OOH Eve (Out-of-hours Evening): 18:00 to 22:00 Monday to Saturday (OOHW P1) and 18:00 to 22:00 Sunday (OOHW P2); OOH Ngt (Out-of-hours Night): 22:00 to 07:00 Monday to Friday, and 22:00 to 08:00 Saturday, Sunday and Public holidays (OOHW P2); OOH MS (Out-of-hours Morning shoulder): 05:00 to 07:00 Monday to Friday, and 06:00 to 08:00 Saturday, Sunday and Public holidays (OOHW P2)

6.2.2. 'Other Sensitive' Land Uses and Commercial Receivers

Non-mandatory management levels for noise near properties which are sensitive to noise impacts are presented in Table 13. These values are set and based on the principle that the characteristic activities for each will not be unduly disturbed.

Other noise-sensitive businesses require specific noise goals, and the ICNG sets out that the internal construction noise levels at these premises are to be referenced to the 'maximum' internal levels presented in AS 2107. Recommended 'maximum' internal noise levels from AS 2107 are reproduced in Table 13 for other sensitive receiver types.

Table 13: Noise management levels for certain sensitive receivers (applicable when property is in use)

Land use	NML $L_{Aeq}(15minute)$ Internal	External
ICNG 'Other Sensitive' Receivers		
Classrooms at schools and other educational institutions	45	55 ¹
Hospital wards and operating theatres	45	65 ²
Places of worship	45	55 ¹
Active recreation areas (characterised by sporting activities and activities which generate noise)	-	65
Passive recreation areas (characterised by contemplative activities that generate little noise)	-	60
Commercial	50 ²	70
Industrial	55 ²	75
Non-ICNG 'Other Sensitive' Receivers		
Hotel – daytime & evening ³	50	70 ²
Hotel – night-time ³	40	60 ²
Café/Bar/Restaurant ³	50	60 ¹
Childcare centres – sleeping areas ³	45	55 ¹
Public building ³ (when in use)	50	60 ¹

Land use	NML $L_{Aeq(15\text{minute})}$ Internal	External
Recording studio ³ (when in use)	25	45 ²
Theatre / auditorium ³ (when in use)	30	50 ²

NOTES:

1. It is assumed that these receivers have windows partially open for ventilation which results in internal noise levels being around 10 dB lower than the external noise level
2. It is assumed that these receivers have fixed windows which conservatively results in internal noise levels being around 20 dB lower than the external noise level
3. Taken from Section 2.2.1, Sydney Metro CNVS (Sydney Metro West) Version 4.3 dated 4 November 2020

6.2.3. 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. Where monitoring has confirmed that any other activities (additional to those described above) possess annoying characteristics in accordance with the ICNG (i.e. tonality or impulsive etc), the addition of 5 dB(A) will apply.

6.3. Ground-borne noise management levels

Ground-borne noise management levels (GNMLs) are based on the ICNG and Condition D26, in accordance with the Sydney Metro CNVS. Ground-borne construction noise management levels at residential receivers are summarised in Table 14.

Table 14: Ground-borne Construction noise management levels at residential receivers

Time of day	Assessment period	GNML $L_{Aeq(15\text{min})}$
07:00 to 18:00	Daytime	Vibration limits for human disturbance apply
18:00 to 22:00	Evening	40dB(A) internal
22:00 to 07:00	Night	35dB(A) internal

The level of mitigation of GBN at any sensitive receiver would depend on the extent of impacts, as well as the scale and duration of works. Any restriction on the days when construction work is allowed would consider whether the community:

- Has identified times of day when they are more sensitive to noise
- Is prepared to accept a longer construction duration in exchange for days of respite.

6.4. Internal noise criteria from Conditions of Approval

In addition to the ICNG noise management levels, Conditions D38 to D40 establish internal noise goals applicable at sensitive receiver locations to the Hunter Street and Pymont worksites during the 7am to 8pm period. Table 14 sets out the internal noise level limits for residential and other sensitive receivers.

Table 15: Internal construction noise criteria levels (Conditions of Approval)

Area	Receiver Type	Condition	Time Period	Requirements
Pymont	All	D39	7am to 8pm	Noise levels are required to be less than $L_{Aeq(15 \text{ minute})}$ 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below $L_{Aeq(15 \text{ minute})}$ 55 dB(A). Noise equal to or above $L_{Aeq(15 \text{ minute})}$ 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm. ¹
Hunter Street	All	D39	7am to 8pm	

NOTES

- Noise goal as described in Condition D39.

6.5. Construction-related road traffic noise

Construction traffic NMLs set at 2dB above the existing road traffic noise levels during the daytime and night-time periods are considered appropriate to identify the onset of potential noise impacts. Where the road traffic noise levels are predicted to increase by more than 2dB because of construction traffic, consideration will be given to applying feasible and reasonable noise mitigation measures to reduce the potential noise impacts and preserve acoustic amenity.

In considering feasible and reasonable mitigation measures where the relevant noise increase is greater than 2dB, consideration will also be given to the actual noise levels associated with construction traffic and whether these levels comply with the following road traffic noise criteria in the RNP:

- 60dB $L_{Aeq(15\text{hour})}$ day and 55dB $L_{Aeq(9\text{hour})}$ night for existing freeway / arterial / sub-arterial roads
- 55dB $L_{Aeq(1\text{hour})}$ day and 50dB $L_{Aeq(1\text{hour})}$ night for existing local roads.

6.6. Vibration criteria**6.6.1. Disturbance to building occupants**

Vibration with the potential to disturb human occupants of buildings is managed referencing DECC's Assessing Vibration: a technical guideline (Condition D25(b)). This guideline 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 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 (Table 16).

Table 16: Vibration dose value ranges above which adverse comment may be expected

Sensitive land user	Low probability of adverse comment ($\text{m/s}^{1.75}$) ¹	Adverse comment possible ($\text{m/s}^{1.75}$)	Adverse comment probable ($\text{m/s}^{1.75}$) 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.

6.6.2. 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 D25(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 17 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 17: 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	50mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	15mm/s at 4 Hz increasing to 20 mm/s at 15 Hz

6.6.3. 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 Table 18 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 cosmetic damage criteria based on the German Standard DIN 4150-2016 Structural Vibration Part 3: Effects of Vibration on Structures will apply (Condition D25(e)). The criteria will be based on the 'Group 3' type structures because of their potential sensitivity to vibration and intrinsic value.

Table 18: DIN 4150-3 guideline values for short-term vibration velocity on structures for Group 3 sensitive structures

Group	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	3mm/s	3 to 8mm/s	3 to 8mm/s	8mm/s	20mm/s

6.6.4. Other structures and utilities

Where structures and utilities are encountered that are sensitive to vibration, a vibration goal, which is different to the structural damage goals presented in Table 17, 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 19 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 19: 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)	100mm/s
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80mm/s
3	Masonry, plastic	50mm/s

6.6.5. 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 will 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) may be adopted as vibration goals. These generic VC curves are provided in Table 20.

Table 20: VC curves for Vibration Sensitive Equipment

Criterion curve	Max level ($\mu\text{m/sec, rms}$) 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 three micron line widths
VC-C	12.5	1	A good standard for most lithography and inspection equipment to one 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
VC-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

NOTE:

1. As measured in one-third octave bands of frequency over the frequency range eight 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.

6.6.6. Vibration screening criteria assessment approach

6.6.6.1. 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 Table 16.

6.6.6.2. Structural damage to buildings

The limits presented in Table 17 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 11 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, 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 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 17.

6.6.6.3. Heritage items

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 and further evaluation will be undertaken.

7. Environmental aspects and impacts

7.1. Overview

Reflecting the requirements of the CEMF (3.1(b)(v)), this Section details the noise and vibration aspects and impacts associated with the Tunnelling, Excavation and Associated Works. Additional details on the environmental risk assessment procedure are provided in the CEMP (Section 3.5). The controls to manage the identified risks (Section 8) and the monitoring program (Appendix A) have been developed in consideration of the SMART Principles – Specific, Measurable, Achievable, Relevant and Time-based. Ongoing risk assessments undertaken throughout the development of the EIS and Submissions Report have informed the identification of REMMs. On this basis, the control measures are considered to be relevant and achievable for the Project and will be monitored against specific, measurable and time-based targets through the compliance management processes (refer to Element 2 and Element 3).

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 or duration of construction works
- Existing background noise.

Noise and vibration impacts attributable to the Project are anticipated and are outlined in the EIS Technical Paper 2 (SLR Consulting Australia Pty Ltd 2021), Chapter 7 of the EIS (Sydney Metro 2021b) and the Response to Submissions Report (Sydney Metro 2022). This Sub-plan provides a suite of mitigation measures that will be implemented to avoid or minimise impacts on the receiving community and 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 (if found), historic heritage buildings and items, public utilities and infrastructure. Where significant new or additional activities 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 Project. Noise and vibration monitoring data will be collected throughout the delivery of the Project in accordance with the NV Program (Appendix A).

The process detailed in Figure 3 is particularly relevant when determining the ground-borne noise and vibration impacts to nearby receivers during the excavation of cross passages. Subject to the outcomes of the assessment, relocation of cross passages to be further away from sensitive receivers to mitigate potential construction impacts will be considered, where feasible and reasonable.

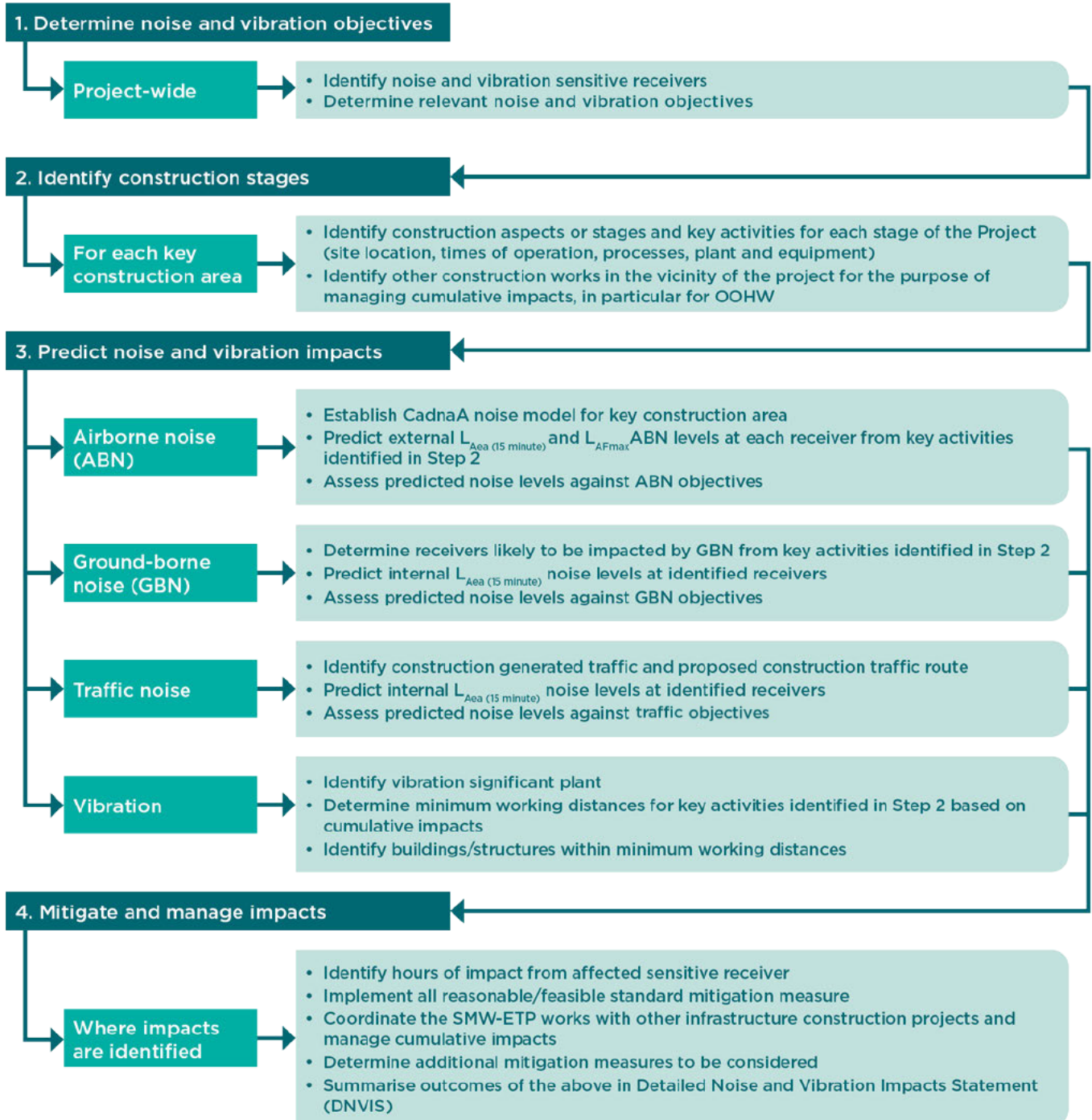


Figure 3: Construction noise and vibration impact assessment process

7.3. Detailed Noise and Vibration Impact Statements

The Detailed Noise and Vibration Impact Statements (DNVISs) will be a key site management tool with clear instructions for managing construction activities being undertaken on each worksite. Each DNVIS will be prepared for works that may exceed the NMLs, vibration criteria or GNMLs specified in Conditions D25 and D26 (refer to Section 6) at any residence outside standard construction hours, or where receivers will be highly noise affected. Each DNVIS will include specific mitigation measures identified through consultation with affected sensitive land user(s) and the mitigation measures will be implemented for the duration of the works.

DNVIS will be prepared for each construction site before construction noise and vibration impacts commence and will be updated as required if site conditions or activities change. Any construction work identified in the DNVIS as exceeding the NMLs, vibration criteria or GNMLs established in Section 6 will be managed in accordance with this NVMP.

All DNVISs will be prepared by an appropriately qualified and experienced acoustic consultant. Each DNVIS 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
- Confirm construction activities, likely plant and equipment, and indicative program to establish the input assumptions for noise and vibration predictions
- Clearly indicate the mitigation and management measures that have been incorporated into the assessment and set out the mitigation measures that must be in place prior to the commencement of:
 - Construction
 - Activities that would exceed the highly noise affected criteria
 - 24/7 operations on relevant worksites.

Mitigation measures include noise walls, acoustic enclosures around fixed plant and acoustic sheds (where required) and at-property treatments. 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. JCG will also:

- Establish the noise and vibration monitoring requirements and auditing process for the ETP Works
- Provide a subjective classification of the noise (and vibration) impact, evaluated and documented as low, medium or high impact, as required by the CNVS.

A copy of each DNVIS will be provided to the AA and ER before the commencement of the associated works, and to the EPA and the Planning Secretary on request.

7.4. Gatewave noise and vibration management tool

A 3D construction noise and vibration management tool, Gatewave, has been developed for the Project to allow defined work areas and activities to be planned, assessed and managed as construction works progress. Data relating to cumulative noise impacts from other aspects of the Project or, where relevant, noise from other construction projects, will be entered into Gatewave to enable any additional assessment in accordance with this NVMP.

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 Appendix B) are integrated into the Gatewave tool.

DNVISs prepared for the Project will establish the overall impacts associated with worksites, ancillary facilities and tunnelling excavation. JCG will use Gatewave to manage construction noise and vibration impact by defining specific work areas and 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 NVMP
- Buildings or structures within minimum working distances will be established for cosmetic damage and human annoyance so that appropriate mitigation and management measures can be applied.

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

8. Environmental control measures

8.1. Construction Noise and Vibration Management System

The Noise and Vibration Management System to be implemented during delivery of the ETP Works is illustrated in Figure 4.

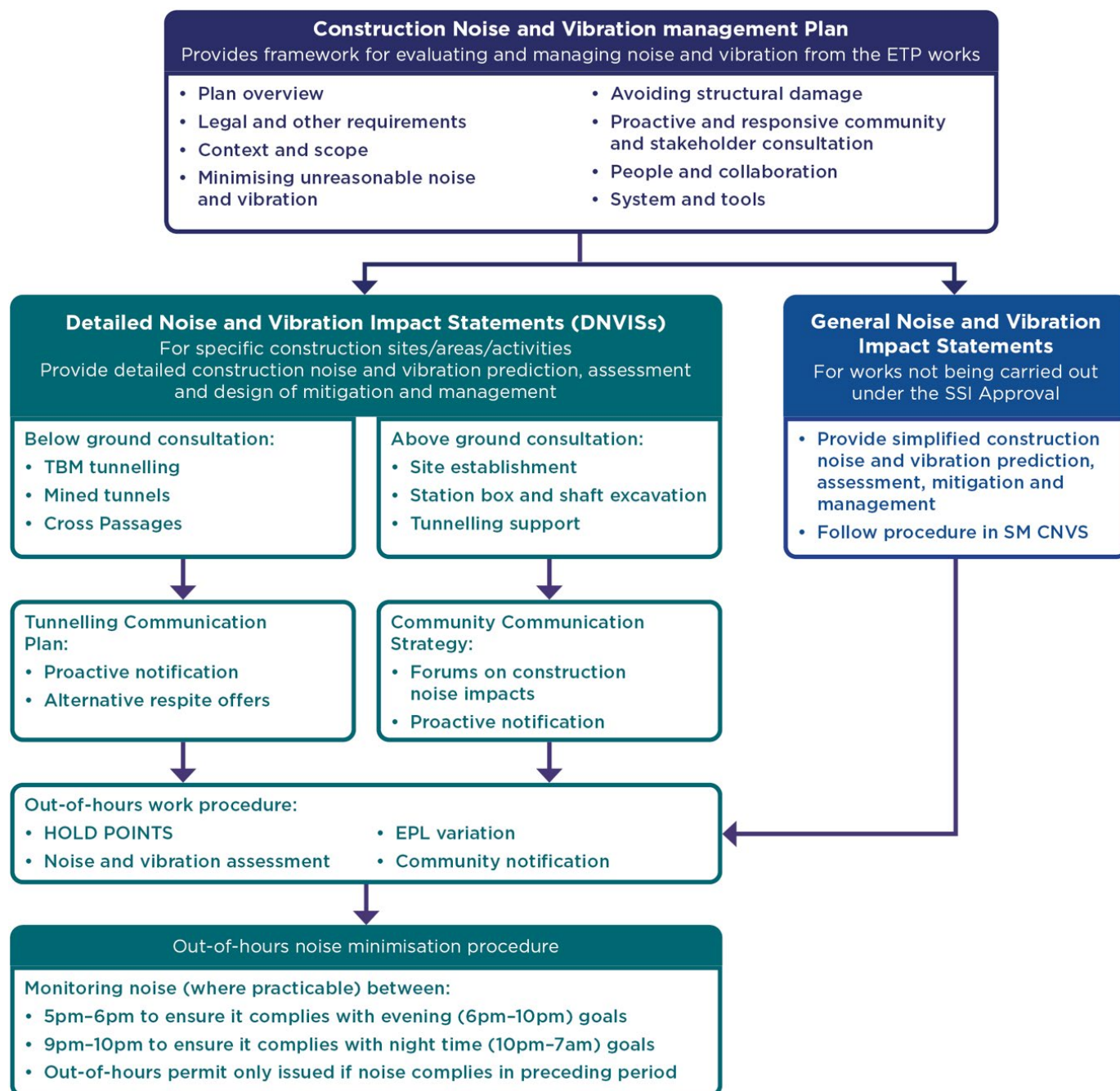


Figure 4: Construction Noise and Vibration Management System

8.2. Noise and vibration mitigation and management measures

In accordance with Conditions D25 and D26, mitigation measures will be implemented with the aim of achieving the construction NMLs and vibration criteria detailed in Section 6 of this Sub-plan. Specific measures and requirements to address contract specifications, Infrastructure Approval Conditions and REMMs in relation to impacts from noise and vibration are detailed in Part B, Element 4 of this Sub-plan.

Table 21: Noise and vibration management and mitigation measures

ID	Measure / Requirement	Responsibility	Deliverables	Timing	Reference
General					
NVMM1	Project and activity specific mitigation measures will be identified and confirmed in the DNVIS prepared for the Project and implemented as early as practicable, as noted in the DNVIS	Environmental Advisor	- DNVIS - Gatewave report - Environmental inspection records	Pre-construction	- Conditions D25, D26 and D29 - CNVS
NVMM2	Implement community consultation or notification measures as detailed in the Community Communication Strategy (CCS) and this Sub-plan	Stakeholder and Community Engagement Director	- DNVIS or Gatewave report - Consultation records	Pre-construction Construction	- Conditions D29, D30 D37, D39 - CNVS - REMMs NV01, NV03
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	- Environmental Advisor - Stakeholder and Community Engagement Director	- Land Use Survey - DNVIS - Noise and vibration sensitive receiver register	Pre-construction Construction	CNVS
NVMM4	Where feasible and reasonable, construction will be carried out during the standard construction hours as outlined in this Sub-Plan	Project Director (or delegate)	- NVMP - Induction records - Environmental inspection records	Construction	- Condition D25 - CNVS
NVMM5	Work generating high noise 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. The use of noise intensive equipment at construction sites with 'moderate' and 'high' OOH NML exceedances will be scheduled for standard construction hours, where feasible and reasonable. Where this is not feasible and reasonable, the work will be undertaken as early as possible in each work shift.	- Environment, Approvals and Sustainability Director - Stakeholder and Community Engagement Director	- DNVIS or Gatewave report - Consultation records	Pre-construction	- Condition D27 - REMMs NV01 and NV03
NVMM6	Cumulative and/or consecutive construction noise and vibration impacts will be managed through consultation with all other approved Critical SSI, SSI and SSD projects. JCG	Environment, Approvals and Sustainability Director	DNVIS or Gatewave report	Pre-construction	Conditions C6(d), D36

ID	Measure / Requirement	Responsibility	Deliverables	Timing	Reference
	will undertake reasonable steps to coordinate works to minimise impacts and maximise respite for affected sensitive receivers. Specifically, JCG will: ▪ Reschedule any work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with Condition D37 ▪ Consider the provision of alternative respite or mitigation to impacted noise sensitive receivers ▪ Provide documentary evidence to the AA in support of any decision made by the Proponent in relation to respite or mitigation.	▪ Stakeholder and Community Engagement Director	▪ Community Communications Strategy (CCS) ▪ Consultation records		▪ REMMs NV01, NV03, NV15
NVMM7	Training will be provided to relevant personnel, including sub-contractors on noise and vibration requirements from this NVMP through inductions, toolboxes or targeted training.	▪ People and Culture Director ▪ Environmental Advisors ▪ Site Supervisor	▪ Induction records ▪ Toolbox talk records	Pre-construction Construction	▪ JCG practice
NVMM8	All employees, contractors and subcontractors will receive a Project induction prior to commencing work on site. The environmental component, covered in either the induction or toolboxes, must include: ▪ Relevant licence and Planning Approval conditions ▪ Permissible hours of work ▪ Limitations on high noise activities ▪ Location of nearest sensitive receivers ▪ Construction employee parking areas ▪ Designated loading and unloading areas and procedures ▪ Relevant site-specific and standard mitigation measures ▪ Site opening and closing times (including deliveries) ▪ OOHW approval process ▪ Appropriate behavioural practices ▪ Environmental incident procedures.	▪ People and Culture Director	▪ Induction records ▪ Toolbox talk records	Pre-construction Construction	▪ CNVS
NVMM9	Noise and vibration verification monitoring is to be undertaken in accordance with the NV Program (Section 5.2.2), and as identified in the DNVISs and any EPL conditions	▪ Environmental Advisors	▪ NV Program ▪ DNVIS ▪ Monitoring records	Construction	▪ Condition C15 ▪ REMM NV13 ▪ CNVS
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.,	▪ Site Supervisor / Site Engineer	▪ DNVIS ▪ Induction records	Construction	▪ REMMs NV05 and NV12

ID	Measure / Requirement	Responsibility	Deliverables	Timing	Reference
	minimising the use of engine brakes and no extended periods of engine idling). We will communicate using notifications under contract provisions and liaising with schedulers from companies using heavy vehicles				
NVMM11	Building condition surveys will be completed before and after construction works where buildings or structures are near to the tunnel and excavations (where appropriate) or within the minimum vibration working distances for cosmetic damage. For heritage buildings and structures the surveys will consider the heritage values of the structure in consultation with a heritage specialist.	Project Director (or delegate)	Condition survey report	Prior to construction Construction	- Condition D44 - REMM NV13
NVMM12	Industry best practice construction methods will be implemented where reasonably practicable to minimised noise and vibration. Long term construction site support equipment and machinery will be low noise emitting and suitable for use in residential areas, where reasonable and feasible. 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 or equipment (If available and appropriate) - Review and add additional on-site mitigation (e.g. noise blankets), if required - The noise assessment will be repeated with the accurate noise level of the plant or equipment.	- Site Supervisor - Environmental Advisors	- DNVIS - Plant inspection records - Environmental inspection records - Monitoring records - Toolbox talk records	Construction	- Condition D28 - REMM NV02
NVMM13	Minimise disturbance arising from heavy vehicle movements (spoil trucks; materials delivery) to worksites by:	- Site Supervisor - Site Engineer	- Site planning and design - Induction records - DNVIS	Construction	- Condition D23(d)(iii) and (iv) - REMMs NV05 and NV12

ID	Measure / Requirement	Responsibility	Deliverables	Timing	Reference
	▪ Loading and unloading of materials and 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 and unloading areas to be shielded if close to receivers ▪ On-site spoil storage capacity would be maximised to reduce the need for truck movements during sensitive times ▪ 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 and loading to be undertaken during standard hours, minimisation of tail gate banging) ▪ Vehicle movements will be redirected away from sensitive receiver areas and scheduled during less sensitive times ▪ The speed of vehicles will be limited, and the use of engine compression brakes avoided ▪ Heavy vehicles will not be permitted to idle near sensitive receivers ▪ Providing training to heavy vehicle drivers on considerate driving practices in residential areas and managing tailgate slams.				
NVMM14	▪ Non-tonal movement alarms will be used in place of tonal reversing alarms for JCG owned plant, subcontract plant and other site alarms (as far as is safe and practical) used at night or during the day ▪ Set up and adjust broadband alarm volumes to minimise environmental impact while achieving safety requirements.	▪ Site Supervisor	▪ Plant risk assessment ▪ Toolbox talk records ▪ SWMS ▪ Environmental inspection records	Construction	▪ Condition D28 ▪ CNVS ▪ REMM NV12
NVMM15	Manage the use and siting of plant, where practicable, by: ▪ 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	▪ Site Supervisor	▪ Induction records ▪ Toolbox talk records ▪ SWMS ▪ Environmental inspection records ▪ DNVIS	Construction	▪ JCG Practice

ID	Measure / Requirement	Responsibility	Deliverables	Timing	Reference
	- Switching off when not in use for more than 15 minutes - Directing noise-emitting plant away from sensitive receivers, particularly during OOHW - 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.				
NVMM16	Plant and equipment should have operating Sound Power or Sound Pressure Levels compliant with the levels this Sub-plan, or as specified in the DNVIS. 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 will also identify defective silencing equipment on the items of plant.	Site Supervisor	- DNVIS or Gatewave report - Plant risk assessment - Plant/ site inspection records	Construction	JCG Practice
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	- Site Supervisor - Environmental Advisors	- DNVIS or Gatewave report - SWMS - Environmental inspection records	Construction	REMMs NV02 and NV06
NVMM18	Stationary noise sources will be enclosed or shielded where reasonable and feasible. This would apply to plant and equipment such as generators, stationary concrete cutters, stationary asphalt corers, stationary vacuum trucks, and stationary jack hammers.	Site Supervisor	- DNVIS or Gatewave report - SWMS - Environmental inspection records	Construction	- Condition D28 - REMMs NV02, NV06, NV07 and NV08
Path Controls					
NVMM19	Acoustic sheds 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 period 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	- Project Director - Environment, Approvals and Sustainability Director	- DNVIS - Design reports - Environmental inspection records	Construction	REMM NV08

ID	Measure / Requirement	Responsibility	Deliverables	Timing	Reference
	The doors of acoustic sheds will be kept closed during the night-time period. Where vehicle access is required at sites with nearby residences, the shed entrances will be designed and constructed to minimise noise breakout.				
NVMM20	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. Boundary screening will minimise noise impacts on adjacent sensitive receivers.	Project Director	DNVIS	Prior to construction Construction	- Condition A24 - REMMs NV02 and NV06
NVMM21	Structures will be used as noise barriers at compounds where appropriate.	- Project Director (or delegate) - Environment, Approvals and Sustainability Director	- DNVIS - Site layout drawings	Construction	CNVS
NVMM22	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.	- Site Supervisor - Environmental Advisor	- DNVIS or Gatewave reports - SWMS - Environmental inspection records	Construction	- CNVS - NV06
Consultation and Complaints Management					
NVMM24	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: - A description of the works, types of activities and location of works to be undertaken - The timing of activities including expected start and finish - 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	- Stakeholder and Community Engagement Director - Environment, Approvals and Sustainability Director	- Communications Strategy - DNVIS or Gatewave report - Community consultation records	Prior to construction Construction	- CNVS - Conditions D31 and D37 - REMMs NV13 and NV14

ID	Measure / Requirement	Responsibility	Deliverables	Timing	Reference
	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.				

8.2.1. Indicative noise and vibration mitigation measures

The indicative management of construction noise and vibration impacts at each ETP worksite is outlined in Appendix C and Appendix D as referenced in Table 22. It is noted that the site layouts are preliminary and will be refined in the relevant DNVIS. Similarly, the mitigation and management measures presented in Appendix C will be refined during the design development and presented in the DNVIS for each worksite.

Table 22: Indicative noise mitigation

Work area	Indicative noise and vibration mitigation reference
The Bays site	Appendix C.1
Pymont Station	Appendix C.2
Hunter Street Station	Appendix C.3
Mainline tunnels and cross passages	Appendix D

8.2.2. Alternative construction techniques

As required by REMM NV02 and Condition D28, alternative construction, excavation and demolition techniques will be implemented where reasonably practicable to minimise and reduce impacts on receivers. This will include:

- Innovative excavation technologies, such as using trenching, saw cutting or inclusion of an 'air-gap' to provide a significant break in the vibration transmission path
- Temporary noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities such as rock hammering and concrete cutting
- Replacement of rock hammers with pulverisers for demolition of existing structures, where possible
- Excavation with rippers excavators, rock hammers, roadheaders and TBMs.

Consideration will also be given to the following methodologies and measures:

- Use of hydraulic concrete shears in lieu of hammers/rock breakers
- Sequencing work to shield noise sensitive receivers by retaining building wall elements
- Locating demolition load out areas away from the nearby noise sensitive receivers
- Providing respite periods to minimise impacts from prolonged periods of noise intensive work
- Minimising structural-borne noise to adjacent buildings including separating the structural connection prior to demolition through saw-cutting and propping, using hand held splitters and pulverisers or hand demolition
- Installing sound barrier screening to scaffolding facing noise sensitive neighbours
- Using portable noise barriers around particularly noisy equipment, such as concrete saws
- Modifying demolition work sequencing/hours to minimise impacts during peak pedestrian times and/or adjoining neighbour outdoor activity periods.

Alternative construction techniques and noise controls will be further developed during detailed design and assessed as necessary during site inspections and environment team meetings. Periodic reporting on alternative construction techniques will occur as part of the Annual Environmental Monitoring Report.

8.3. Minimising noise impacts

8.3.1. Respite from highly noise intensive activity

As part of the detailed design, JCG will be responsible for preparing DNVISs, in accordance with Condition D29 and the Sydney Metro CNVS. The DNVIS will include specific mitigation measures to manage construction noise from the worksite. Appendix C sets out the indicative path controls including noise barriers and acoustic enclosures for the ETP Works to meet the requirements of Conditions D25 and D26. Indicative mitigation measures include limitations on plant and equipment use, noise walls, acoustic enclosures around fixed plant, acoustic sheds (where required).

Where, after the implementation of all reasonable and feasible mitigation measures, sensitive receivers are still noise affected, the DNVIS for the Pymont and Hunter Street worksites will undertake further review. The review will identify all receivers likely to experience internal noise levels from airborne or

ground-borne construction activities (including works associated with utility adjustments) between 7am and 8pm that are greater than $L_{Aeq(15min)}$ 60 dB(A) inclusive of a 5 dB(A) penalty, in accordance with Condition D38. Condition D39 requires consultation with all receivers identified in Condition D38 to determine appropriate hours of respite. Note that this does not apply to noise associated with the cutting surface of a TBM as it passes under receivers.

For all other worksites, highly noise intensive work that results in construction noise levels above the (external) highly noise affected level of $L_{Aeq(15min)}$ 75 dB(A) will be managed by limiting the highly noise intensive work to satisfy any standard EPL Conditions and Condition D22 to:

- Between the hours of:
 - 08:00 to 18:00 Monday to Friday
 - 08:00 to 13:00 Saturday.
- In continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block, except as expressly permitted by the EPL issued for the ETP Works.

For the purposes of this requirement, 'continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work that is subject to this requirement.

These respite periods do not apply to high noise impact works required to be undertaken outside of standard hours provided they are approved through an EPL.

8.3.2. 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.

All plant and equipment used for the ETP Works will have SWL no higher than the corresponding figures shown in Appendix C of this Sub-plan, or as updated by a DNVIS prepared under this Sub-plan. Regularly serviced low sound power equipment will be specified for use (where practicable) to satisfy Condition D28. Plant and equipment with SWLs higher than those in the Appendix C tables will be deemed to be emitting an excessive level of noise and will not be permitted to operate on the ETP Works. Plant and equipment will be subject to regular compliance checks as detailed in Appendix A. In addition, noise-focussed checks will be incorporated into the daily pre-starts, for example, subjective listening test for items such as defective mufflers, excessively loud squawkers, and squeaking excavator tracks.

8.4. Minimising vibration impacts

The pattern of vibration radiation is very different to the pattern of airborne noise radiation and is site specific. Final vibration levels are dependent on various 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. In preparing DNVISs in accordance with Condition D29 and the Sydney Metro CNVS, recommended minimum working distances for specific vibration intensive construction equipment will be identified.

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.

8.4.1. 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 to 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 23. 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.

Table 23: 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	30	35	20	15
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
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

8.4.2. 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 or defects observed and any changes in crack width or defect size will be measured after construction completion. 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 24. 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 assessment approach outlined in Section 6.6.6.

Unlike noise, vibration cannot be readily predicted. The minimum working distances in Table 24 are indicative and will vary depending on the plant item, building types, foundations and local geotechnical conditions. Vibration monitoring will be carried out to confirm the site-specific minimum working distances for the ETP Works.

Table 24: 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 saw	5	5	5
Excavator (tracked) ≤ 5t + hydraulic hammer	5	5	10
Excavator (tracked) ≤ 15t + hydraulic hammer	5	10	10

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
Excavator (tracked) ≤ 35t + hydraulic hammer	5	10	20
Percussive drill (small)	5	5	10
Piling rig – bored (rock)	5	5	5
Piling rig – bored (soft ground)	5	5	5
Piling rig - vibratory driven	5	10	15
Pneumatic hammer (jackhammer)	15	30	65
Terrain leveller	10	15	35
Vibratory roller (11t) padfoot - High vibration	10	20	50
Vibratory roller (11t) padfoot - Low vibration	5	5	5
Vibratory roller (13t) smooth drum - High vibration	5	10	20
Vibratory roller (13t) smooth drum - Low vibration	5	5	15
Wacker packer	5	5	10

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 17) by 50% due to potential dynamic magnification
3. A building condition inspection should determine whether a heritage item is structurally unsound.

The DNVISs prepared for each construction site in accordance with Condition D29 and the Sydney Metro CNVS will identify properties within the recommended minimum working distances for specific vibration intensive construction equipment and therefore at risk of exceeding the screening criteria for cosmetic damage. Owners and occupiers of identified properties will be notified before works that generate vibration commences in the vicinity of those properties, in accordance with Condition D31. Further monitoring and assessment will be undertaken as described in Appendix E.

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

8.5.1. Strategy for 24-hour tunnelling operations

Tunnelling by TBM (excluding cut and cover tunnelling and surface works) are prescribed activities that can be undertaken 24 hours a day, seven days a week. Ground-borne noise and vibration impacts will be assessed and managed through the DNVISs which will be prepared for each stage of the works as described in Section 7.3. Surface works to support tunnelling will also be undertaken in line with Condition D23(d) and any EPL requirements.

OOHW and OOH noise minimisation procedures are presented in Appendix E, including processes, roles and responsibilities, and Hold Points. These will ensure:

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

8.5.2. Safety and emergency works

Where OOHW are required for safety or in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm (Condition D23 (a)), we will notify the AA, ER, the Planning Secretary and the EPA of the reasons for emergency works. We will use best practice 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.

8.5.3. Out-of-Hours Works Protocol

An OOHW Protocol has been prepared by Sydney Metro in accordance with Condition D24. The OOHW Protocol provides a process for the consideration, management, and approval of work outside the approved construction hours 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 D27 and D37
- 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 and is consistent with the requirements of Condition D36
- An approval process for OOHW that considers risks, proposed mitigation, management and coordination, and includes review and approval by the AA 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.

8.5.4. Community consultation on respite from OOHW

To satisfy Condition D37, JCG will consult with the community to determine appropriate respite periods where works are:

- Undertaken outside standard construction hours
- Likely to exceed the noise and vibration objectives identified in Conditions D25 and D26.

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 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 D25 and D26 (including details about how the affected community can access the respite or relocation offers).

Note: Respite periods can be any combination of days or hours where OOHW would 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 (Condition D27).

The standard approach to managing noise and vibration impact from OOHW, including respite periods and temporary alternative accommodation, is outlined in the additional mitigation measures (Section 8.6.2). 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 AA, EPA and Planning Secretary for information.

8.6. Managing residual noise impacts

8.6.1. At-property treatment

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' within the DNVIS (Section 7.3) 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, light rail 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 or less than 12 months): 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 or greater than 12 months): consideration will be given to at-property treatment, subject to consultation.

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.

Where at-property treatment (temporary or permanent) is required to mitigate impacts to a Heritage item identified in the EIS, the advice of a suitably qualified and experienced built heritage expert will be obtained and implemented to ensure the at-property treatment does not have an adverse impact on the heritage significance of the item.

8.6.2. Additional mitigation measures

The additional mitigation measures to be applied are outlined 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. 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 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 seven days of proposed work to provide tailored advice and the opportunity for stakeholders to provide comments on the proposed work and specific needs.
- **Specific notifications (SN)** will be letterbox dropped or hand distributed to identified stakeholders no later than seven 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.

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).

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

Figure 5: Construction assessment periods

Figure 6 to Figure 8 details 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.

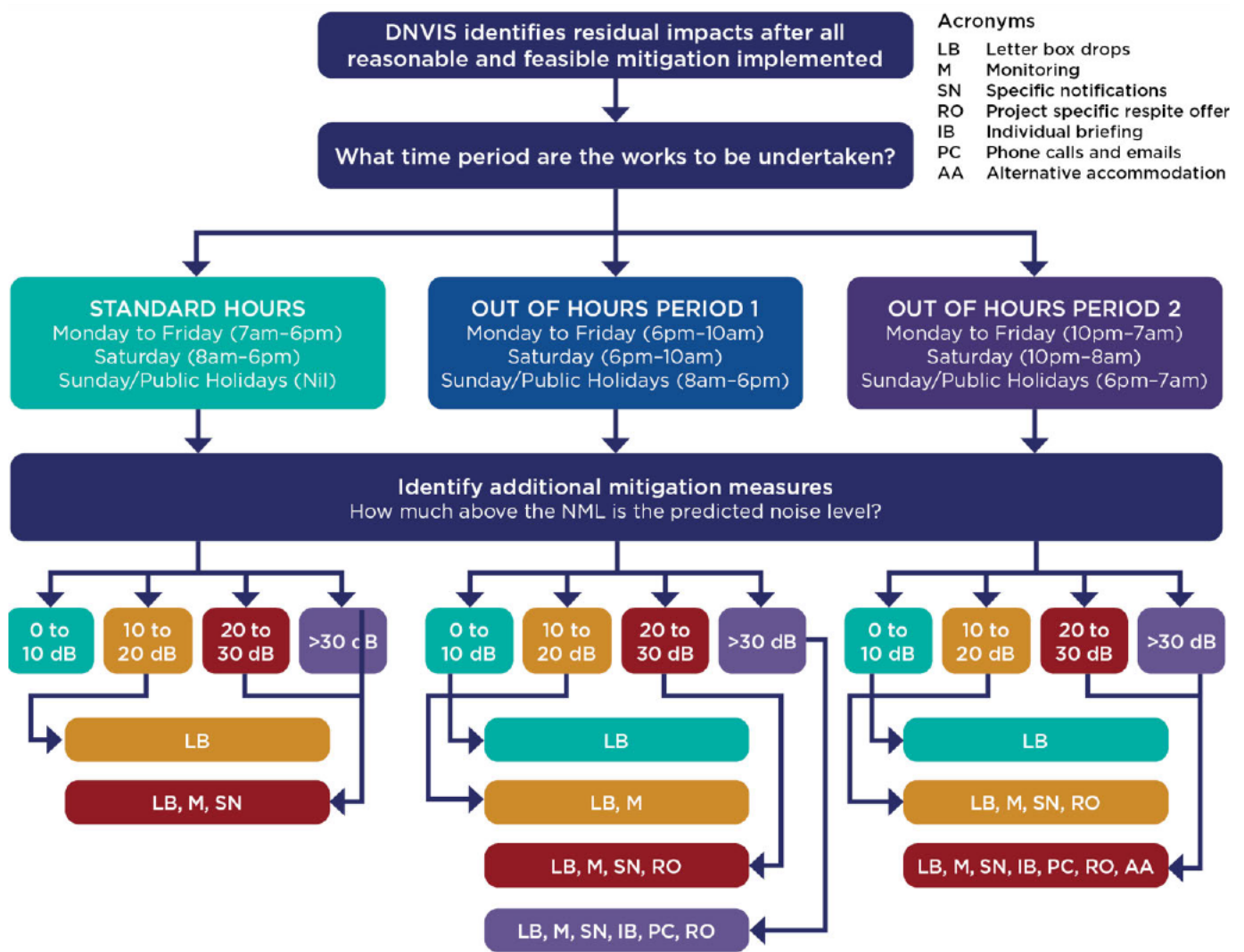


Figure 6: Additional airborne noise mitigation measures

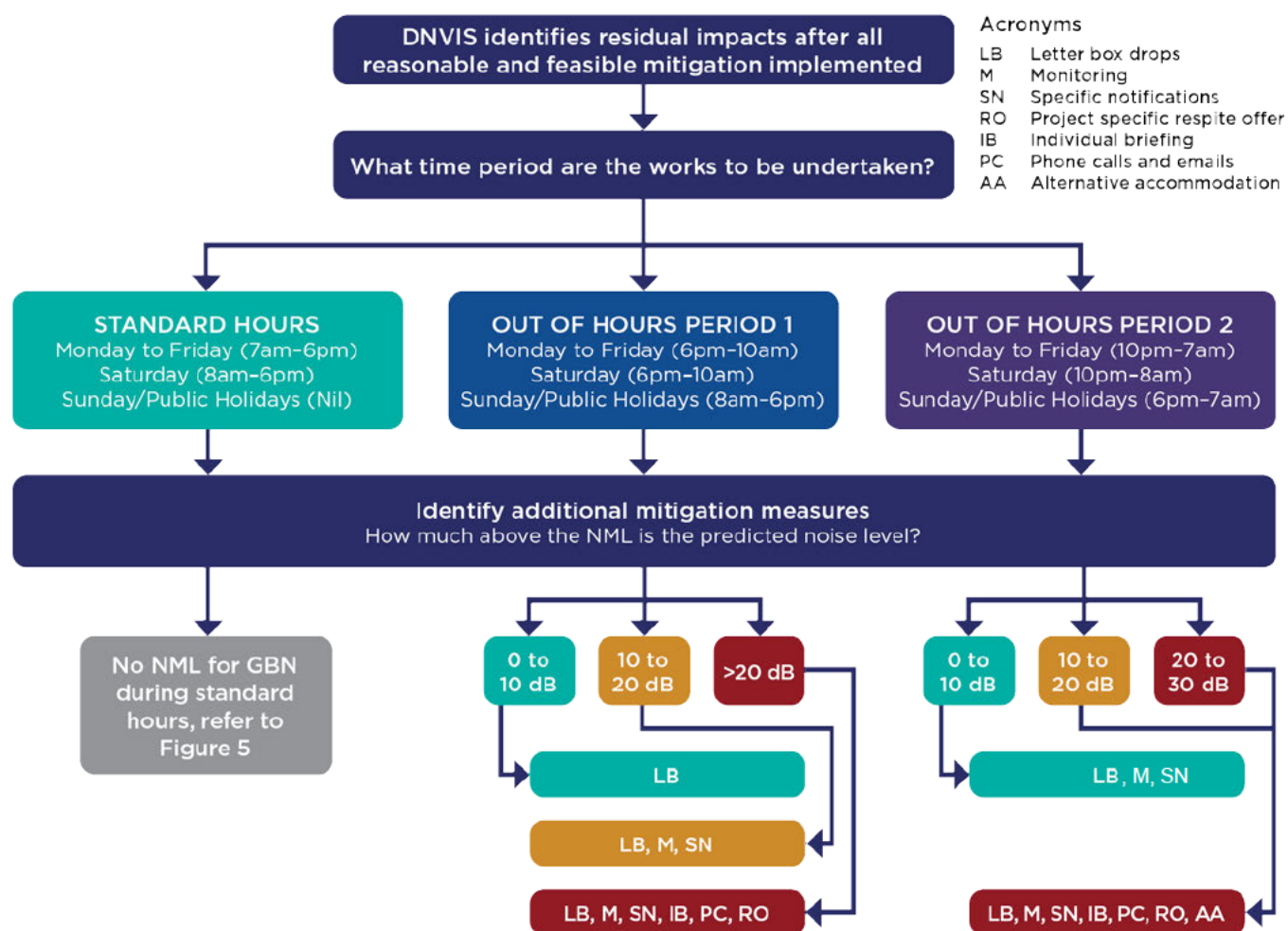


Figure 7: Additional ground-borne noise mitigation measures

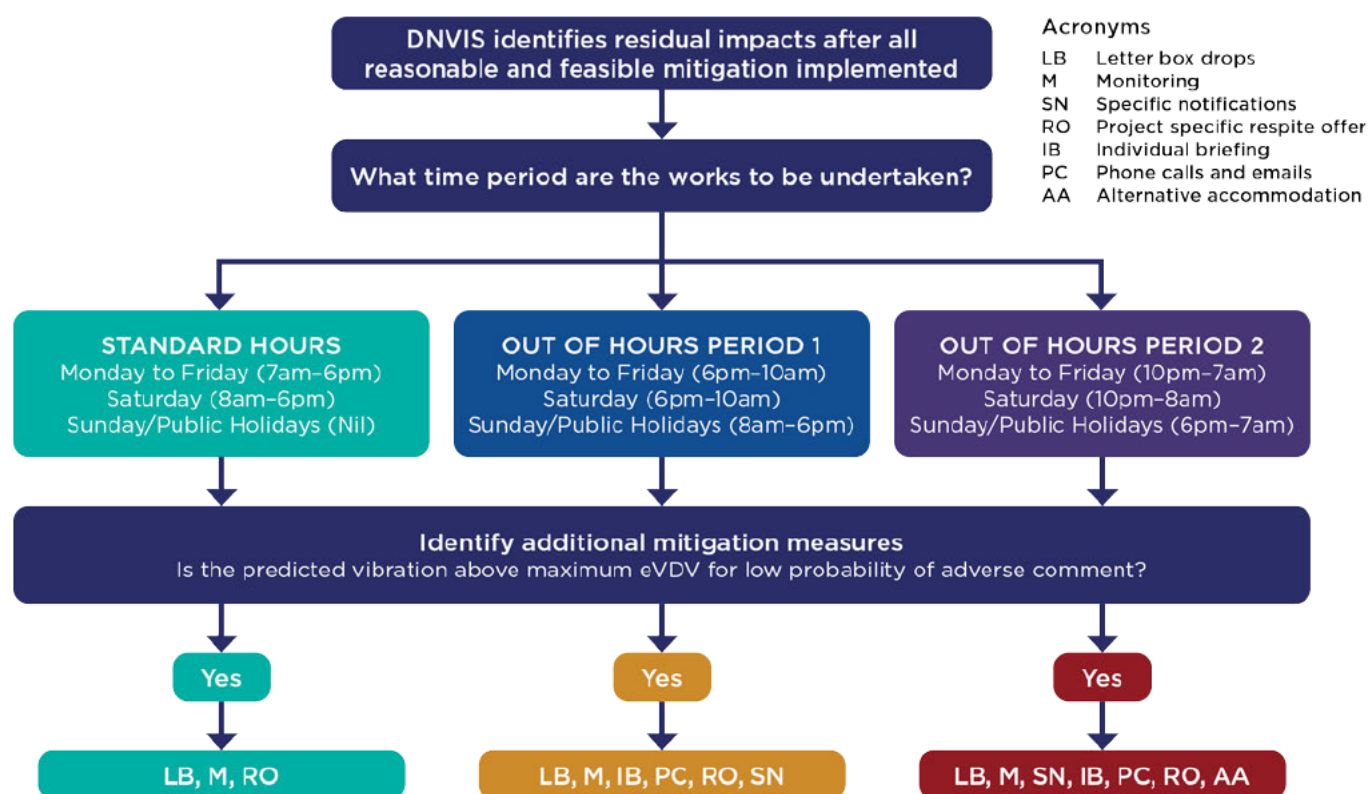


Figure 8: Additional vibration mitigation measures

9. Compliance management

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

9.1. Hold points

The activities detailed in Table 25 are recognised as hold points and will not proceed without objective review and approval by the nominated authority.

Table 25: Hold points

Hold point	Sub-plan Reference	Release of hold point	Responsibility
Conduct of OOHW	Section 8.5 Appendix E	Preparation and approval of DNVIS and OOHW Permit	Environment, Approvals and Sustainability Director (or delegate)
Detailed land use survey to confirm sensitive receivers before the commencement of work which generates construction noise, vibration or ground-borne noise in any one area	Appendix B	Preparation of land use survey, progressively updated in DNVIS	Specialist Acoustic Consultant
DNVIS must be prepared for each construction site before construction noise and vibration impacts commence	Section 7.3	Preparation and approval of DNVIS	Specialist Acoustic Consultant Environment, Approvals and Sustainability Director (or delegate)
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	Section 8.4 Appendix E	Notification completed	Site Supervisor Community Liaison Officer
Vibration monitoring of heritage items where property is within the minimum working distances to prevent cosmetic damage	Section 8.4 Appendix E	Monitoring implemented as identified in DNVIS	Site Supervisor Environment, Approvals and Sustainability Director (or delegate)
A condition survey must be prepared for all buildings, structures, utilities identified in the EIS and 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 Section 8.4 and the CEMP for further details.	Section 8.4	Copies of Pre-construction Condition Survey Reports must be provided to the relevant property owners	Appropriate professional nominated by Construction Manager

9.2. Complaints

Complaints will be recorded and managed as detailed in the CEMP and the Community Communications Strategy.

10. Review and improvement

10.1. Continual improvement

The continual improvement process will be undertaken in accordance with Section 3.15 of the CEMP. 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
- Identify the results of alternative construction methods
- Recognise good behaviour and practice
- Reward innovation
- Identify plant and equipment with good noise/vibration performance and prioritise use in sensitive locations.

10.2. Sub-plan review

The processes described in Section 3.6 of the CEMP may result in the need to update or revise this Sub-plan. This will occur as needed, in accordance with Section 3.14.2 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

- Sydney Metro 2021 Construction Environmental Management Framework (CEMF)
- Sydney Metro 2021 Sydney Metro West Major civil construction between The Bays and Sydney CBD Environmental Impact Statement, November 2021
- SLR Consulting Australia Pty Ltd 2021 Sydney Metro West Major Civil Construction Work between The Bays and Sydney CBD Technical Paper - Noise and Vibration, October 2021
- Sydney Metro 2022 Sydney Metro West Major Civil Construction Work between The Bays and Sydney CBD Submissions Report, April 2022
- Renzo Tonin & Associates 2020 Western Harbour Tunnel and Warringah Freeway Upgrade, Technical working paper: Noise and vibration, Roads and Maritime, January 2020
- Sydney Metro 2020 Sydney Metro Construction Noise and Vibration Standard (reference: SM-20-00098866, version 4.3)
- Department of Environment and Climate Change 2009 NSW Interim Construction Noise Guideline (ICNG)
- Environment Protection Authority 2017 NSW Noise Policy for Industry (NPfI)
- Department of Environment, Climate Change and Water 2011 NSW Road Noise Policy (RNP)
- Department of Environment Conservation NSW 2006 Assessing Vibration; a technical guideline (AVTG)
- British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz)
- German Standard DIN 4150-3: 1999-02, Structural vibration - Effects of vibration on structures, February 1999
- ASHRAE Applications Handbook (SI) 2003, Chapter 47 Sound and Vibration Control, pp47.39-47.40
- Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration, p16
- Australian Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors
- Association of Australasian Acoustical Consultants (AAAC) 2020 Guideline for Child Care Centre Acoustic Assessment Version 3.

Part B: Implementation Systems and Tools

Part B of this Sub-plan explains how the noise and vibration impacts of the Project will be minimised. All relevant mitigation measures from the Planning Approval, REMMs, CEMF, CNVS and EPL are addressed in this Section. Compliance with these systems and tools is required at all times to minimise the risk of unauthorised environmental harm.

Part B contains the following:

- **Expectations and Requirements:** These describe what is required of the Project to implement the objectives of the Environment and Sustainability Policy and achieve the intended environmental performance outcomes
- **JCG Response:** These are the specific actions that will be performed to demonstrate compliance with the Elements and Requirements.
- **Responsibility:** These are the people responsible for achieving compliance with the Expectations and Requirements. The key contributor is identified in bold font
- **Deliverables:** These are the tangible outcomes that will be produced to demonstrate compliance with the Expectations and Requirements.

Element 1: Training

Table 26: Element 1: Training

ID	Expectations/Requirements	JCG Response	Responsibility	Deliverables	Timing
1.1	All personnel have completed an induction containing relevant environmental information before they are authorised to work on the ETP Works	All personnel working on the ETP Works will undertake a site induction, which will provide initial training on various environmental aspects, including noise and vibration. It will cover: ▪ The existence and requirements of the NVMP ▪ Relevant legislation ▪ Approved construction hours and worksite opening/closing times (including deliveries) ▪ Construction employee parking areas ▪ Designated loading/unloading areas and procedures ▪ The process for seeking approval for OOHV, including consultation ▪ Location of noise sensitive areas ▪ Relevant site-specific and standard mitigation measures, including site specific respite periods for high impact noise ▪ Complaints reporting ▪ General noise and vibration management measures ▪ Specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works.	People & Culture Director Environment, Approvals and Sustainability Director Environment Advisors	Induction records	Pre-construction Construction
1.2	Personnel are trained and assessed according to the training matrix	Targeted environmental training will be provided including: ▪ Training in Gatewave modelling targeted at engineers, environment and community personnel ▪ Training in noise, vibration, and ground-borne noise monitoring targeted at engineers, environment and community personnel.	People & Culture Director Environment, Approvals and Sustainability Director	Training matrix Training records Training evaluation forms	Pre-construction Construction
1.3	Toolbox talks used to reinforce key management requirements and lessons learnt	Toolbox talks on DNVIS requirements will be held regularly. The talks will reinforce and reiterate information from inductions that are specific to the works being undertaken. Toolbox talks will be presented when changes in work practices (e.g., OOHV) or seasonal weather increases the risk of adverse impacts from noise and/or vibration.	Environment, Approvals and Sustainability Director Site Supervisor Environment Advisors	Toolbox records	Construction

Element 2: Monitoring and reporting

Table 27: Element 2: Monitoring and reporting

ID	Expectations/Requirements	JCG Response	Responsibility	Deliverables	Timing
2.1	Worksites 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 noise and vibration management controls will be undertaken as part of environmental inspections.	Environmental Advisors Superintendents Site Supervisors	Site Diary entries Environmental Inspection records	Construction
2.2	Monitoring performed to establish baseline data and ensure compliance is maintained	Noise and vibration monitoring will be undertaken in accordance with the NV Program (Appendix A). To satisfy Condition C16, where noise and vibration monitoring is undertaken, the data will be readily available to the construction team, Sydney Metro, ER and AA (refer to Section 8.2 of the NV Program). This report will be provided to DPE and the EPA on request. 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, the following actions will be undertaken: ▪ Cease the noise or vibration-generating source causing the exceeded predictions ▪ Confirm the monitored levels are not being impacted by other (non-ETP related) noise or vibration sources ▪ Confirm if the exceedance is due to an uncharacteristically loud or high vibration generating piece of equipment in accordance with Section 6 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 ▪ Confirm the modelling reflects the actual activity being undertaken ▪ Implement other feasible and reasonable measures which may include reducing plant size, modifying time of works, changing operational settings (such as	Environment, Approvals and Sustainability Director Environment Advisors	Monthly EPA Report Annual Environmental Monitoring Report	Pre-construction Construction

ID	Expectations/Requirements	JCG Response	Responsibility	Deliverables	Timing
		turning off the vibratory function of the machine), and utilising alternative construction methodology ▪ Review work practices to ensure compliance with the management levels set out in this NVMP ▪ 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 REMM NV14, consultation with a heritage specialist will be undertaken prior to the installation of any monitoring equipment, where installation may impact on heritage listed structures.			
2.3	Monitoring records are maintained	The results of noise and vibration monitoring will be documented and published on ETP Project website where required, in accordance with the POEO Act and Regulations.	Environment, Approvals and Sustainability Director Environmental Advisors	Monthly EPL Report	Construction
2.4	Community consultation on respite	In accordance with Condition D37, the outcomes of the community consultation, the identified respite periods and the scheduling of the likely OOWH will be provided to the ER, AA and the Planning Secretary (via the ER monthly reporting process). This information will also be provided to the EPA through the EPL Monthly Report.	Environment, Approvals and Sustainability Director	Monthly EPA Report Monthly submission to ER	Construction
2.5	Environmental Control Maps	ECMs provide a practical translation of environmental risks and controls for workers. ECMs are specific to a site or activity and will incorporate the following minimum requirements: ▪ Depict the current representation of the site ▪ Indicate which environmental procedures, environmental approvals, or licences are applicable ▪ Illustrate the site, showing significant structures, work areas and boundaries ▪ Identify and label all heritage items ▪ Illustrate the environmental control measures and environmentally sensitive receivers ▪ Is endorsed by the Environment, Approvals and Sustainability Director, or delegate	Environment, Approvals and Sustainability Director Environmental Advisors	ECMs	Construction

ID	Expectations/Requirements	JCG Response	Responsibility	Deliverables	Timing
		▪ Include all the training and competency requirements for relevant workers ▪ Is communicated to relevant workers, including sign-off for the appropriate procedures prior to commencing works on the specific site and/or activity ▪ Is displayed on site notice boards. The ECM is a progressive document and will be updated to reflect the relevant stage as works progress. ECMs will be submitted to the ER for information on request.			

Element 3: Auditing, review and improvement

Table 28: Element 3: Auditing, review and improvement

ID	Expectations/Requirements	JCG Response	Responsibility	Deliverables	Timing
3.1	Review this Sub-plan to ensure compliance with the EPL	▪ We 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 the CEMP ▪ Any updates to this Sub-plan will be provided to the ER under Condition A30(j).	Environment, Approvals and Sustainability Director Environment Representative	Updates to this Sub-plan if required during delivery	Construction
3.2	Audits are undertaken to ensure compliance with the requirements of this Sub-Plan	Audits will be performed in accordance with the CEMP (Section 7.13.1), and we will update this Sub-plan and/or the associated DNVIS or procedures if required.	Environment, Approvals and Sustainability Director Environment Advisors	Audit Reports	Construction
3.3	All non-compliances are reported and actioned	A noise or vibration non-compliance can generally be defined as a failure to comply with the Infrastructure Approval or the EPL. Where a non-compliance is also an environmental incident, JCG will implement the relevant notification procedures for both non-compliances and incidents (refer to Sections 3.10 and 3.12.2 of the CEMP). Where a non-compliance conformance is raised as part of an audit, inspection, incident investigation or complaint investigation, the relevant process 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. 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, Approvals and Sustainability Director Environment Advisors	Complaints register Inspection reports Incident Reports Audit Reports	Construction

Element 4: Project specific requirements

Planning Approval (SSI 19238057)

Table 29: Planning Approval (SSI 19238057)

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
A34	Work must not commence until an AA has been nominated by the Proponent and approved by the Planning Secretary.	AA has been nominated by Sydney Metro and approved by DPE.	Sydney Metro	N/A	Pre-construction
A38	The Proponent must cooperate with the AA by: (a) providing access to noise and vibration monitoring activities as they take place; (b) providing access to the Complaints Register if requested; (c) providing for review of noise and vibration documents required to be prepared under the conditions of this approval; and (d) considering any recommendations to improve practices and demonstrating, to the satisfaction of the AA, why any recommendation is not adopted.	Consultation with the AA addressed in this Sub-plan (Section 4.3)	Environment, Approvals and Sustainability Director	This Sub-Plan	Pre-construction
D20	A detailed land use survey must be undertaken to confirm sensitive receivers (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 Noise and Vibration CEMP Sub-plan required under Condition C5.	An initial land use survey is included in this NVMP (Appendix B). The land use survey will be updated for the final Sub-plan	RT&A Environmental Advisors	Land use survey	Prior to commencement of work in an area
D21	Work must only be undertaken during the following hours: (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 6:00pm Saturdays; and (c) at no time on Sundays or public holidays.	Work hours are identified in this Sub-plan (Section 6.1) and in the DNVIS for worksites	Project Director (or delegate) Environment Advisors	This Sub-plan DNVIS	Pre-construction Construction
D22	Except as permitted by an EPL, highly noise intensive work that results 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	Work hours are identified in this Sub-plan (Section 6.1) and in the DNVIS for worksites	Project Director (or delegate) Environment Advisors	This Sub-plan DNVIS	Pre-construction Construction

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
	(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.				
D23	Notwithstanding Conditions D21 and D22 work may be undertaken outside the hours specified in the following circumstances:	Work hours are identified in this Sub-plan (Sections 6.1, 8.5.3, 8.5.4, 8.6.2) and in the DNVIS for worksites	Project Director (or delegate) Environment Advisors	This Sub-plan DNVIS	Pre-construction Construction
	(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. On becoming aware of the need for emergency work in accordance with (a)(ii) above, the AA, 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.				
	(b) Low impact, including: (i) construction that causes $L_{Aeq(15\text{ minute})}$ 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 $L_{AFmax(15\text{ minute})}$ noise levels no more than 15 dB(A) above the rating background level at any residence; or (iii) 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).				

Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
(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 D24; or (iii) negotiated agreements with directly affected residents and sensitive land user(s).				
(d) By Prescribed Activity, including: (i) tunnelling by tunnel boring machine (excluding cut and cover tunnelling and surface works) are permitted 24 hours a day, seven days a week; or (ii) delivery of material that is required to be delivered outside of standard construction hours in Condition D21 to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Pymont construction site which could result in a sleep disturbance event for receivers in the proximity of Pymont Street, Edward Street, Union Street, Paternoster Row and Pymont Bridge Road; or (iii) haulage of spoil except between the hours of 10:00 pm and 7:00 am to / from the Pymont construction site; or (iv) work within an acoustic shed where there is no exceedance of noise levels under Low Noise Impact Work circumstances identified in (b) above, unless otherwise agreed by the Planning Secretary. Note: Tunnelling does not include station box excavation.				
D24 An Out-of-Hours Work Protocol must be prepared before the approval of out-of-hours-work under Condition D23(c)(ii). The Protocol must identify a process for the consideration, management and approval of work which are outside the hours defined in Conditions D21 and D22. 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 and the AA. The Protocol must provide: (a) 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 and AA review all proposed out-of-hours activities and confirm their risk levels; (ii) low risk activities can be approved by the ER in consultation with the AA; and	The requirements of this Condition are addressed in Section 8.5.3.	Sydney Metro	Sydney Metro West Out-of-Hours Work Protocol (to be prepared by Sydney Metro)	Pre-construction

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
	(iii) high risk activities that are approved by the Planning Secretary; (b) a process for the consideration of out-of-hours work against the relevant NML and vibration criteria; (c) 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 D36. 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; (d) 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 (e) 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. Note: Out-of-hours work is any work that occurs outside the construction hours identified in Conditions D21 and D22				
D25	All reasonable and feasible 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 established using the Interim Construction Noise Guideline (DECC, 2009); (b) 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 for structurally unsound heritage items). 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.	This Sub-plan establishes the airborne construction noise objectives (Section 6.2) and the vibration criteria (Section 6.6). DNVIS prepared for each worksite will identify all feasible and reasonable mitigation measures.	Project Director (or delegate) Environmental Advisors RT&A	This Sub-plan and DNVIS for worksites	Pre-construction Construction

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
	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.				
D26	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 D24.	This Sub-plan establishes the GBN management levels (Section 6.3). DNVIS prepared for each worksite will identify all feasible and reasonable mitigation measures.	Project Director (or delegate) Environment Advisors RT&A	This Sub-Plan and DNVIS for worksites.	Pre-construction Construction
D27	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.	Community consultation requirements are identified in Section 8.5.4.	Stakeholder and Community Engagement Director Environment, Approvals and Sustainability Director RT&A	CCA Consultation records DNVIS	Pre-construction
D28	Industry best practice construction methods must be implemented where reasonably practicable to ensure that noise levels are minimised around sensitive land user(s). Practices must include, but are not limited to: (a) use of regularly serviced low sound power equipment; (b) temporary noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities such as rock hammering and concrete cutting; and (c) use of alternative construction and demolition techniques.	Commitment to implementing industry best practice identified in Section 8.2.2.	Project Director (or delegate) Environment, Approvals and Sustainability Director RT&A	DNVIS for worksites	Pre-construction
D29	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 D25 and D26 at any residence outside construction hours identified in Condition D21, or where receivers will be highly noise affected. 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 AA and ER before the commencement of the associated works. The Planning Secretary and the EPA may request a copy (ies) of the DNVIS.	The requirement to prepare a DNVIS is detailed in Section 7.3 and Section 7.4.	Environmental Advisors RT&A	DNVIS or Gatewave Report	Pre-construction

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
D30	DNVIS must be prepared for each construction site before construction noise and vibration impacts commence and include specific mitigation measures identified through consultation with affected sensitive land users and updated as required if site conditions or activities change.	Refer to DNVIS (Section 7.3).	Environmental Advisors RT&A	DNVIS or Gatewave Report	Pre-construction
D31	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.	Refer to Table 21 (NVMM 24)	Stakeholder and Community Engagement Director Environment, Approvals and Sustainability Director	DNVIS for worksites Consultation Manager records	Pre-construction
D32	Vibration testing must be conducted during vibration generating activities that have the potential to impact on Heritage items to identify 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.	Refer to Section 8.4, Appendix A, and Appendix E.	Project Director (or delegate) Environment, Approvals and Sustainability Director Environmental Advisors	DNVIS for worksites Consultation Manager records	Pre-construction
D33	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. Note: The installation of noise and vibration equipment must not impact on the heritage value of the Heritage items.	Refer to Part B, Element 2 (2.2) and the NV Program (Appendix A).	Environmental Advisors RT&A	DNVIS	Pre-construction
D34	Before conducting at-property treatment at any Heritage item identified in the documents listed in Condition A1, the advice of a suitably qualified and experienced built heritage expert must be obtained and implemented to ensure any such work does not have an adverse impact on the heritage significance of the item.	Refer to Section 8.6.1.	Environment, Approvals and Sustainability Director RT&A	DNVIS	Pre-construction
D35	If a Heritage item is found to be structurally unsound (following inspection) a more conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) must be applied.	Refer to Section 6.6.6.3.	Project Director (or delegate) Environment, Approvals and Sustainability Director	DNVIS	Pre-construction

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
			RT&A		
D36	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 receivers so that the respite is achieved in accordance with Condition D37; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the AA 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.	Refer to Section 1.4.3 and Table 21 (NVMM 6)	Project Director (or delegate) Environment, Approvals and Sustainability Director	DNVIS	Construction
D37	In order to undertake out-of-hours work outside the hours specified under Condition D21, 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 D26 (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 AA, EPA and the Planning Secretary.	Refer to Section 8.5 and Section 8.5.4.	Stakeholder and Community Engagement Director Environment, Approvals and Sustainability Director	DNVIS	Construction

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
	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.				
D38	The Proponent must identify all receivers at Pyrmont and Hunter Street Sydney CBD likely to experience internal noise levels greater than Leq(15 minute) 60 dB(A) inclusive of a 5 dB penalty, if rock breaking or any other highly noise intensive activity likely to result in regenerated (ground-borne) noise or a perceptible level of vibration is planned (including works associated with utility adjustments), between 7am and 8pm. Note: This condition does not override requirements for work hours as outlined in Conditions D21, D22 and D23 above.	Refer to Section 8.3.1.	Environment, Approvals and Sustainability Director RT&A	DNVIS	Pre-construction
D39	The Proponent must consult with all receivers identified in accordance with Condition D38 with the objective of determining appropriate hours of respite so that construction noise (including ground-borne noise), does not exceed internal noise levels of: (a) Leq(15 minute) 60 dB(A) inclusive of a 5 dB penalty if rock breaking or any other highly noise intensive activity likely to result in ground-borne noise or a perceptible level of vibration is planned between 7am – 8pm for more than 50 percent of the time; and (b) Leq(15 minute) 55 dB(A) inclusive of a 5 dB penalty if rock breaking or any other highly noise intensive activity likely to result in ground-borne noise or a perceptible level of vibration is planned between 7am – 8pm for more than 25 percent of the time, unless an agreement is reached with those receivers. This condition does not apply to noise associated with the cutting surface of a TBM as it passes under receivers. <i>Note This condition requires that noise levels be less than Leq(15 minute) 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below Laeq(15 minute) 55 dB(A). Noise equal to or above Leq(15 minutes) 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm.</i>	Refer to Section 6.4, Table 21 (NVMM 2) and Section 8.3.1	Stakeholder and Community Engagement Director Environment, Approvals and Sustainability Director	DNVIS	Pre-construction
D40	Notwithstanding Conditions D22 and D23, rock breaking and other particularly highly noise intensive activities for station shaft or cut and	Construction hours are identified in Table 10.	Environmental Advisors	This Sub-plan DNVIS	Pre-construction

	Requirements (Conditions)	JCG response	Responsibility	Deliverables	Timing
	cover stations is not permitted outside of hours identified in Condition D21, except at Hunter Street Sydney CBD; or (a) 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) where different construction hours are permitted or required under an EPL in force in respect of the construction; or (c) where an EPL is not required or in force, approved through an Out of Hours Work Protocol developed in accordance with Condition D24; or (d) construction that causes LAeq(15 min) noise levels: (i) no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009); and (ii) no more than the noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses; and (iii) continuous or impulsive vibration values, measures at the most affected residence are no more than those for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006); and (iv) intermittent vibration values measured at the most affected residence are no more than those for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006).		Project Director (or delegate) Environmental Advisors RT&A		
D41	No blasting is permitted as part of this CSSI.	No blasting will be undertaken as part of the ETP Works.	Project Director (or delegate) Environment, Approvals and Sustainability Director Environment Advisors	N/A	Construction

Revised Environmental Mitigation Measures

Table 30: Revised Environmental Mitigation Measures

ID	EIS Revised Environmental Mitigation Measures	JCG response	Responsibility	Deliverables	Timing
NV01	Where justified by the application of the Construction Noise and Vibration Standard, further engagement and consultation would be carried out in accordance with the Sydney Metro Overarching Community Communications Strategy with: - The affected communities to understand their preferences for mitigation and management measures 'Other sensitive' receivers such as schools, medical facilities, theatres, or places of worship to understand periods in which they are more sensitive to impacts. Based on this consultation, appropriate mitigation and management options would be considered and implemented where feasible and reasonable to minimise the impacts.	Refer to Section 1.4.2 and 8.5.4	Stakeholder and Community Engagement Director Environmental Advisors	CCA Consultation records DNVIS	Pre-construction
NV02	Alternative construction methodologies and measures that minimise noise and vibration levels during noise intensive work would be investigated and implemented where feasible and reasonable. This would include consideration of: - The use of hydraulic concrete shears in lieu of hammers/rock breakers - Sequencing work to shield noise sensitive receivers by retaining building wall elements - Locating demolition load out areas away from the nearby noise sensitive receivers - Providing respite periods to minimise impacts from prolonged periods of noise intensive work - Minimising structural-borne noise to adjacent buildings including separating the structural connection prior to demolition through saw-cutting and propping, using hand held splitters and pulverisers or hand demolition - Installing sound barrier screening to scaffolding facing noise sensitive neighbours - Using portable noise barriers around particularly noisy equipment, such as concrete saws - Modifying demolition work sequencing/hours to minimise impacts during peak pedestrian times and/or adjoining neighbour outdoor activity periods.	Refer to Section 8.2.2	Project Director (or delegate) Environmental Advisors	DNVIS for worksites	Pre-construction
NV03	Appropriate respite would be provided to affected receivers in accordance with the Sydney Metro Construction Noise and Vibration Standard. This	Refer to Section 7.3, Section 8.5.4 and Table 21	Project Director (or delegate)	DNVIS	Construction

ID	EIS Revised Environmental Mitigation Measures	JCG response	Responsibility	Deliverables	Timing
	would include consideration of impacts from utility and power supply work when determining appropriate respite periods for affected receivers. When determining appropriate respite, the need to efficiently undertake construction would be balanced against the communities' preferred noise and vibration management approach.		Environmental Advisors		
NV04	The use of noise intensive equipment at construction sites with 'moderate' and 'high' out of hours noise management level exceedances would be scheduled for standard construction hours, where feasible and reasonable. Where this is not feasible and reasonable, the work would be undertaken as early as possible in each work shift.	Refer to Table 21 (NVMM5)	Project Director (or delegate) Environmental Advisors	DNVIS	Construction
NV05	Where practicable, air brake silencers would be used on heavy vehicles that access construction sites multiple times per night or over multiple nights.	Refer to Table 21 (NVMM5)	Project Director (or delegate) Environmental Advisors	DNVIS	Construction
NV06	Perimeter site hoarding would be designed with consideration of on-site heavy vehicle movements with the aim of minimising sleep disturbance impacts.	Refer to Section 8.2.1 and DNVIS	Project Director (or delegate) Environment Manager	DNVIS	Pre-construction
NV07	Long term construction site support equipment and machinery would be low noise emitting and suitable for use in residential areas, where feasible and reasonable. Examples include: - Low noise water pumps for use in water treatment facilities - Low noise generators and compressors - Low noise air conditioner units for use of amenities buildings.	Refer to Section 8.2.2 and Table 21 (NVMM12)	Project Director (or delegate) Environmental Advisors	DNVIS for worksites	Pre-construction
NV08	- Where acoustic sheds are installed, the internal lining and construction materials would be determined during later design stages to ensure appropriate attenuation is provided. This design of sheds would likely include the following considerations: All significant noise producing equipment that would be used during the night-time would be inside the shed, where feasible and reasonable - Noise generating ventilation systems such as compressors, scrubbers, etc, would also be inside the shed and external air intake/discharge ports would be appropriately acoustically treated - Acoustic shed doors would be kept closed during the night-time period, where feasible and reasonable. Where night-time vehicle access is required, the doors would be designed and constructed to minimise noise breakout.	Refer to Table 21 (NVMM19)	Project Director (or delegate) Environment Manager RT&A	DNVIS for worksites	Pre-construction

ID	EIS Revised Environmental Mitigation Measures	JCG response	Responsibility	Deliverables	Timing
NV09	Feasible and reasonable measures would be implemented to minimise ground-borne noise where exceedances are predicted. This may require implementation of less ground-borne noise and less vibration intensive alternative construction methodologies.	Refer to Section 8.2.2 and Table 21.	Project Director (or delegate) Environmental Advisors	DNVIS for worksites	Pre-construction
NV10	The proximity of cross passages to nearby receivers and the corresponding construction ground-borne noise and vibration impacts during the excavation work would be considered when determining locations. Relocation of cross passages to be further away from sensitive receivers to mitigate potential construction impacts would be considered, where feasible and reasonable.	Refer to Section 7.3.	Project Director (or delegate) Environment, Approvals and Sustainability Director	DNVIS for worksites	Pre-construction
NV11	Activity specific Detailed and/or General Noise and Vibration Impact Statement (in accordance with the requirements of the Construction Noise and Vibration Standard) would be developed for rockbreaking in the tunnel and at cross passages, specifically addressing the activity where it is required between 22:00 - 07:00.	Refer to Section 7.3 and Section 8.2.1.	Project Director (or delegate) Environment, Approvals and Sustainability Director RT&A	DNVIS for worksites	Pre-construction
NV12	Further assessment of construction traffic would be completed during detailed design, including consideration of the potential for exceedances of the NSW Road Noise Policy base criteria (where greater than two dB increases are predicted). The potential impacts would be managed using the following approaches, where feasible and reasonable: - On-site spoil storage capacity would be maximised to reduce the need for truck movements during sensitive times - Vehicle movements would be redirected away from sensitive receiver areas and scheduled during less sensitive times - The speed of vehicles would be limited, and the use of engine compression brakes would be avoided - Heavy vehicles would not be permitted to idle near sensitive receivers.	Refer to Table 21 (NVMM13)	Project Director (or delegate) Environmental Advisors	DNVIS for worksites	Pre-construction
NV13	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure (in consultation with a structural engineer) and vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.	Refer to the NV Program (Appendix A) and relevant procedures (Appendix E)	Project Director (or delegate) Environmental Advisors RT&A Heritage specialist	DNVIS for worksites Monitoring records	Pre-construction

ID	EIS Revised Environmental Mitigation Measures	JCG response	Responsibility	Deliverables	Timing
NV14	Condition surveys of buildings and structures near to the tunnel and excavations would be undertaken prior to the commencement of excavation at each site, where appropriate. For heritage buildings and structures the surveys would consider the heritage values of the structure in consultation with a heritage specialist.	Refer to Table 21 (NVMM11)	Project Director (or delegate) Environmental Advisors	Condition surveys	Pre-construction
NV15	The likelihood of cumulative construction noise impacts would be reviewed during detailed design when detailed construction schedules are available. Co-ordination would occur between potentially interacting projects to minimise concurrent or consecutive work in the same areas, where possible. Specific mitigation strategies would be developed to manage impacts. Depending on the nature of the impact, this could involve adjustments to construction program or activities of Sydney Metro West or of other construction projects.	Refer to Section 1.4.3 and 8.5.4	Project Director (or delegate) Environment, Approvals and Sustainability Director	DNVIS	Construction

Environmental Performance Outcomes

Table 31: Environmental Performance Outcomes

Key Issue	Desired Performance Outcome	Sydney Metro West Performance Outcome	Sub-plan reference
Noise and Vibration	Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity, and adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage.	- Construction noise and vibration impacts on local communities are minimised by controlling noise and vibration at the source, on the source to receiver path and at the receiver - Structural damage to buildings and heritage items from construction vibration is avoided. - Local communities are engaged during construction, including on noise mitigation in areas predicted to be affected by high noise impacts.	Section 8 Out of Hours Works Management Procedure (Appendix E) Vibration Assessment Procedure (Building Damage) (Appendix E)

Construction Environmental Management Framework

Table 32: Construction Environmental Management Framework requirements

Construction Environmental Management Framework		Sub-plan reference
3.5 (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: i. Spoil management; ii. Groundwater management; iii. Noise and vibration management; iv. Heritage management; v. Flora and fauna management; vi. Visual amenity management; vii. Soil and water management; viii. Air quality management; and ix. Waste management.	Section 1.1
3.6 (a)	The Principal Contractor will prepare and implement activity specific environmental procedures. These procedures should supplement environmental management sub plans, but may substitute for sub plans in agreement with Sydney Metro if a reasonable risk based justification can be made and the sub plan is not a requirement of any approval.	Appendix E Activity Method Statements Task Risk Assessments
3.6 (b)	The procedures will include: i. A breakdown of the work tasks relevant to the specific activity and indicate responsibility for each task; ii. Potential impacts associated with each task; iii. A risk rating for each of the identified potential impacts; iv. Mitigation measures relevant to each of the work tasks; and v. Responsibility to ensure the implementation of the mitigation measures.	Appendix E Activity Method Statements Task Risk Assessments
5.1 (a)	Working Hours Standard working hours are between 07:00 – 18:00 on weekdays and 08:00 – 18:00 on Saturdays	Section 6.1
5.1 (b)	Works which can be undertaken outside of standard construction hours without any further approval include: i. Those which have been described in respective environmental assessments as being required to take place 24/7. For example, tunnelling and underground excavations and supporting activities will be required 24/7 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 Sydney Roads) 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 6.1

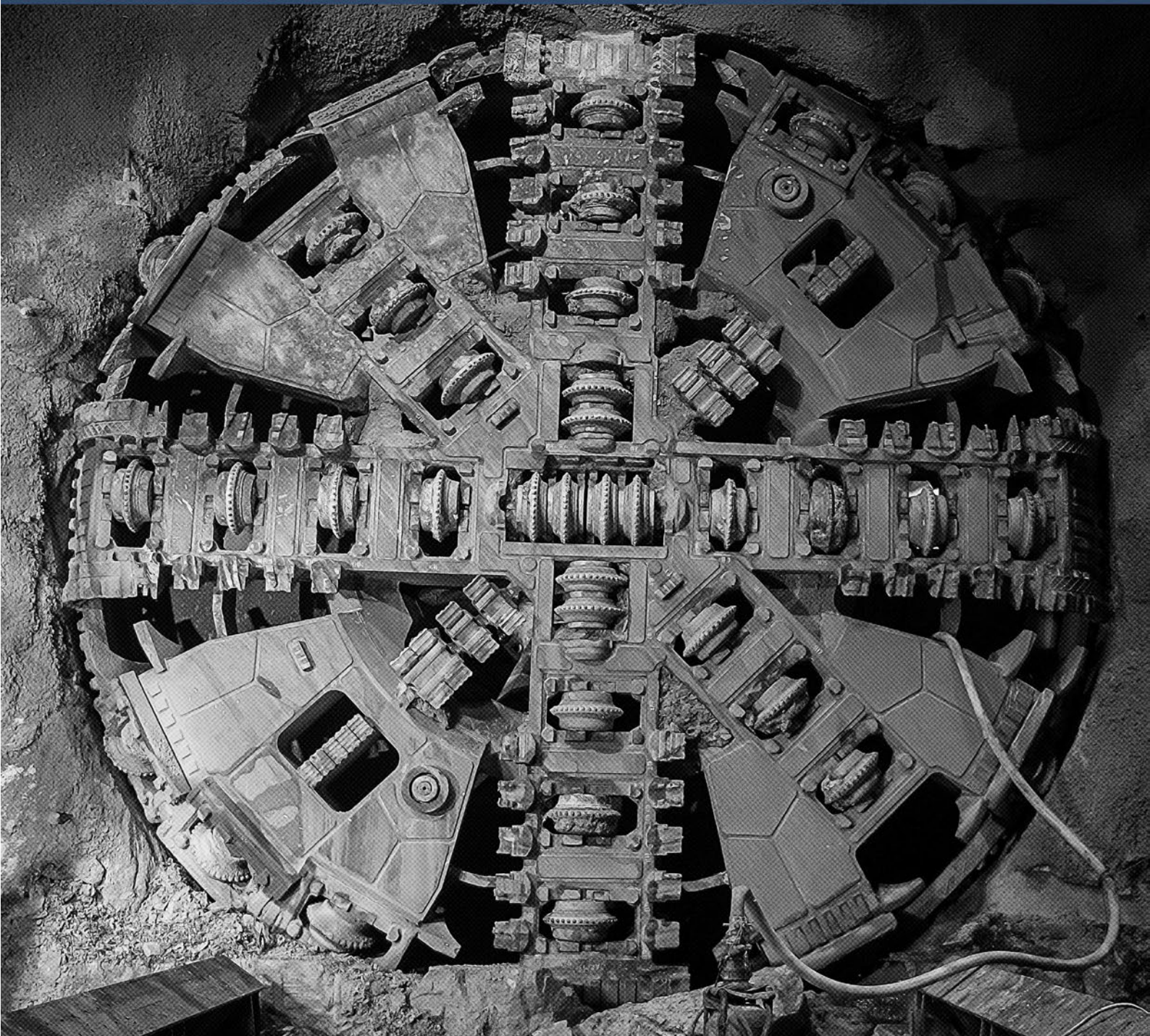
Construction Environmental Management Framework		Sub-plan reference
5.1 (c)	Principal Contractors may apply for EPA approval to undertake works outside of normal working hours under their respective Environment Protection Licences.	Noted.
8.1 (a)	Construction Noise and Vibration Management Objectives 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 1.2
8.2 (a)	Principal Contractors will develop and implement a Construction Noise and Vibration Management Plan for their scope of works consistent with the Interim Construction Noise Guidelines (Department of Environment and Climate Change, 2009). The Construction Noise and Vibration Management Plan will include as a minimum:	This Sub-plan. Work areas, site compounds and access points are identified in Appendix C
	i. Identification of work areas, site compounds and access points;	
	ii. Identification of sensitive receivers and relevant construction noise and vibration goals	Sensitive receivers are identified in Appendix B. Construction noise and vibration goals are set out in 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)	Noise and vibration mitigation measures are summarised in 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;	Appendix C
	v. Identification of feasible and reasonable procedures and mitigation measures to ensure relevant vibrations and blasting criteria are achieved, including a suitable blast program	Appendix E
	vi. Community consultation requirements and Community notification provisions specifically in relation to blasting;	Section 1.4.2 and Section 8.5.4
	vii. The requirements of any applicable licence or approval (for example EPL);	To be updated upon issue of EPL
	viii. Additional requirements in relation to activities undertaken 24 hours of the day, 7 days per week;	Section 8.5.1
	ix. Pre-construction compliance requirements and hold points;	Section 9.1
	x. The responsibilities of key project personnel with respect to the implementation of the plan;	Section 4
	xi. Noise monitoring requirements;	Appendix A

Construction Environmental Management Framework		Sub-plan reference
	xii. An Out of Hours Works Protocol applicable to all construction methods and sites.	Section 8.5.3
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 and Section 7.4
8.2 (c)	Noise and vibration monitoring would be undertaken for construction as specified in the CNVS.	Appendix A
8.2 (d)	The following compliance records would 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	Appendix A

Part C: Appendices

Appendix A Noise and Vibration Monitoring Program

Noise and Vibration Monitoring Program



NOISE AND VIBRATION MONITORING PROGRAM

Project number	7040
Document number	SMWSTETP-JCG-SWD-SW000-EN-PLN-002020

Document approval

Rev	Date	Prepared by	Reviewed by	Comments	Approved by
A	24/11/2022	Renzo Tonin		Draft for consultation SM and ER review	
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D	15/02/2023	Renzo Tonin		Draft for SM review and ER endorsement	
0	22/03/2023	Renzo Tonin		Change of revision number only	
Signature:					

Compliance

Table 1: Compliance matrix

ID	Requirement	Reference
SSI 19238057 Planning Approval		
A6	Where the conditions of this approval require a document or monitoring program to be prepared, or a review to be undertaken, in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Planning Secretary with the document. The evidence must include: (a) documentation of the engagement with the party identified in the condition of approval that has occurred before submitting the document for approval; (b) a log of the dates of engagement or attempted engagement with the identified party and a summary of the issues raised by them; (c) documentation of the follow-up with the identified party(s) where feedback has not been provided to confirm that the party(s) has none or has failed to provide feedback after repeated requests; (d) outline of the issues raised by the identified party(s) and how they have been addressed; and (e) a description of the outstanding issues raised by the identified party(s) and the reasons why they have not been addressed. Note: *Consultation with the community and businesses will be undertaken in accordance with the Overarching Community Communication Strategy required under Condition B1.	Section 1.4
C14	The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies 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: (a) Noise and vibration: EPA, Place Management NSW (in respect of The Bays) and Relevant Council(s) (b) Surface water quality: DPE Water, Relevant Council(s) and Sydney Water (if any Sydney Water assets are impacted) (c) Groundwater: DPE Water	Section 1.4
C15	Each Construction Monitoring Program must provide:	Section 4
	(a) details of baseline data available including the period of baseline monitoring;	
	(b) details of baseline data to be obtained and when;	Section 4
	(c) details of all monitoring of the project to be undertaken;	Section 5 and Section 6
	(d) the parameters of the project to be monitored;	Table 7 and Table 9
	(e) the frequency of monitoring to be undertaken;	Table 7 and Table 9
	(f) the location of monitoring;	Section 5.2 and Section 6.2
	(g) the reporting of monitoring results and analysis results against relevant criteria;	Section 8.3 and Section 8.5
	(h) details of the methods that will be used to analyse the monitoring data;	Section 8.3
	(i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts;	Section 8.3
	(j) a consideration of SMART principles; and	Section 5 Section 6
	(k) any consultation to be undertaken in relation to the monitoring programs; and	Section 1.4

ID	Requirement	Reference
	(l) any specific requirements as required by Conditions C16 and C17.	Refer to Condition C16
C16	The Noise and Vibration Construction Monitoring Program must include: (a) noise and vibration monitoring determined in consultation with the AA to confirm the best-achievable construction noise and vibration levels with consideration of all reasonable and feasible mitigation and management measures that will be implemented; (b) for the purposes of (a), noise monitoring must be undertaken during the day, evening and night-time periods and within the first month of work as well as throughout the construction period and cover the range of activities being undertaken at the sites; and (c) 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, ER and AA. The Planning Secretary and EPA must be provided with access to the results on request. (d) noise monitoring methods must be developed and carried out to meet the requirements of the EPA's Approved Methods for the Measurement and Analysis of Environmental Noise (EPA, 2022).	Section 1.4 Table 7 Table 7 and Table 9 Section 8.2 Section 5
C18	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
C19	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 phased no later than one (1) month before the commencement of that phase.	Section 1.4
C20	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 phased no later than one (1) month before the commencement of that phase.	Section 1.4
C21	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
C22	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
C23	The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, ER, AA (where relevant) and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Notes: - Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan. - Data must be provided in an acceptable format for relevant regulatory agencies.	Section 8.5

ID	Requirement	Reference
	3. With regards to monitoring data to be provided to DPE Water, the format of the dataset must be both in a tabulated and electronic quality-controlled data (.csv, Excel) ready to use format.	
D32	Vibration testing must be conducted during vibration generating activities that have the potential to impact on Heritage items to identify 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 6.2.2
D33	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. Note: The installation of noise and vibration equipment must not impact on the heritage value of the Heritage items.	Section 6.2.2
D35	If a Heritage item is found to be structurally unsound (following inspection) a more conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) must be applied.	Section 6.2.2
Revised Environmental Mitigation Measures (REMM)		
NV13	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure (in consultation with a structural engineer) and vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.	Section 6.2.2
NAH9	Where required, heritage items identified by NAH8 as requiring further assessment should undergo instrumentation and monitoring as part of further assessments and during the work.	Section 6.2.2
Construction Environmental Management Framework (CEMF)		
8.2 (a) xi	Principal Contractors will develop and implement a Construction Noise and Vibration Management Plan for their scope of works consistent with the Interim Construction Noise Guidelines (Department of Environment and Climate Change, 2009). The Construction Noise and Vibration Management Plan will include as a minimum: xi. Noise monitoring requirements	Section 5
8.2 (c)	Noise and vibration monitoring would be undertaken for construction as specified in the CNVS.	Section 5 and Section 6
8.2 (d) i	The following compliance records would be kept by Principal Contractors: i. Records of noise and vibration monitoring results against appropriate NMLs and vibration criteria;	Section 7.2

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Acronyms and definitions

Table 2: Acronyms and definitions

Acronym	Definition
AA	The Acoustic Advisor for the CSSI approved by the Planning Secretary
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 and underfloor areas as described in Appendix B of At Receiver Noise Treatment Guideline (Roads and Maritime Services, 2017) and other treatments including, but not limited to, noise curtains, shutters and secondary glazing.
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.
AVTG	NSW Assessing Vibration – a technical guideline
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
CNVS	Construction Noise and Vibration Standard
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.
DNVIS	Detailed Noise and Vibration Impact Statement(s)
DPE	Department of Planning and Environment
ECM	Environmental Control Map
EIS	The Environmental Impact Statement referred to in Condition A1, submitted to the Planning Secretary seeking approval to carry out the development described in it, as revised if required by the Planning Secretary under the EP&A Act, and including any additional information provided by the Proponent in support of the application for approval of the project.
ENMM	Environmental Noise Management Manual

Acronym	Definition
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment.
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve.
Environmental target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
E&SMS	Environment and Sustainability Management System
ETP Works	Eastern Tunnelling Package Works
ER	The Environmental Representative(s) for the CSSI approved by the Planning Secretary
eVDV	Estimated Vibration Dose Value
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 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.
GNML	Ground-borne noise management level
Highly noise affected	As defined in the ICNG
Highly noise intensive works	Works which are defined as annoying under the ICNG, including: (a) use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work (b) grinding metal, concrete or masonry (c) rock drilling (d) line drilling (e) vibratory rolling (f) bitumen milling or profiling (g) jackhammering, rock hammering or rock breaking (h) rail tamping and regulating (i) impact piling.
IC	Independent Certifier
ICNG	NSW 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.

Acronym	Definition
JCG	John Holland CPB Ghella Joint Venture
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.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LGA	Local government area
NCA	Noise Catchment Area
NML	Noise Management Level as defined in the ICNG
NPfI	Noise Policy for Industry
NVMP	Noise and Vibration Management Sub-plan
NV Program	Noise and Vibration Monitoring Program
OOHW	Out-of-hours work
POEO Act	Protection of the Environment Operations Act 1997
PPV	Peak Particle Velocity
Project, the	Eastern Tunnelling Package
RBL	Rating Background Level
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
REMM	Revised Environmental Mitigation Measure
RMS	Root-Mean-Square acceleration
RNP	NSW Road Noise Policy
RT&A	Renzo Tonin & Associates
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.
Sensitive land use(s)	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. Note: For the purpose of determining appropriate mitigation, a multi-storey residential flat building must not be counted as a single sensitive receiver.
SHR	State Heritage Register
Sleep disturbance event	Where the subject development / premises night-time noise levels at a residential location exceed:

Acronym	Definition
	(a) $L_{Aeq, 15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and / or (b) L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.
SLEP	Sydney Local Environment Plan
SM	Sydney Metro
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.
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.
SPL	Sound Pressure Level
SSI	State Significant Infrastructure
STP	Slurry Treatment Plant
TBM	Tunnel Boring Machine
VC	Vibration criterion
VDV	Vibration Dose Values
WFU	Warringah Freeway Upgrade
WHT	Western Harbour Tunnel project
WTP	Water Treatment Plant

Part A: Overview

1. Introduction

1.1. Purpose

This Noise and Vibration Monitoring Program (NV Program) is applicable to the Sydney Metro West - Eastern Tunnelling Package (ETP Works or the Project). This NV Program describes how John Holland CPB Ghella Joint Venture (JCG) will monitor noise and vibration during construction of the Project.

This NV Program has been prepared to address the requirements of the:

- State Significant Infrastructure (SSI) 19238057 Planning Approval (dated 24 August 2022) and relevant conditions of the Sydney Metro West Concept Schedule 2 of SSI 10038 Planning Approval (dated 11 March 2021) (Planning Approvals)
- Environment Protection Licence (EPL) (details to be added on receipt of the EPL)
- Environment Protection Authority Approved methods for the measurement and analysis of environmental noise in NSW 2022
- 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 ETP Deed and General and Particular Specifications
- Applicable legislation.

1.2. Objectives, targets and key performance indicators

The objectives, targets and key performance indicators for the NV Program are detailed in Table 3.

Table 3: Objectives, targets and key performance indicators

Objectives	Targets	Key Performance Indicators
Establish adequate and appropriate processes to achieve compliance with the noise and vibration monitoring requirements of the Planning Approval, REMMs, performance outcomes, EPL (on receipt), CEMF and CNVS	No breaches or regulatory infringements (PINs or prosecutions)	Number of breaches or regulatory infringements
Demonstrate compliance with the noise and vibration monitoring requirements of this NV Program (Table 7 and Table 9).	100% compliance with triggered noise and vibration monitoring requirements	Number of actual noise and vibration monitoring events against the number of triggered monitoring events
Demonstrate continual improvement through the verification of predicted noise and vibration levels.	100% compliance with predicted noise and vibration levels	Number of breaches of predicted noise and vibration levels

1.3. Context and interface with other plans

To achieve the intended environmental performance outcomes of the Project, JCG have established an Environment and Sustainability Management System (E&SMS) in accordance with the requirements of ISO 14001:2016. Guided by the Environment and Sustainability Policy, the E&SMS consists of a Construction Environmental Management Plan (CEMP), issue-specific procedures, Sub-plans and monitoring programs as illustrated in Figure 1. Implementation of the E&SMS is achieved through tools, checklists and forms as detailed in the CEMP.

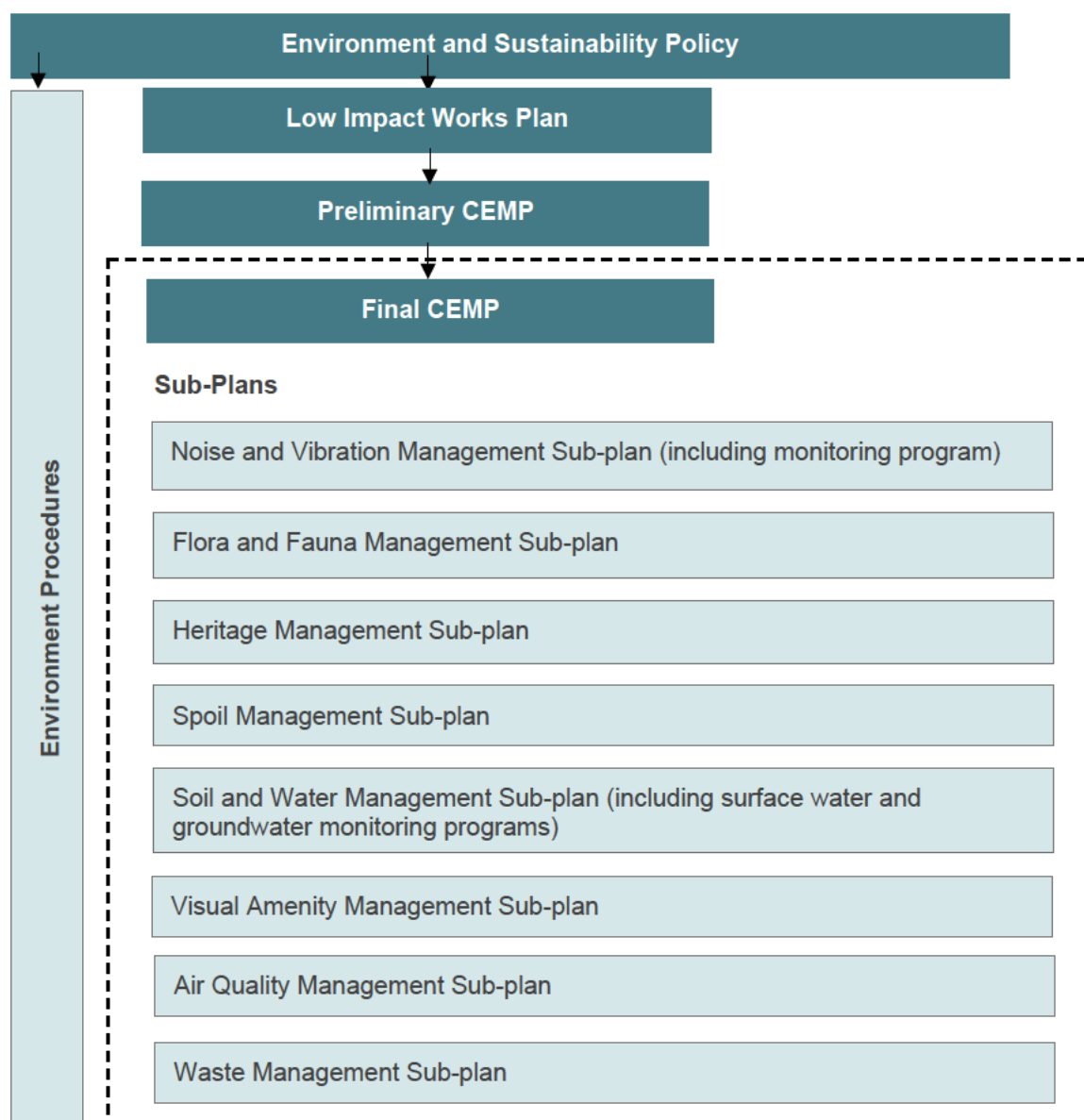


Figure 1: CEMP Framework

1.4. Consultation and approval

Reflecting the requirements of Conditions A6 and C14, this NV Program will be prepared in consultation with the Environment Protection Authority (EPA), Place Management NSW, City of Sydney Council and Inner West Council. A detailed consultation report, including matters raised by stakeholders and JCG responses, is provided in Appendix F of the Noise and Vibration Management Sub-plan (NVMP).

This NV Program will be endorsed by the ER and Acoustic Advisor (AA) and submitted to the Planning Secretary for approval at least one month before the commencement of the relevant construction phase.

The Tunnelling, Excavation and Associated Works phase will not commence until the CEMP, Sub-plans and monitoring programs have been approved by the Planning Secretary or endorsed by the ER (whichever is applicable). This NV Program, including any minor amendments approved by the ER and AA, will be implemented for the duration of the Project. In accordance with the Sydney Metro West Stage 2 Phasing Report, construction of a phase will not commence until the CEMP and CEMP Sub-plans for that phase have been approved by the Planning Secretary or endorsed by the ER upon nomination by the Planning Secretary (whichever is applicable).

2. Project overview

2.1. Background

Sydney Metro West is a new 24-kilometre metro line that will connect Greater Parramatta with the Sydney CBD via stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD).

The planning process for Sydney Metro West was assessed as a staged infrastructure application under section 5.20 of the *Environment Planning and Assessment Act 1979* (EP&A Act).

Stage 1 of the development, the Sydney Metro West Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (SSI-10038 Schedule 2), was approved on 11 March 2021 and includes:

- Construction and operation of new passenger rail infrastructure between Westmead and the central business district of Sydney, including:
 - Tunnels, stations (including surrounding areas) and associated rail facilities
 - Stabling and maintenance facilities (including associated underground and overground connections to tunnels)
- Modification of existing rail infrastructure, including stations and surrounding areas
- Ancillary development.

The Eastern Tunnelling Package (ETP or this Project) is addressed under the Stage 2 Planning Approval (SSI 19238057). This Project includes all major civil construction work including station excavation (at the Pyrmont Station and Hunter Street Station (Sydney CBD) construction sites) and tunnelling between The Bays and Sydney CBD (Figure 2).

It is noted that the existing Sydney Metro West precast facility at Eastern Creek will be utilised in the delivery of the ETP Works. The facility, which was assessed by Sydney Metro in a Review of Environmental Factors (REF) and approved on 11 March 2021, is outside of the scope of the NVMP.



Figure 2: Overview of the Sydney Metro West between The Bays and Sydney CBD (Source: EIS)

2.2. Project scope

The ETP Works (construction) involves the delivery of:

- Enabling works such as demolition, utility supply to construction sites, utility adjustments and modifications to the existing transport network
- Mined crossover cavern construction
- 4.2 km of TBM tunnel excavation, 650m of mined tunnels and 7 cross passage excavation, from The Bays to Sydney CBD
- Excavation for two new underground metro stations at Pyrmont and Hunter Street
- Construction of a turnback, crossover tunnels and caverns at the eastern end of the tunnel section
- A concrete segment facility for use during construction located at Eastern Creek (outside of the scope of this PCEMP).

3. Legal and other requirements

3.1. Legislation

This NV Program has been prepared in accordance with the:

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

Additional details on legislative requirements are provided in Section 3.3 of the CEMP.

3.2. Guidelines

The main guidelines, specifications and policy documents of relevance to this NV Program include:

- NSW Approved Methods for the Measurement and Analysis of Environmental Noise, Environment Protection Authority 2022
- NSW Interim Construction Noise Guideline, Department of Environment and Climate Change 2009
- 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.

3.3. Other environmental requirements

Other environmental requirements relevant to noise and vibration monitoring include:

- SSI 19238057 Planning Approval (dated 24 August 2022) and relevant conditions of the Sydney Metro West Concept Schedule 2 of SSI 10038 Planning Approval (dated 11 March 2021) (Planning Approvals)
- EPL (details to be added on receipt of the EPL)
- Sydney Metro West Stage 2 – Phasing Report, Rev 1.0
- Sydney Metro CEMF
- EIS and the Submissions Report, including the REMMs
- Contractual requirements including the ETP Deed and General and Particular Specifications.

In addition, the ETP works will be assessed by the Infrastructure Sustainability Council (ISC) IS V1.2 Rating. Noise and vibration requirements of the relevant credits (DIS-2 Noise and DIS-3 Vibration) are summarised in Table 4, including cross-references to where the requirement is addressed in this NVMP. Additional details on the ISC requirements and the credit objectives are provided in the Sustainability Management Plan.

Table 4: ISC Noise and Vibration Credits

ISC Credit	Level	Criteria	Reference
DIS-2 Noise	1	Measures to mitigate noise during construction and operation have been identified and implemented.	Section 8 of the NVMP
	1	Monitoring of noise is undertaken at appropriate intervals and in response to complaints during construction.	This NV Program
	2	For construction, modelling and monitoring demonstrates no recurring or major divergences from the noise management process in ISCA approved noise guidelines.	This NV Program
	3	For construction, modelling and monitoring demonstrates no divergence from the noise management process in ISCA approved noise guidelines.	This NV Program
DIS-3 Vibration	1	Measures to mitigate vibration during construction and operation have been identified and implemented.	Section 8 of the NVMP
	1	Monitoring of vibration is undertaken at appropriate intervals and in response to complaints during construction and operation.	This NV Program
	2	For construction, modelling and monitoring demonstrates no exceedances of vibration goals for structural damage to buildings and structures.	This NV Program

4. Existing environment

4.1. Baseline monitoring

As part of the EIS process, baseline noise monitoring was conducted in 2021 at six locations between The Bays and Hunter Street (Table 5).

Table 5: Baseline monitoring results

Study Area	Location ID	Address	Noise Level (dBA) ^{1,2}					
			Background Noise (RBL)			Average Noise Level (L _{Aeq})		
			Day	Evening	Night	Day	Evening	Night
The Bays ³	B.01	21 Mansfield Street, Rozelle	43	43	35	56	54	47
	B.02	22 Lilyfield Road, Rozelle	51	51	45	57	57	54
	B.03	308 Glebe Point Road, Glebe	48	47	39	59	58	51
Pyrmont	B.04 ⁴	200 Paternoster Row, Pyrmont	50	47	45	56	50	47
	B.05	1-5 Harwood Street, Pyrmont	52	49	46	61	59	56
Hunter Street (Sydney CBD) ⁵	B.06	1 Hosking Place, Sydney	61	56	52	66	62	63

NOTES

1. The RBL and L_{Aeq} noise levels have been determined with reference to the procedures in the NPfI.
2. Daytime is 7am to 6pm, evening is 6pm to 10pm and night-time is 10pm to 7am.
3. Data taken from Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020).
4. Data based on several attended ambient noise measurements.
5. Data measured as part of Sydney Metro Chatswood to Sydenham Environmental Impact Statement in 2015. Noise levels in the CBD are typically elevated due to relatively constant sources of noise and the measured levels are considered representative of current ambient noise conditions.

Further review of the NCAs identified in the EIS has been undertaken by JCG resulting in the subdivision of NCA2 (The Bays) into three NCAs. This change better represents the existing acoustic environment to the north of the worksite and provides consistency with the NCAs identified in the EIS for the Western Harbour Tunnel (WHT) and Warringah Freeway Upgrade (WU) project (Renzo Tonin & Associates 2020).

Existing noise levels vary across the ETP Works. The surface worksites are in mixed residential and commercial areas, with some industrial areas around The Bays. The noise environment is typically characterised by urban sounds, road traffic noise, mechanical plant noise (especially in the CBD near Hunter Street) and other transport noise, including the Light Rail and harbour traffic.

The ambient noise monitoring locations were selected with reference to the procedures outlined in the Noise Policy for Industry (NPfI). The rating background level (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 and ambient noise levels (L_{Aeq}) for the day, evening and night assessment periods is described in detail within the NPfI.

For further information regarding baseline noise monitoring, refer to Section 5.2 of the NVMP and Section 3 of the EIS Technical Paper – Noise and Vibration. An overview of the baseline noise monitoring locations is provided in Figure 3 and Figure 4. No additional baseline monitoring is anticipated as part of the ETP Works.

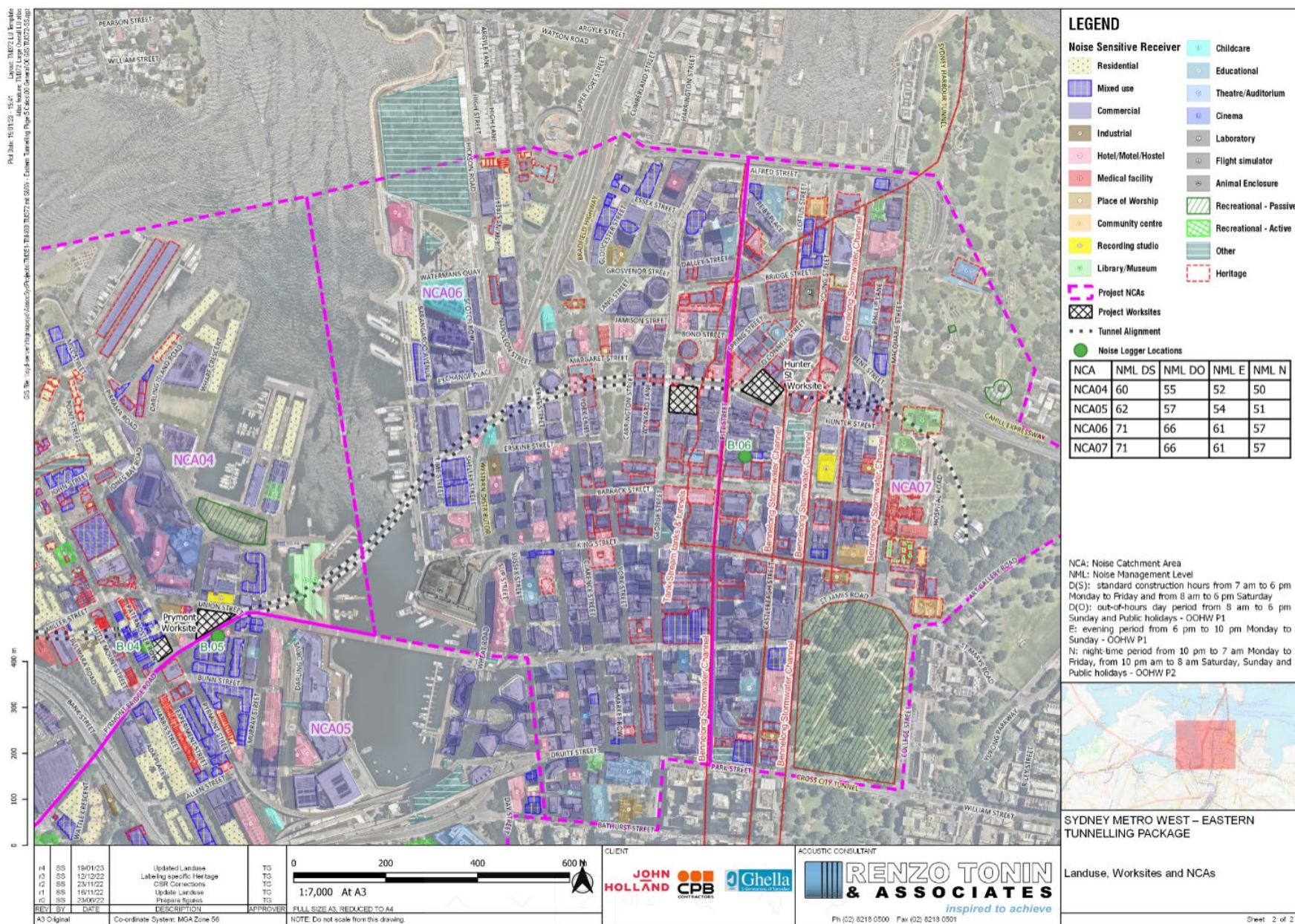
4.2. Sensitive receptors

Reflecting the requirements of Condition D20, a land use survey has been undertaken to confirm sensitive receivers (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration and construction ground-borne noise. It builds on the land use survey presented in the EIS and brings the NSW cadastral database

and identified land use details into a Geographic Information System (GIS), allowing progressive update throughout the Project, as outlined in Section 5.1 of the NVMP.

To facilitate the assessment of noise impacts from the ETP Works, receivers along the Project alignment have been divided into NCAs. NCAs group individual sensitive receivers by common traits such as existing noise environment and location in relation to the ETP Works. An overview of the NCAs of relevance to the ETP Works is provided in in Figure 3 and Figure 4.

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



5. Noise monitoring

5.1. Overview

This Section describes monitoring of noise impacts during the Tunnelling, Excavation and Associated Works, including:

- Monitoring locations
- Monitoring frequency and method
- Noise goals.

5.2. Monitoring locations

5.2.1. Fixed station (real-time) noise monitoring

In accordance with Condition C16(c), unattended noise monitoring will occur at fixed locations at construction worksites. This real-time monitoring will start at the commencement of Tunnelling, Excavation and Associated Works and assess and confirm whether noise emissions are within the predicted noise levels identified in the Detailed Noise and Vibration Impact Statements (DNVIS).

Indicative locations of all monitoring stations are found in Appendix A and coordinates are detailed in Table 6. The monitoring station locations are informed by the site layout, receiver locations, and the safety and security of the monitor. The monitoring locations will be confirmed once the monitoring equipment is physically installed. Where changes to the location of the fixed real time monitoring stations need to occur, the AA will be consulted prior to the change occurring and the NP Program will be revised in accordance with Section 3.14.2 of the CEMP.

Table 6: Indicative coordinates of fixed real-time noise monitoring stations

Fixed station monitoring location ID	Easting	Northing
Fixed Monitor PYR-W	333,070	6,250,750
Fixed Monitor PYR-E	333,130	6,250,790
Fixed Monitor HUN-W	334,200	6,251,300
Fixed Monitor HUN-E	334,405	6,251,315

5.2.2. Verification and activities based airborne noise monitoring

Attended noise monitoring locations may vary throughout the Tunnelling, Excavation and Associated Works and will be undertaken for specific construction activities where noise levels are predicted to approach or exceed the NMLs at a noise sensitive receiver. Locations will be determined on a case-by-case basis in a DNVIS, in response to complaints, as required by the EPA under the EPL or as required by OOH permits under the OOH Protocol.

The identification of monitoring locations 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 will be undertaken at the nearest 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 NPfl.

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 will 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 will 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.

5.2.3. Ground-borne noise monitoring

Ground-borne noise monitoring locations will be determined on a case-by-case basis in a DNVIS, 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, JCG will endeavour to monitor at the next most suitable available room or location, noting this in the monitoring form.

5.2.4. 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 Appendix C of the NVMP.

Plant/equipment noise checks will consider the following guidelines:

- Sound Pressure Level of stationary plant or equipment – 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
- Sound Pressure Level of moving plant or equipment – Australian Standard AS2012–1977 Method for Measurement of Airborne Noise from Agricultural Tractors and Earthmoving Machinery
- Sound Power Level – International Standard ISO 9614-2 1996 Acoustics – Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning.

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, depending on site constraints. 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) will be applied to remove the effect of increased noise due to sound reflections from such structures.

For measurements unable to be 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 3.2.

In the case of an exceedance in Sound Power Level, 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 Sound Pressure Level and/or Sound Power Level for each item of plant will be kept for reference where future noise audits are conducted. The register will be reviewed annually and corresponding revisions made to the Sound Pressure Levels presented in Appendix C of the NVMP or the DNVIS to represent contemporary plant noise emission levels.

5.3. Monitoring frequency and method

All environmental noise monitoring equipment used will be at least Type 1 instruments as described in as required by the EPA's Approved methods for the measurement and analysis of environmental noise in NSW. 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:

- Sydney – Observatory Hill (Station ID 066214)
- Sydney – Fort Denison (Station ID 066022).

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 will be applied as described in the AS 1055. Measurements of noise will be disregarded during rain periods, except as described in the AS 1055. Where monitoring cannot be carried out due to adverse weather, arrangements will be made to complete the monitoring as soon as conditions allow.

Monitoring frequency and methods during construction are outlined in Table 7.

Table 7: Monitoring frequency and method

Type of noise monitoring	Timing / Frequency	Duration
Fixed station monitoring ¹	Continuous, real-time monitoring, as required by Condition C16(c).	15-minute
Verification and activities based airborne noise monitoring	▪ At the first opportunity within the first month of starting Tunnelling, Excavation and Associated Works as well as throughout the construction period, during the day, evening and night-time periods, to: – ensure the range of activities being undertaken 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	15-minute
Plant/ Equipment checks	▪ At the first opportunity within the first month of starting Tunnelling, Excavation and Associated Works 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	Static/stationary plant ¹ : 1 to 2-minute Dynamic plant ² : capture a representative activity,

Type of noise monitoring	Timing / Frequency	Duration
Ground-borne noise monitoring	and during noise verification monitoring when it is possible to isolate the noise from one piece of plant or equipment.	such as one truck-and-trailer load cycle
	- At the first opportunity following commencement of Tunnelling, Excavation and Associated 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 - As otherwise required by a DNVIS, OOHV 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)

5.4. 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 6.2 and 6.3 of the NVMP. The results will also be compared with predicted levels and documented with discussion about the details of work underway at the time and the mitigation in place.

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 8.3.

6. Vibration monitoring

6.1. Overview

This Section describes monitoring of vibration impacts during the Project works, including:

- Monitoring locations
- Monitoring frequency and method
- Vibration management.

6.2. Monitoring locations

6.2.1. 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.

Indicative locations of all monitoring stations are found in Appendix A and coordinates are detailed in Table 8, based on the site layout and nearest sensitive receivers at the design phase. Other factors, including the safety and security of the monitor, availability of mains power, and the construction program, are considered when determining the location of the equipment on site.

The monitoring locations will be confirmed once the monitoring equipment is physically installed. Where changes to the location of the fixed real time monitoring stations need to occur, the AA will be consulted prior to the change occurring and the NP Program will be revised in accordance with Section 3.14.2 of the CEMP.

Table 8: Indicative coordinates of fixed real-time vibration monitoring stations

Fixed station monitoring location ID	Easting	Northing
Fixed Monitor PYR-W	333,070	6,250,750
Fixed Monitor PYR-E	333,130	6,250,790
Fixed Monitor HUN-W	334,200	6,251,300
Fixed Monitor HUN-E	334,370	6,251,150

6.2.2. Building damage vibration monitoring

Attended or unattended vibration monitoring will be undertaken as outlined in Section 8.4 and Appendix E of the NVMP. Monitoring locations may vary throughout the Tunnelling, Excavation and Associated 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 D44 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
- Placement of vibration monitoring equipment 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 it is not possible to use a ground spike, the vibration sensor or transducer will be placed on the measurement surface and covered with a heavy weight such as a sandbag.

Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure (in consultation with a structural engineer) and vibration monitoring will be carried out to ensure vibration levels remain below appropriate limits for that structure.

For heritage items, the more detailed assessment will specifically consider the heritage values of the structure in consultation with a heritage specialist to prevent damage to the mounting surface and ensure sensitive heritage fabric is adequately monitored and managed. If a heritage item is found to be structurally unsound (following inspection), a more conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) must be applied.

Specific heritage items where the requirement for monitoring will be reviewed in the DNVISs prepared for worksites and tunnelling include:

- (i) Former Skinners Family Hotel (SHR 00584)
- (ii) NSW Club House Building (SHR 00145)
- (iii) Former Bank – Delfin House (SLEP I1903)
- (iv) Richard Johnson Square (SLEP I1673)
- (v) Tank Stream
- (vi) Bennelong Stormwater Channel No. 29A
- (vii) Railway Cutting (Pyrmont)
- (viii) St James Railway Station.

Where heritage items are within the minimum working distances for cosmetic damage (see Section 8.4.2 of the NVMP), vibration monitoring will be undertaken to ensure there is little to no impact as per Condition D8. JCG 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. Where vibration generating activities have the potential to impact on heritage items, vibration monitoring will be undertaken to identify minimum working distances to prevent cosmetic damage.

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

In the event that the vibration testing and attended monitoring shows that the preferred values for vibration are likely to be exceeded, JCG will review the construction methodology and, if necessary, implement additional mitigation measures. Such measures will include the review or modification of excavation techniques.

6.2.3. 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. Items to consider in the identification of a suitable vibration monitoring location are noted above.

6.2.4. 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 or in response to complaints. Reflecting the process detailed in Figure 5, the monitoring will be 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, JCG will endeavour to monitor at the next most suitable available room or location, noting this on 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.

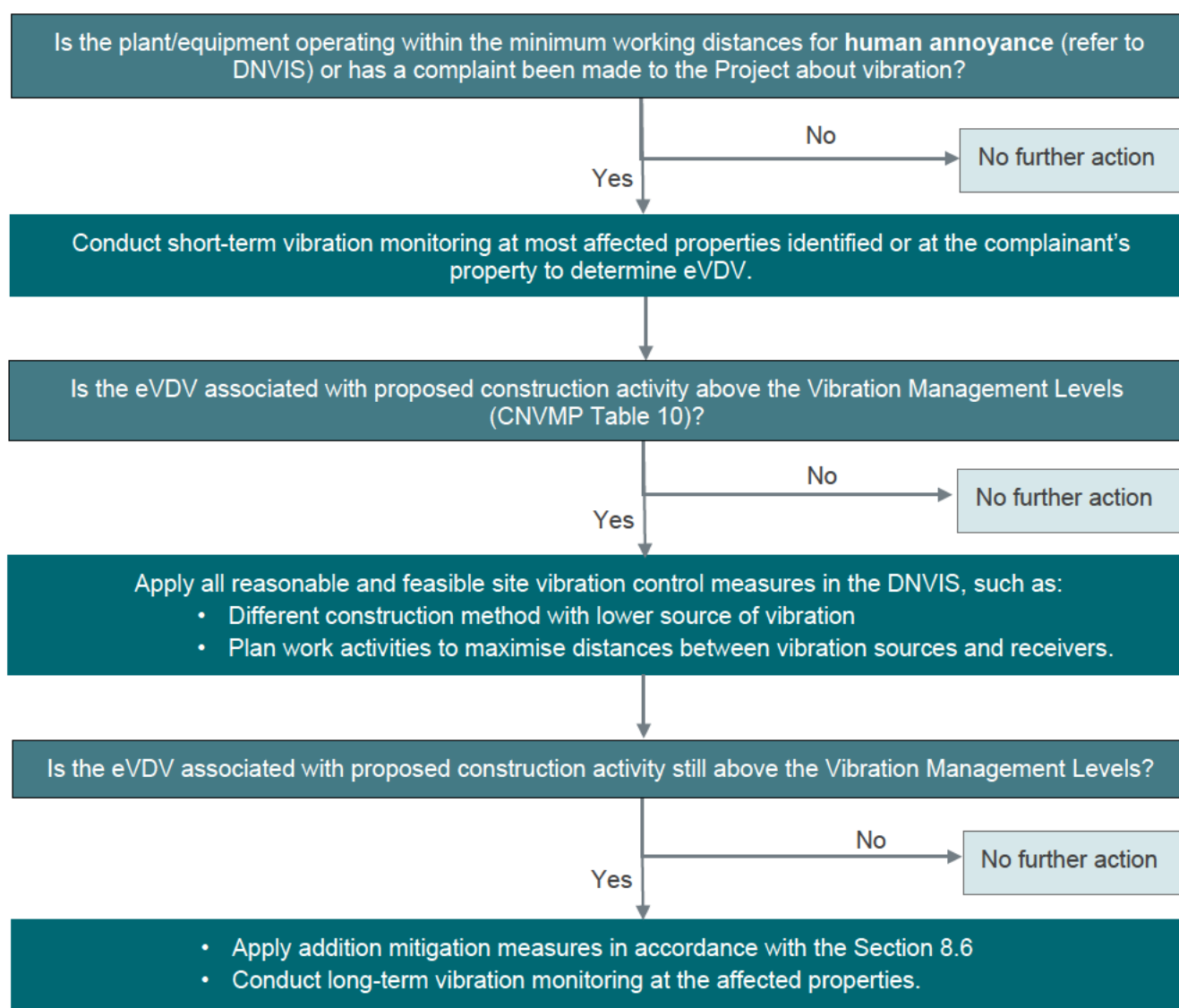


Figure 5: Project vibration monitoring (human exposure) flow chart

6.3. 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 9.

Table 9: Monitoring frequency and method

Type of vibration 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, as likely to exceed the vibration screening criteria	Representative sample of vibration being generated

Type of vibration monitoring	Timing / frequency	Duration
Human exposure vibration monitoring	At the first opportunity following commencement of Tunnelling, Excavation and Associated 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)

6.4. Vibration management

The vibration monitoring results will be compared to the vibration goals outlines in Section 6.6 of the NVMP and the DNVIS. If an exceedance is identified, a management response will be triggered as detailed in Section 8.3 of this NV Program.

7. Calibration and documentation

7.1. Calibration

Attended noise monitoring equipment will be at least Type 1 instrument as required by the EPA's Approved methods for the measurement and analysis of environmental noise in NSW and calibrated in accordance with manufacturer specifications or relevant Australian Standards. Records of equipment laboratory calibration will be maintained by JCG throughout the delivery of the Tunnelling, Excavation and Associated 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 JCG.

7.2. Monitoring records

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
 - 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
 - Mitigation measures in place at the time of the measurement and observations on their potential effectiveness.

8. Compliance management

8.1. Roles, responsibility and training

The JCG organisational structure and overall roles and responsibilities are outlined in the Section 4 of the NVMP. 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 Section 9.2 and Element 1 of the NVMP. Training will be undertaken by the Project Noise and Vibration consultant.

All employees and contractors working on site will undergo a site induction. Further details regarding staff induction and training are outlined in Section 3.8 of the CEMP.

8.2. Monitoring and inspection

This NV Program details the monitoring requirements for noise and vibration. In accordance with Section 3.11.2 of the CEMP, the Environment, Approvals and Sustainability Director will be responsible for ensuring monitoring activities are undertaken with this NV Program. Additional requirements and responsibilities in relation to inspections are documented in Section 9.3 of the NVMP and Section 3.11.1 of the CEMP.

Real-time noise and vibration monitoring alerts will be issued via text message and email to relevant construction and environment team members, Sydney Metro, the ER and the AA through the monitoring software. This process will ensure that the construction and environment teams are immediately advised of alerts and can take appropriate action (refer to Section 8.3).

The DPE and EPA will be provided with access to the real-time monitoring data, on request.

8.3. Data analysis and management response

Results obtained from monitoring activities will be compared against the predictions made in the relevant noise and vibration assessments. Where monitored levels are found to be above modelling predictions, 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-Project 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 (Appendix C of the NVMP 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 the NVMP (Section 6)
- 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 vibration 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.

8.4. 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 NV Program, the SSI 19238057 Planning Approval, and other relevant approvals, licenses and guidelines. Compliance and auditing requirements are detailed in Section 3.12 of the CEMP.

8.5. Reporting

During the Project works, noise and vibration monitoring data will be collected, tabulated and assessed against the criterion identified in the DNVIS. Reporting requirements associated with the NV Program are presented in Table 10.

Table 10: Construction Noise and Vibration Reporting Requirements

Report	Content	Frequency	Recipient
EPL Monitoring Reports and Annual Returns	EPL monitoring reports will be prepared in accordance with the requirements of the EPL. An EPL Annual Return will be prepared in respect of each EPL reporting period (typically 12 months).	Monthly Annual	EPA
Annual Environmental Monitoring Report	Monitoring program results, including analysis of results against relevant criteria, comparisons with predicted levels, discussion about the work underway at the time and the mitigation in place will be documented in the Annual Environmental Monitoring Report and submitted to nominated recipients within 30 days of the reporting period. Data will be provided in an acceptable format for relevant regulatory agencies.	Annual	DPE, ER and AA

9. Review and improvement

9.1. Continual improvement

Monitoring data will be reviewed throughout the Tunnelling, Excavation and Associated Works to identify opportunities for continual improvement. The continual improvement process will be undertaken in accordance with the CEMP with a view 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
- Identify the results of alternative construction methods
- Recognise good behaviour and practice
- Reward innovation
- Identify plant and equipment with good noise/vibration performance and prioritise use in sensitive locations.

9.2. Document review

The processes described in Section 3.6 of the CEMP may result in the need to update or revise this NV Program. This will occur as needed, in accordance with Section 3.14.2 of the CEMP.

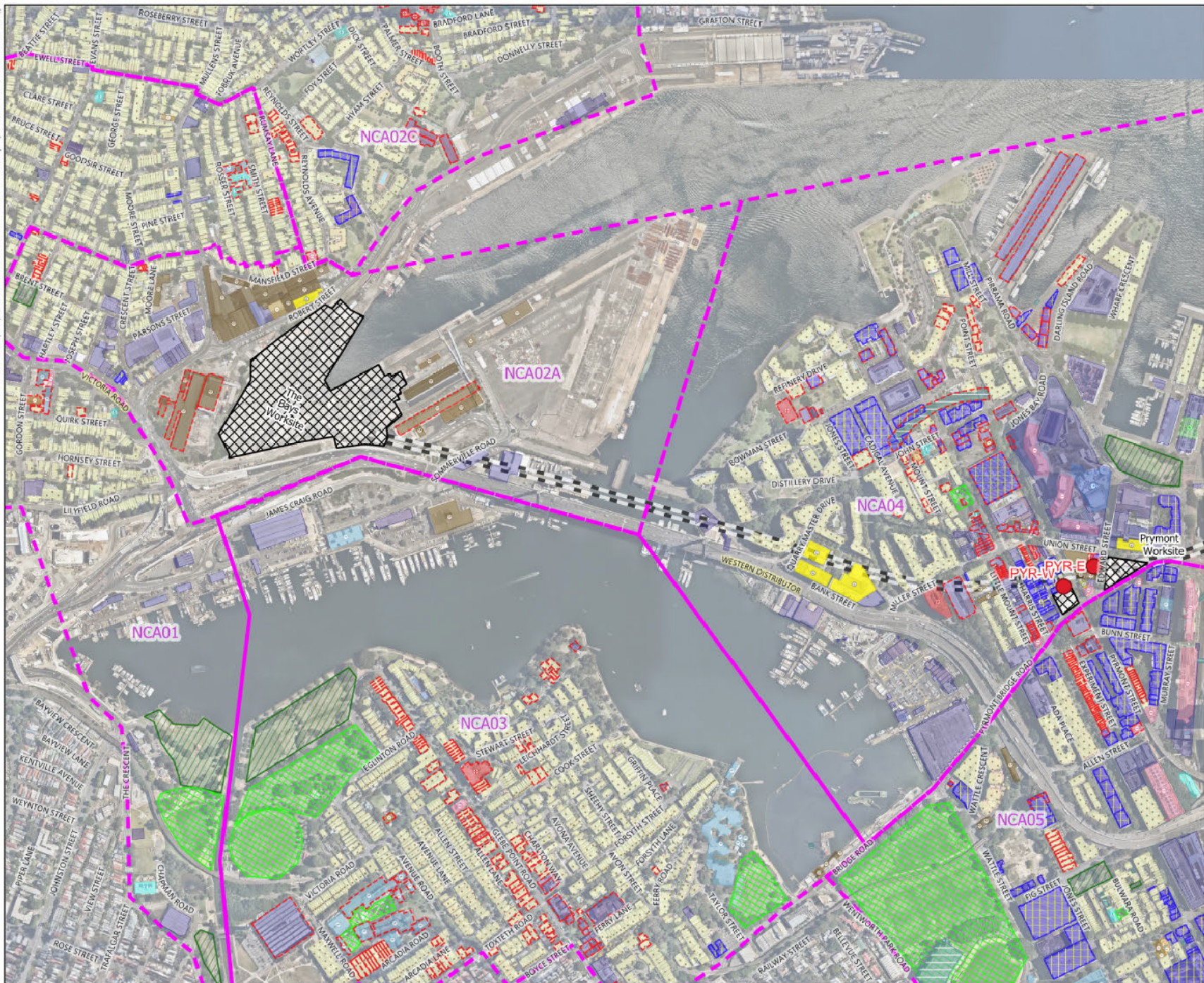
A copy of the updated NV Program and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure.

10. References

- Approved methods for the measurement and analysis of environmental noise in NSW (EPA 2022P3486), Environment Protection Authority 2022
- Sydney Metro Construction Noise and Vibration Standard Version 4.3 (SM-20-00098866) – 4 November 2020
- NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
- NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
- NSW Industrial Noise Policy (INP), Environment Protection Authority 2000
- NSW Noise Policy for Industry (NPfI), Environment Protection Authority 2017
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Sydney Airport Master Plan 2039 and Environment Strategy 2019-2039
- Australian Standard AS/NZS 1055 Acoustics - Description and Measurement of Environmental Noise
- 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
- Australian Standard AS/NZS 2107:2016 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 AS2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- Australian Standard 2775 Mechanical Mounting of Accelerometers
- 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- 2016 Structural vibration Part 3: Effects of vibration on Structures
- 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

Part B Annexures

Appendix A Fixed monitoring locations (indicative)



LEGEND

Noise Sensitive Receiver

- 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
- Animal Enclosure
- Recreational - Passive
- Recreational - Active
- Other
- Heritage

Project NCAs

Project Worksites

Tunnel Alignment

Fixed real-time monitoring

NCA	NML DS	NML DO	NML E	NML N
NCA01	61	56	56	50
NCA02A	53	48	48	40
NCA02B	52	47	47	40
NCA02C	59	54	54	51
NCA03	58	53	52	44
NCA04	60	55	52	50
NCA05	62	57	54	51

NCA: Noise Catchment Area
NML: Noise Management Level
D(S): standard construction hours from 7 am to 6 pm Monday to Friday and from 8 am to 6 pm Saturday
D(O): out-of-hours day period from 8 am to 6 pm Sunday and Public holidays - OOHWP P1
E: evening period from 6 pm to 10 pm Monday to Sunday - OOHWP P1
N: night-time period from 10 pm to 7 am Monday to Friday, from 10 pm to 8 am Saturday, Sunday and Public holidays - OOHWP P2



SYDNEY METRO WEST – EASTERN TUNNELLING PACKAGE

REV	BY	DATE	DESCRIPTION	APPROVER
1	SS	21/11/22	OSR Corrections	TG
2	SS	16/11/22	Update Landuse	TG
3	SS	23/06/22	Prepare figures	TG

Co-ordinate System: MGA Zone 56

0 200 400 600 m

1:7,500 At A3

NOTE: Do not scale from this drawing

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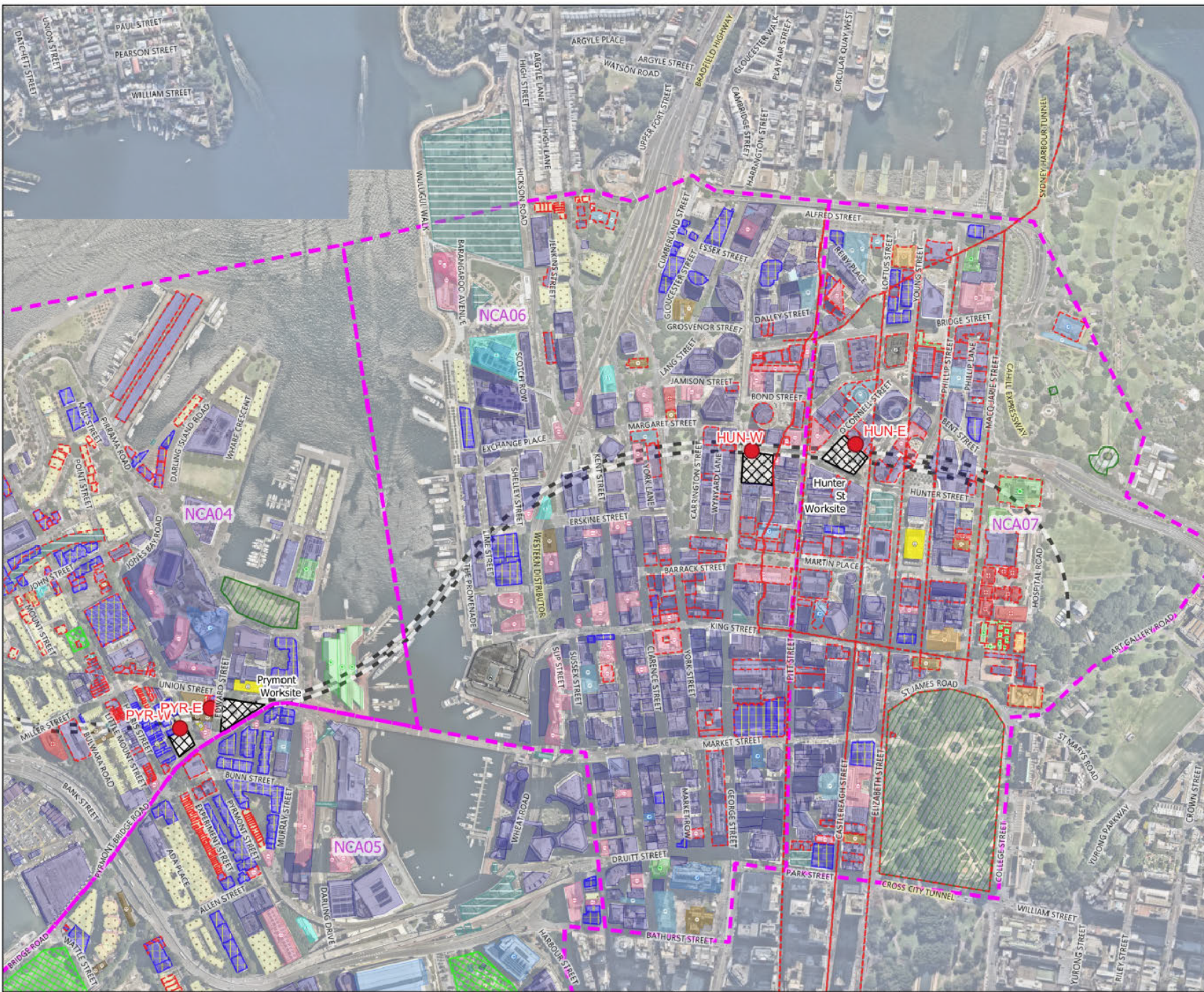
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LEGEND

Noise Sensitive Receiver

- Residential
- Mixed use
- Commercial
- Industrial
- Hotel/Motel/Hostel
- Medical facility
- Place of Worship
- Community centre
- Recording studio
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- Educational
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- Cinema
- Laboratory
- Flight simulator
- Animal Enclosure
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- Recreational - Active
- Other
- Heritage

Project NCAs

Project Worksites

Tunnel Alignment

Fixed real-time monitoring

NCA	NML DS	NML DO	NML E	NML N
NCA04	60	55	52	50
NCA05	62	57	54	51
NCA06	71	66	61	57
NCA07	71	66	61	57

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4	SS	23/06/22	Prepare figures	TG

Co-ordinate System: MGA Zone 56

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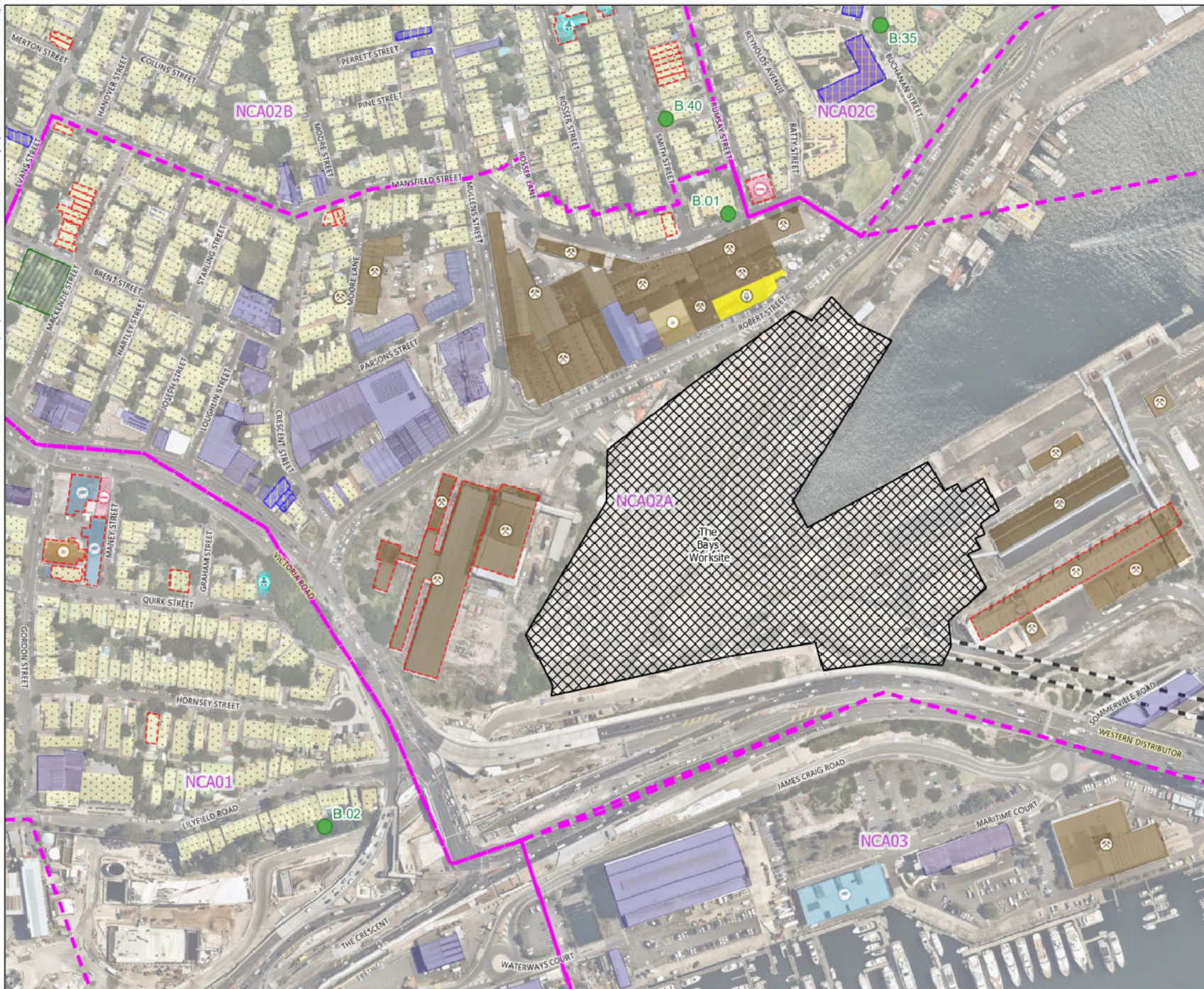
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Project NCAs

Project Worksites

Tunnel Alignment

Noise Monitoring Locations

NCA	NML DS	NML DO	NML E	NML N
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Co-ordinate System: MGA Zone 56

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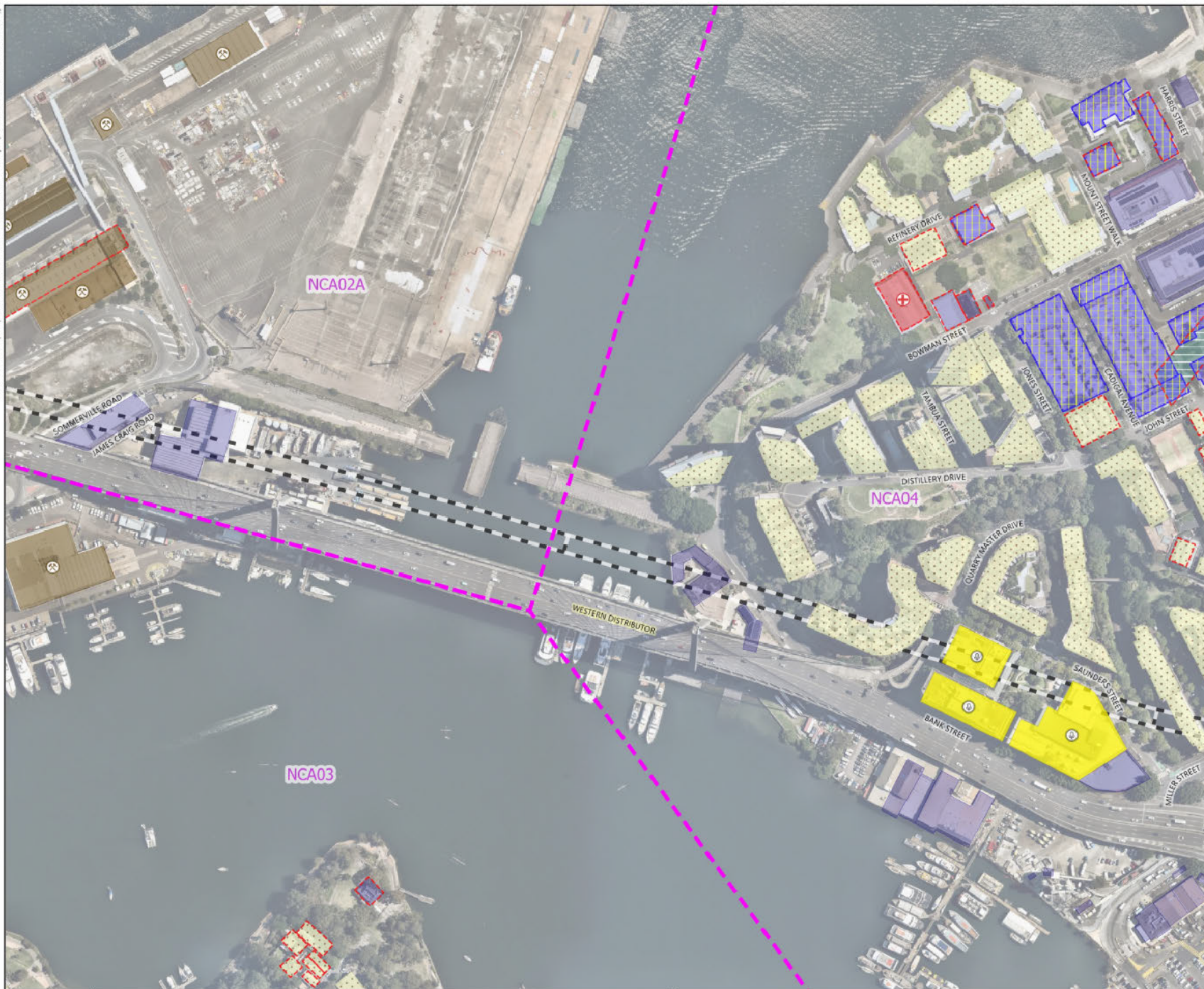
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LEGEND

Noise Sensitive Receiver

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Project Worksites

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SYDNEY METRO WEST – EASTERN TUNNELLING PACKAGE

Landuse, Worksites and NCAs

Sheet 2 of 5

REV	BY	DATE	DESCRIPTION	APPROVER
r2	SS	21/11/22	OSR Corrections	TG
r1	SS	16/11/22	Update Landuse	TG
r0	SS	23/06/22	Prepare figures	TG

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Co-ordinate System: MGA Zone 56

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LEGEND

- Noise Sensitive Receiver**
- Residential
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 - Medical facility
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 - Heritage
- Project NCAs**
- Project Worksites**
- Tunnel Alignment**
- Noise Monitoring Locations**

NCA	NML DS	NML DO	NML E	NML N
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Landuse, Worksites and NCAs

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LEGEND

- Noise Sensitive Receiver**
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Appendix C Surface worksites: Indicative Mitigation Measures

C.1 The Bays Worksite

Figure C1-1: Site Layout and Hoardings

INDICATIVE NOISE MITIGATION

The Bays

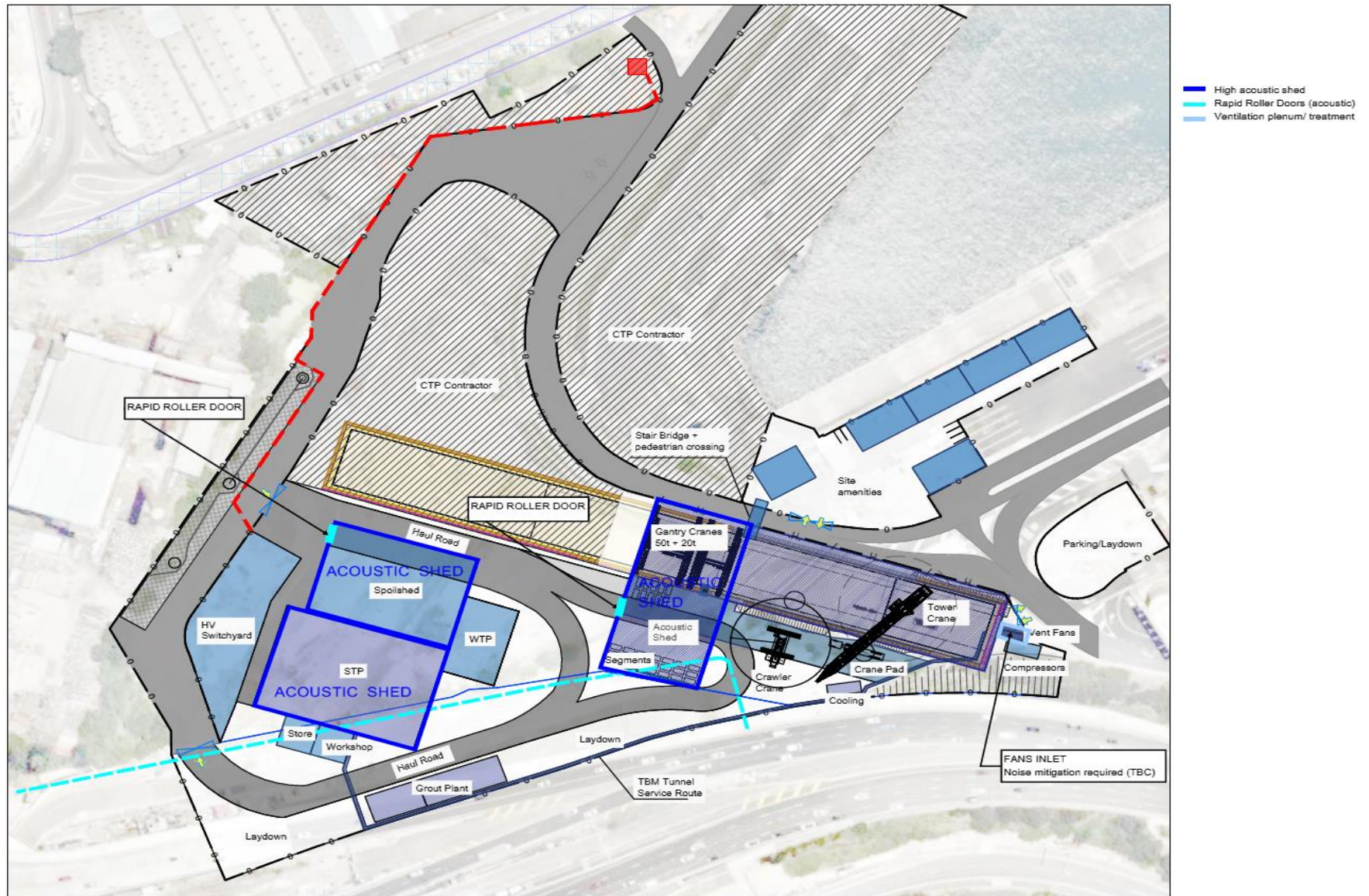


Table C2-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

The Bays

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity		Sound Power Level (Lw re: 1pW) in Noise Model dB(A)			High noise plant	Vibration intensive plant	Notes
			7am - 6pm	6pm - 10pm	10pm - 7am	Start Date	Duration	L _{Aeq}	Penalty	L _{Amax}			
Compound	Deliveries Maintenance Office areas Storage areas Car parking	Delivery truck	4 per hour	-	-	-	Duration	106	-	111	-	-	
		Light vehicle	180 in/ out	60 in/ out	60 in/ out	-	Duration	89	-	100	-	-	
		Wheel wash unit	1	1	1	-	Duration	99	-	101	-	-	
		Water treatment plant pump	2	2	2	-	Duration	99	-	101	-	-	
		Compressor	2	-	-	-	Duration	102	-	103	-	-	
		Workshop Hand Tools	1	-	-	-	Duration	105	-	118	-	-	
		Franna Crane	1	-	-	-	Duration	98	-	102	-	-	
		Gantry Crane	2	2	2	-	Duration	106	-	110	-	-	
		Water cart/ Street Sweeper	1	-	-	-	Duration	107	-	111	-	-	
Mined tunnel	Acoustic Shed Erection	Mobile Crane 150T	1	-	-	-	6 weeks	104	-	108	-	-	
		Franna Crane	2	-	-	-	6 weeks	98	-	102	-	-	
		Delivery Trucks	4 p.h.	-	-	-	6 weeks	106	-	111	-	-	
		ERP	2	-	-	-	6 weeks	95	-	98	-	-	
	Tunnel excavation & support	Road Header 1000V Electric	2	2	2	-	-	104	-	108	-	-	Cavern
		Bolting rig Robodrill 525	1	1	1	-	-	106	-	116	-	X	Cavern
		Shotcrete rig (Potenza)	1	1	1	-	-	104	-	107	-	-	Cavern
		Concrete site agitator	2	2	2	-	-	108	-	111	-	-	Cavern
		Concrete road agitator	2 p.h	2 p.h	2 p.h	-	-	108	-	111	-	-	Inside shed
		Skid steer	1	1	1	-	-	109	-	113	-	-	Cavern
		Excavator 25t w hammer	1	-	-	-	-	118	5	126	HN	X	Cavern
		Excavator 8t w hammer	1	-	-	-	-	118	5	123	HN	X	Cavern
		Excavator 25t w bucket	1	1	1	-	-	103	-	108	-	-	Cavern/ station box
		Excavator 8t w bucket	1	1	1	-	-	103	-	108	-	-	Cavern
		Dust Scrubber with silencer	4	4	4	-	-	104	-	107	-	-	Shaft from commencement - to be acoustically treated
	Spoil Handling	Ventilation fan with silencer	2	2	2	-	-	98	-	102	-	-	Inside shed - to be acoustically treated
		Dump truck (Moxey CAT 725)	3	3	3	-	-	109	-	119	-	-	Cavern/ station box
		Excavator 30T w bucket	1	1	1	-	-	103	-	108	-	-	Inside shed
		FE Loader (CAT980)	1	1	1	-	-	110	-	115	-	-	Loading spoil into kibble at bottom of shaft.
		FE Loader (CAT980)	1	1	1	-	-	110	-	115	-	-	
		Gantry Crane	1	1	1	-	-	106	-	110	-	-	Inside shed
		Trucks (spoil haulage)	4-6 p.h.	4 p.h.	-	-	-	106	-	111	-	-	Inside shed
	Tunnel Lining (concreting)	Concrete pump	2		-	-	-	103	-	107	-	-	Cavern - form pumps
		Compressor	1		-	-	-	102	-	103	-	-	On form for vibrators
		Genset	1		-	-	-	94	-	95	-	-	2 / 3 days usage for form power
		Ventilation fan with silencer	2	2	2	-	-	98	-	102	-	-	Same fans from excavation
		Pneumatic vibrator	40		-	-	-	97	-	100	-	-	During crown concrete pours - every 2-3 days significantly less during invert and kicker works
		Concrete road agitator	5 p.h		-	-	-	108	-	111	-	-	Inside shed during concrete pours - every 2-3 days
		Concrete site agitator (10m3 transmix)	3		-	-	-	108	-	111	-	-	Cavern
		Telehandler	1		-	-	-	98	-	102	-	-	Cavern
TBM Delivery/ Assembly	TBM delivery (on surface)	Delivery trucks	4 p.h.	4 p.h.	4 p.h.	-	10 days	106	-	111	-	-	Oversized deliveries would be at night
		Mobile Crane	4 lifts/hr	4 lifts/hr	4 lifts/hr	-	10 days	104	-	108	-	-	OOWH TBC
		Franna Crane 20T	2	2	2	-	10 days	98	-	102	-	-	OOWH TBC
	TBM assembly (in station box) (& disassembly)	Hammering Steel	2 locations	-	-	-	12 weeks	116	-	118	-	-	OOWH TBC
		Air/ hydraulic hand tools	2	2	2	-	12 weeks	108	-	118	-	-	OOWH TBC
		Hydraulic Power Pack	1	1	1	-	12 weeks	94	-	95	-	-	OOWH TBC
		Welding Machines 400 amp	4	4	4	-	12 weeks	96	-	107	-	-	OOWH TBC
		Welding Machines 400 amp	1	-	-	-	12 weeks	96	-	107	-	-	OOWH TBC
		Site Forklift	1	1	1	-	12 weeks	99	-	103	-	-	OOWH TBC
		SPMT in cavern	1	1	1	-	2 weeks	-	-	-	-	-	OOWH TBC
	TBM retrieval	Delivery trucks	4 p.h.	4 p.h.	4 p.h.	-	10 days	106	-	111	-	-	TBM cutting head and shields via truck
		Gantry Crane	1	1	1	-	10 days	106	-	110	-	-	TBM back-up trailers transferred back through tunnels
		Gantry Crane	1	1	1	-	10 days	106	-	110	-	-	Inside shed
		Franna Crane 20T	2	2	2	-	11 days	98	-	102	-	-	OOWH TBC
TBM Support	Tunnelling & Support	Grout plant	1	1	1	-	9 months	105	-	108	-	-	Acoustic treatment TBC
		Ventilation fan with silencer	4	4	4	-	9 months	98	-	102	-	-	Acoustic treatment TBC
		TBM Cooling water pump	1	1	1	-	9 months	99	-	101	-	-	Partial or full enclosure TBC
		Water treatment plant pump	1	1	1	-	9 months	99	-	101	-	-	Partial or full enclosure TBC
		Gantry crane (electric)	2	2	2	-	9 months	106	-	110	-	-	Visible alarm after 8pm
		Bentonite mixing area	1	1	1	-	for duration	70	-	73	-	-	on surface
	Slurry Treatment Plant (shed requirements TBC)	DESANDER	3	3	3	-	9 months	103.9794001	-	106.9794001	-	-	inside acoust c shed
		55-1-G Centrifuge	3	3	3	-	9 months	97	-	100	-	-	inside acoust c shed
		SD 2400 Primary shaker	1	1	1	-	9 months	108	-	111	-	-	inside acoust c shed
		Active Tank B pump	1	1	1	-	9 months	78	-	81	-	-	outside acoustic shed
		Fresh bentonite pumps	4	4	4	-	9 months	97	-	100	-	-	Outside acoustic shed. Acoustic treatment TBC
	Spoil Handling (in shed)	FE Loader	2	2	2	-	18 months	110	-	115	-	-	In the spoil loadout area
		Excavator 25t w bucket	1	1	1	-	9 months	103	-	108	-	-	
		Spoil loading conveyor / stacker	1	1	1	-	18 months	83/m	-	103	-	-	
		Forklift	1	1	1	-	9 months	99	-	103	-	-	
		Trucks (spoil haulage)	4-6 p.h.	4 p.h.	4 p.h.	-	18 months	106	-	111	-	-	Loading/moving materials outside acoustic shed
	Tunnel Lining (segments)	Truck Movement (MSVs) Combustion Engine CATERP	2 p.h.	2 p.h.	2 p.h.	-	9 months	103	-	107	-	-	within Station Box and cross over cavern
		Delivery truck	3 p.h.	2 p.h.	2 p.h.	-	9 months	106	-	111	-	-	Semi trailers delivering segments from Precast
		MSV/Truck Horn		minimise	minimise	-	for duration	-	-	107	-	-	Broadband horn - e.g. BBS-tek. Within Station Box/ Cross Over Cavern
	Tunnel Support Post Portion 01 Handover (TBM tunnelling complete)	Acoustic segment shed and plant demobilisation (on surface)	Tower Crane (electric)	1	1	-	-	TBC	96	-	101	-	-
Forklift			1	1	-	-	TBC	99	-	103	-	-	
Handtool - non-powered			Various	Various	-	-	TBC	105	-	118	-	-	
Impact gun			1	1	-	-	TBC	107	-	118	-	-	
Forklift			1	1	-	-	TBC	99	-	103	-	-	
Tunnelling & Support - Ongoing works in tunnels (XPs etc)		Tower Crane (electric)	1	1	1	-	8 months	96	-	101	-	-	
		Ventilation fan with silencer	4	4	4	-	8 months	98	-	102	-	-	Same fans from TBM tunnelling support

Table C2-1: Construction timetable/ activities/ equipment						INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT								The Bays	
Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity		Sound Power Level (Lw re: 1pW) in Noise Model dBA			High noise plant	Vibration intensive plant	Notes		
			7am - 6pm	6pm - 10pm	10pm - 7am	Start Date	Duration	L _{Aeq}	Penalty	L _{Amax}					
- Tunnel lining	Water treatment plant pump	1	1	1		8 months	99	-	101	-	-	Same WTP from TBM tunnelling support			
	Concrete Pump	1	1	1		8 months	103	-	107	-	-	In station box			
	Concrete road agitator	4ph	4ph	4ph		8 months	108	-	111	-	-	On surface			
	Concrete site agitator (10m3 transmix)	4ph	4ph	4ph		8 months	108	-	111	-	-	In station box			
	Concrete truck discharge	1	1	1		8 months	108	-	111	-	-	Into drop pipe will require temporary acoustic enclosure once segment shed disassembled (Table C4)			
	Forklift	2	2	2		8 months	99	-	103	-	-	1 on surface/ 1 in station box			
	Assembly of formwork	Various non-power hand tools				8 months	105	-	118	-	-				
	Truck Movement (MSVs) Combustion Engine CATERP	7-9 p.h.	7-9 p.h.	-		8 months	103	-	107	-	-				
	FE Loader	1	1	1		8 months	110	-	115	-	-	In the spoil shed			
	Excavator 25t w bucket	1	1	-		8 months	103	-	108	-	-	On the surface			
Spoil Handling (in shed)	Excavator 25t w bucket	1	1	1		8 months	103	-	108	-	-	In the station box			
	Forklift	1	1	1		8 months	99	-	103	-	-	Loading moving materials			
	Trucks (spoil haulage)	4-6 p.h.	4 p.h.	4 p.h.		8 months	106	-	111	-	-				

Table C1-2: Construction Noise Management Schedule

INDICATIVE NOISE AND VIBRATION MITIGATION

The Bays

Area to be Managed		Specific Mitigation/ Management Measure		Details
Airborne Noise				
1	TBM Operations			
1.1	Work during Standard Construction Hours	DAY:	Standard hours activities	see Table C1 for details
1.2	Acoustic enclosures/ sheds			
	Spoil handling area	D(O)/EVE/ NGT: D(O)/EVE/ NGT: D(O)/EVE/ NGT:	Acoustic shed to allow OOHW spoil loading 1 Front End Loader (FEL) with residential grade muffler inside acoustic shed only. Rapid roller door on the western side of the shed to be closed in the evening and at night. Roller door on the eastern side to be partly closed during EVE/ NGT period to the minimum height required to allow trucks to access the shed	see Table C4 for details see Table C1 for details see Table C1 for details
	Segment shed	D(O)/EVE/ NGT:	Acoustic shed to allow OOHW Rapid roller door on the western side of the shed to be closed in the evening and at night. Roller door on the eastern side to be partly closed during EVE/ NGT period to the minimum height required to allow trucks to access the shed	see Table C4 for details
	Slurry treatment plant shed	D(O)/EVE/ NGT:	Acoustic shed to allow OOHW If any, rapid roller door on the western side of the shed to be closed in the evening and at night whenever practicable If any roller door on the eastern side to be partly closed during EVE/ NGT period to the minimum height required to allow to access the shed	see Table C4 for details
1.3	Truck restrictions during the OOHW period			
	Deliveries (segment material and concrete)	D(O)/EVE: NIGHT:	Avoid the use of park air brakes outside the sheds at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving the site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site. ≤ 4 per hour ≤ 4 per hour	see Table C1 for details
	SPOIL trucks on site	D(O)/EVE: NIGHT:	≤ 4 per hour ≤ 4 per hour	see Table C1 for details
1.4	Ventilation Fan (TBC)		Ventilation fans with silencer additional attenuation (duct lining/ inlet attenuator). Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
1.5	TBM Grout plant Cooling towers		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
1.6	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
1.7	Residual impacts		NCAs around the site should be consistent with WHT EIS for the following reasons: 1) NCAs better represent noise catchments with similar ambient noise levels 2) NMLs are more representative for the most noise affected receivers 3) As WHT and SMW EPT will be concurrent, using the same NMLs would be provide a better management approach	
2	Crossover Cavern (Mined tunnelling)			
2.1	Work during Standard Construction Hours	DAY:	Standard hours activities	see Table C1 for details
2.2	Work outside Standard Construction Hours	D(O)/EVE/ NGT:	OOHW activities limited as noted below and in Table C1 Subject to verification monitoring roadheader tunnelling and support works may occur OOH once plant is completely inside stub tunnel. That is once stub tunnel is approx 20 metres long.	see Table C1 for details
2.3	Acoustic enclosures/ sheds			
	Concrete deliveries	D(O)/EVE/ NGT: D(O)/EVE/ NGT:	OOHW concrete/ shotcrete delivery to be inside acoustic shed (segment shed) Roller door to be closed during EVE/ NGT period during concrete discharge	see Table C4 for details see Table C1 for details
	Workshop	D(O)/EVE/ NGT:	Any OOH maintenance of plant to be conducted in tunnel or in segment shed with door closed (subject to verification monitoring).	see Table C4 for details
2.4	Truck restrictions during the OOHW period			
	Deliveries (concrete)	D(O)/EVE: NIGHT:	Avoid the use of park air brakes outside the sheds at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving the site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site. ≤ 4 per hour ≤ 4 per hour	see Table C1 for details
	SPOIL trucks on site	D(O)/EVE: NIGHT:	≤ 4 per hour ≤ 4 per hour	see Table C1 for details
2.5	Ventilation Fan (TBC)		Ventilation fans with silencer additional attenuation (duct lining/ inlet attenuator). Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
2.6	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
2.7	Electrical substation		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
3	Tunnel Support Post Portion 01 Handover			
3.1	Work during Standard Construction Hours	DAY:	Standard hours activities	see Table C1 for details
3.2	Work outside Standard Construction Hours	D(O)/EVE/ NGT:	OOHW activities limited as noted below and in Table C1 Subject to verification monitoring tunnel lining and support works may occur OOH.	see Table C1 for details
3.3	Acoustic enclosures/ sheds			
	Concrete deliveries	D(O)/EVE/ NGT: D(O)/EVE/ NGT:	OOHW concrete delivery to be inside temporary partial enclosure (once segment shed is disassembled) Any OOH maintenance of plant to be conducted wholly within tunnel or in spoil shed with door closed (subject to verification monitoring).	see Table C4 for details see Table C4 for details
3.4	Truck restrictions during the OOHW period		As per 2.4 above	
3.5	Ventilation Fan (TBC)		As per 2.5 above	
3.6	Water treatment plant		As per 2.6 above	
3.7	Electrical substation		As per 2.7 above	
Ground-borne Noise				
4	Mined tunnels (where airborne noise not significant)	DAY:	N/A	None
Vibration Assessment				
5	Mined tunnel excavation	Residential Structural Damage: 20m Human Disturbance: 70m Commercial/Industrial	None None	

Table C1-2: Construction Noise Management Schedule		INDICATIVE NOISE AND VIBRATION MITIGATION		The Bays
Area to be Managed		Specific Mitigation/ Management Measure		Details
		Structural Damage: 10m	None	
		Human Disturbance: 30m	None	
Traffic on Public Roads				
6	Heavy Vehicle Movements	DAY/ NIGHT:	As per EIS	
	Light Vehicle Movements		As per EIS	

Figure C2-1: Site Layout and Hoardings

INDICATIVE NOISE MITIGATION

PYRMONT EAST

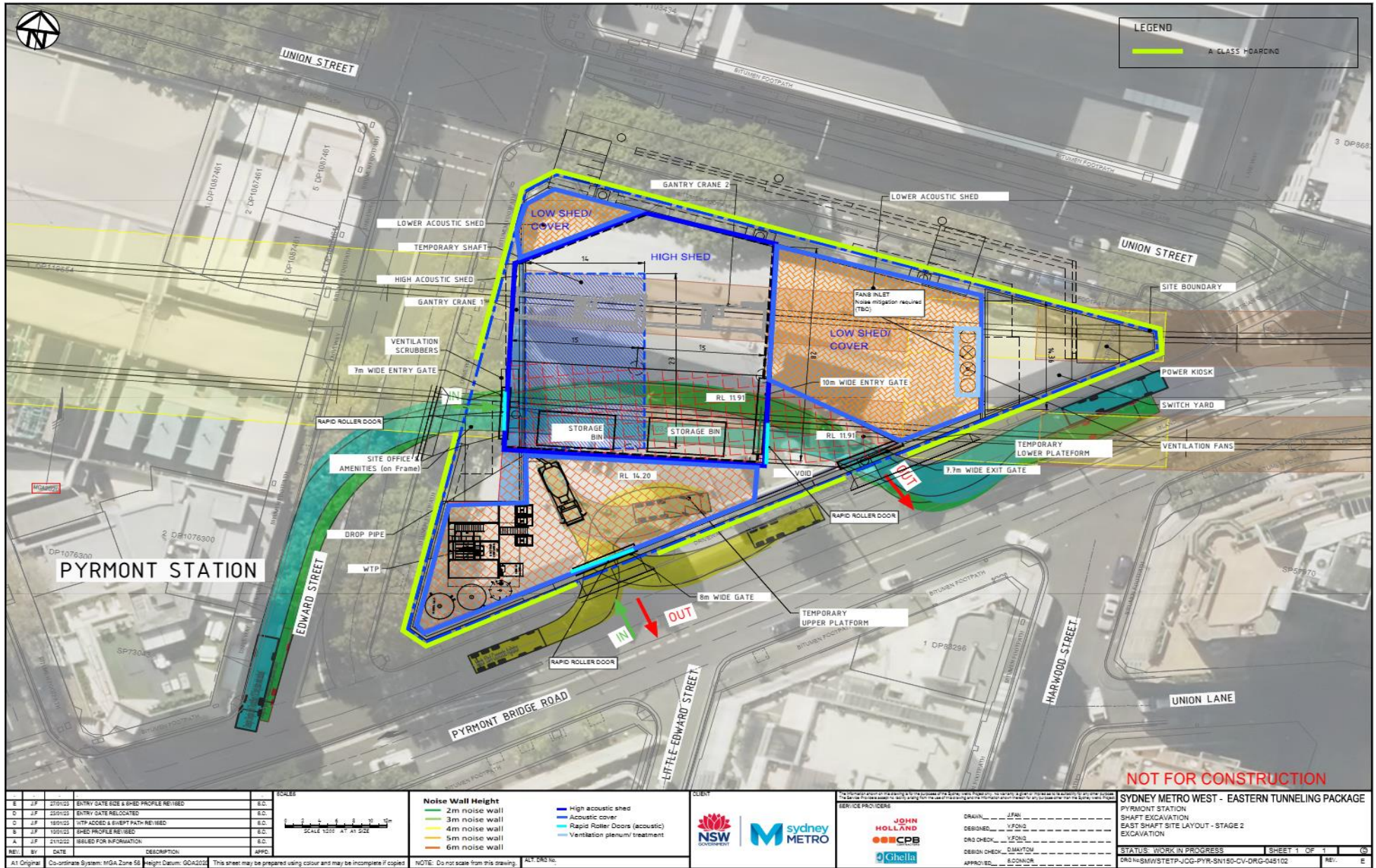


Figure C1: Site Layout and Hoardings

INDICATIVE NOISE MITIGATION

PYRMONT WEST

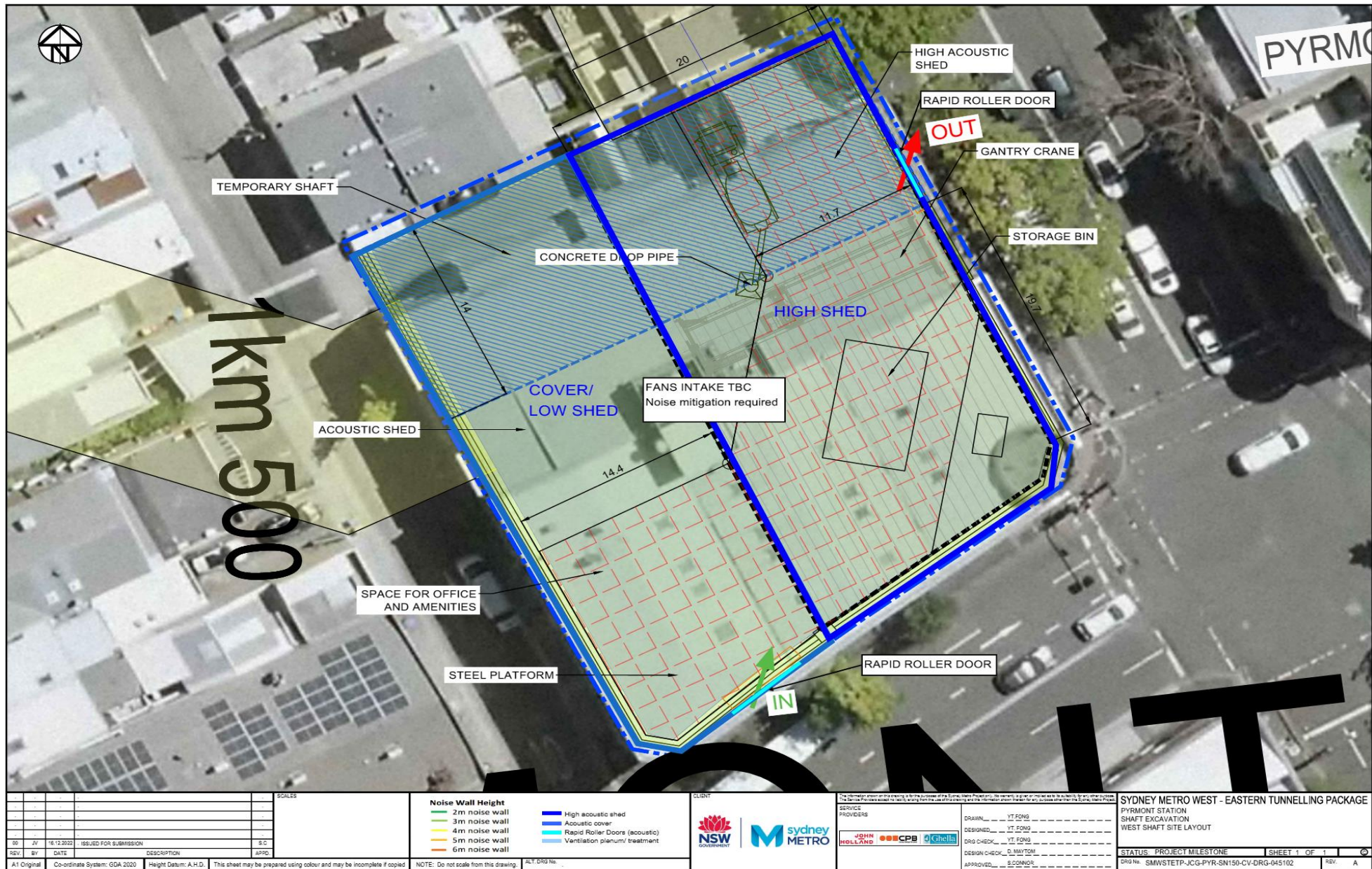


Table C2-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

PYRMONT STATION

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)			High noise plant	Vibration intensive plant	Notes	
			7am - 6pm	6pm - 10pm	10pm - 7am		Start Date	Duration	L _{Aeq}				Penalty
WEST WORKSITE													
Compound	Deliveries Maintenance Office areas Storage areas Car parking	Delivery truck	4 per hour	-	-			106	-	111	-	-	
		Light vehicle	180 in/ out	60 in/ out	60 in/ out			89	-	100	-	-	
		Compressor	1	-	-			102	-	103	-	-	
		Workshop Hand Tools	1	-	-			105	-	118	-	-	
		Franna Crane	1	-	-			98	-	102	-	-	
		Water cart/ Street Sweeper	1	-	-			107	-	111	-	-	
Site Establishment	Demolition	Excavator 30T with shears grabs and bucket	4	-	-	20 weeks	103	-	108	-	-		
		Truck (spoil haulage)	10 p.h.	-	-	9 weeks	106	-	111	-	-		
		Water cart	1	-	-	20 weeks	107	-	111	-	-		
		Hand Tools	1	-	-	20 weeks	105	-	118	-	-		
		Oxy Acetylene	2	-	-	20 weeks	96	-	107	-	-		
		EWP / Scissor Lift	4	-	-	20 weeks	95	-	98	-	-		
	Tree Clearing	Excavator 25T w grabs and bucket	1	(1)	(1)	1 week	103	-	108	-	-	OOHW required where ROL prohibits lane closure during standard construct on hours	
		Chainsaw (petrol)	4	(4)	(4)	1 week	116	5	120	HN	-		
		Chainsaw (electric)	4	(4)	(4)	1 week	106	-	111	-	-		
		Truck & Wood Chipper	2	(2)	(2)	1 week	120	5	124	HN	-		
		Mobile Crane	1	(1)	(1)	1 week	104	-	108	-	-		
		Site bogie	2	(2)	(2)	1 week	103	-	111	-	-	there are at least 5 trees to be removed	
	LAUW	Workshop Hand tools	1	-	-	3 weeks	105	-	118	-	-		
		Lighting tower	1	-	-	3 weeks	99	-	102	-	-		
		Water pump	2	-	-	3 weeks	99	-	101	-	-		
		Excavator 12T w rockhammer	2	-	-	3 weeks	118	5	126	HN	X		
		Road saw	1	-	-	3 weeks	121	5	129	HN	X		
		P pe cutter	1	-	-	3 weeks	96	-	107	-	-		
		Jumping jack compactor	1	-	-	3 weeks	108	-	110	-	X		
		Asphalt roller	1	-	-	3 weeks	105	-	112	-	-		
		Concrete Agi	1	-	-	3 weeks	108	-	111	-	-		
		Delivery truck	2	-	-	3 weeks	106	-	111	-	-		
		Vacuum Truck	1	-	-	3 weeks	107	-	111	-	-		
		Tipper Truck 12T	2	-	-	3 weeks	103	-	111	-	-		
	Service Relocation	Workshop Hand tools	1	-	-	3 weeks	105	-	118	-	-		
		Generator	1	-	-	3 weeks	94	-	95	-	-		
		Water pump	2	-	-	3 weeks	99	-	101	-	-		
		Excavator 12T w rockhammer	2	-	-	3 weeks	118	5	126	HN	X		
		Road saw	1	-	-	3 weeks	121	5	129	HN	X		
		P pe cutter	1	-	-	3 weeks	96	-	107	-	-		
		Trench roller	1	-	-	3 weeks	112	5	120	HN	X		
		Asphalt roller	1	-	-	3 weeks	105	-	112	-	-		
		Concrete Agi	1	-	-	3 weeks	108	-	111	-	-		
		Delivery truck	2	-	-	3 weeks	106	-	111	-	-		
		Slew Crane	1	-	-	3 weeks	104	-	108	-	-		
		Tipper Truck 12T	2	-	-	3 weeks	103	-	111	-	-		
	Prelim Earthworks and Piling Pad Construction	Excavator 35T w hammer	2	-	-	2weeks	118	5	126	HN	X	Stripping and loading of subgrade	
		Excavator 30T w bucket	2	-	-	2weeks	103	-	108	-	-	Spread and place fill for piling pad	
		Vibratory Roller 16T (Smoothdrum)	2	-	-	2weeks	108	5	113	HN	X		
		Vibratory Roller 16T (Padfoot)	2	-	-	2weeks	108	5	113	HN	X		
		Truck (spoil haulage)	2 p.h.	-	-	2weeks	106	-	111	-	-	Import / export material	
		Moxy 20T	2	-	-	2weeks	109	-	119	-	-	Cart to/from stockpile	
	Hoarding Erection and Site Offices	Excavator 20T w bucket and auger	2	2	2	1 week	103	-	108	-	-	less than 1 week done by demolition guys	
		Franna Crane / Manitou	2	2	2	1 week	98	-	102	-	-	OOHW required where ROL prohibits lane closure during standard construct on hours	
		Concrete Agi	4 p.h.	4 p.h.	4 p.h.	1 week	108	-	111	-	-		
		Power Hand Tools	6	6	6	1 week	108	-	118	-	-		
		EWP / Scissor Lift	4	4	4	1 week	95	-	98	-	-		
		Mobile Crane 150T	1	1	1	1 week	104	-	108	-	-		
Permanent Shaft		Piling and capping beams	Piling Rig (Bauer BG36)	1	-	-	6 weeks	107	-	116	-	X	Assumes piling in series (temp east then permanent west then permanent east)
			Concrete pump	1	1	1	6 weeks	103	-	107	-	-	Capping beam on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL
	Concrete agitator		4	4	4	6 weeks	108	-	111	-	-	Capping beam on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL	
	Compressor		2	2	2	6 weeks	102	-	103	-	-	Capping beam on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL	
	Crawler Crane 100t		1	-	-	6 weeks	104	-	108	-	-		
	Delivery truck		1	-	-	6 weeks	106	-	111	-	-		
	Power hand tools		1	-	-	6 weeks	108	-	118	-	-		
	Jackhammer		1	-	-	6 weeks	111	5	121	HN	X		
	Acoustic Shed Erection (west site)	Mobile Crane 150T	1	1	1	6 weeks	104	-	108	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL	
		Franna Crane	1	1	1	6 weeks	98	-	102	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL	
		Delivery Trucks	4 p.h.	4 p.h.	4 p.h.	6 weeks	106	-	111	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL	
		EWP	2	2	2	6 weeks	95	-	98	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL	

Table C2-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

PYRMONT STATION

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity	Sound Power Level (Lw re: 1pW) in Noise Model_dB(A)			High noise plant	Vibration intensive plant	Notes	
			7am - 6pm	6pm - 10pm	10pm - 7am		Start Date	Duration	L _{Aeq}				Penalty
	Shaft excavation	Dri ling machine (ECM 660IV)	1	-	-		11 months	106	-	116	-	X	this should be a drill RIG
		Power hand tools	1	-	-		11 months	108	-	118	-	-	
		Generator	1	-	-		11 months	94	-	95	-	-	
		Water pump (diaphragm pump)	1	-	-		11 months	106	-	109	-	-	
		Excavator w rockhammer	4	-	-		11 months	118	5	123	HN	X	
		Excavator with saw attachment	1	-	-		11 months	121	5	129	HN	X	
		Excavator with cutter attachment	-	-	-		11 months	121	5	129	HN	X	
		Site Forklift	1	-	-		11 months	99	-	103	-	-	
		Compressor	1	-	-		11 months	102	-	103	-	-	
		Truck (spoil haulage)	4-6 p.h	-	-		11 months	106	-	111	-	-	
	Road sweeper truck	1	-	-		11 months	107	-	111	-	-		
	Support works (concreting)	Dri ling machine (ECM 660IV)	1	1*	-		11 months	106	-	116	-	X	*OOHW where low impact requirements of Condition D23(b) can be met
		Concrete truck	4 p.h.	4 p.h.*	-		11 months	108	-	111	-	-	*OOHW where low impact requirements of Condition D23(b) can be met
		Concrete pump	1	1*	-		11 months	103	-	107	-	-	*OOHW where low impact requirements of Condition D23(b) can be met
		Shotcrete r g	1	2*	-		11 months	104	-	107	-	-	*OOHW where low impact requirements of Condition D23(b) can be met
		Welding equipment	1	1*	-		11 months	96	-	107	-	-	*OOHW where low impact requirements of Condition D23(b) can be met
	Mined tunnel	Adit excavation & support	Road Header 1 000V Electric	1	1	1	8 weeks	104	-	108	-	-	Adits
			Bolting rig Robodril 525	1	1	1	8 weeks	106	-	116	-	X	Adits
			Shotcrete r g (Potenza)	1	1	1	8 weeks	104	-	107	-	-	Adits
			Concrete site agitator	2	2	2	8 weeks	108	-	111	-	-	Shaft / Adits
			Concrete road agitator	2 p.h	2 p.h	2 p.h	8 weeks	108	-	111	-	-	Inside shed
			Skid steer	1	1	1	8 weeks	109	-	113	-	X	Adits
			Excavator 8t w hammer	1	-	-	8 weeks	118	5	123	HN	X	Adits
			Excavator 25t w bucket	1	1	0	8 weeks	103	-	108	-	-	Adits
			Dust Scrubber with silencer	1	1	1	8 weeks	104	-	107	-	-	Shaft from commencement - to be acoustically treated
Ventilation fan with silencer			2	2	2	8 weeks	98	-	102	-	-	Inside shed - to be acoustically treated	
Spoil Handling		Dump truck (Moxy CAT 725)	1	1	1	8 weeks	109	-	119	-	-	Adit / temp shaft	
		Gantry Crane	1	1	1	8 weeks	106	-	110	-	-	Inside shed	
		Truck (spoil haulage)	7-9 p.h.	7-9 p.h.	-	8 weeks	106	-	111	-	-	Inside shed	
Tunnel Lining (concreting)		Concrete pump	2	-	-	6 weeks	103	-	107	-	-	Adit - form pumps	
		Compressor	1	-	-	6 weeks	102	-	103	-	-	On form for vibrators	
	Genset	1	-	-	6 weeks	94	-	95	-	-	2 / 3 days usage for form power		
	Ventilation fan with silencer	2	2	2	6 weeks	98	-	102	-	-	Same fans from excavation		
	Pneumatic vibrator	40	-	-	6 weeks	97	-	100	-	-	During crown concrete pours - every 2-3 days significantly less during invert and kicker works		
Concrete road agitator	5 p.h	-	-	6 weeks	108	-	111	-	-	Inside shed dur ng concrete pours - every 2-3 days			
Concrete site agitator	5	-	-	6 weeks	108	-	111	-	-	Adits			
Telehandler	1	-	-	6 weeks	98	-	102	-	-	Adits			
EAST WORKSITE													
Compound	Deliveries Maintenance Office areas Storage areas Car parking	Delivery truck	4 per hour	-	-			106	-	111	-	-	
		Light vehicle	180 in/ out	60 in/ out	60 in/ out			89	-	100	-	-	
		Water Treatment Plant pump	2	2	2			99	-	101	-	-	
		Compressor	2	-	-			102	-	103	-	-	
		Workshop Hand Tools	1	-	-			105	-	118	-	-	
		Franna Crane	1	-	-			98	-	102	-	-	
		Water cart/ Street Sweeper	1	-	-			107	-	111	-	-	
		Excavator 30T with shears grabs and bucket	4	-	-	12 weeks	103	-	108	-	-		
Site Establishment	Demolition	Truck (spoil haulage)	4 p.h.	-	-	6 weeks	106	-	111	-	-		
		Water cart	1	-	-	12 weeks	107	-	111	-	-		
		Hand Tools	1	-	-	12 weeks	105	-	118	-	-		
		Oxy Acetylene	2	-	-	12 weeks	96	-	107	-	-		
		EWB / Scissor Lift	4	-	-	12 weeks	95	-	98	-	-		
	Tree Clearing	Excavator 25T w grabs and bucket	1	1	1	1 week	103	-	108	-	-	OOHW required where ROL prohibits lane closure during standard construct on hours	
		Chainsaw	4	4	4	1 week	116	5	120	HN	-		
		Truck & Wood Chipper	2	2	2	1 week	120	5	124	HN	-		
		Mobile Crane	1	1	1	1 week	104	-	108	-	-		
		Site bogie	2	2	2	1 week	103	-	111	-	-	there are at least 8 trees to be removed	
	Service Relocation	Workshop Hand tools	1	-	-	4 weeks	105	-	118	-	-	4 weeks site reticulation and site accessways	
		Generator	1	-	-	4 weeks	94	-	95	-	-		
Water pump		2	-	-	4 weeks	99	-	101	-	-			
Excavator 12T w rockhammer		2	-	-	4 weeks	118	5	126	HN	X			
Road saw		1	-	-	4 weeks	121	5	129	HN	X			
P pe cutter		1	-	-	4 weeks	96	-	107	-	-			
Trench roller		1	-	-	4 weeks	112	5	120	HN	X			
Asphalt roller		1	-	-	4 weeks	105	-	112	-	-			
Concrete Agi		1	-	-	4 weeks	108	-	111	-	-			
Delivery truck		2	-	-	4 weeks	106	-	111	-	-			
Slew Crane	1	-	-	4 weeks	104	-	108	-	-				
Tipper Truck 12T	2	-	-	4 weeks	103	-	111	-	-				

Table C2-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

PYRMONT STATION

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity		Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)			High noise plant	Vibration intensive plant	Notes
			7am - 6pm	6pm - 10pm	10pm - 7am	Start Date	Duration	L _{Aeq}	Penalty	L _{Amax}			
Temporary Shaft	Piling and capping beams	Excavator 35T w hammer	2	-	-		3 weeks	118	5	126	HN	X	Levelling site and piling pad stripping and loading of subgrade
		Excavator 30T w bucket	2	-	-		3 weeks	103	-	108	-	-	Spread and place fill for piling pad
		Vibratory Roller 16T (Smoothdrum)	2	-	-		3 weeks	108	5	113	HN	X	
		Vibratory Roller 16T (Padfoot)	2	-	-		3 weeks	108	5	113	HN	X	
		Truck (spoil haulage)	2 p.h.	-	-		3 weeks	106	-	111	-	-	Import / export material
		Moxy 20T	2	-	-		3 weeks	109	-	119	-	-	Cart to/from stockpile
	Hoarding Erection and Site Offices	Excavator 20T w bucket and auger	2	2	2		2 weeks	103	-	108	-	-	Done by demolition guys
		Franna Crane / Manitou	2	2	2		2 weeks	98	-	102	-	-	OOHW required where ROL prohibits lane closure during standard construct hours
		Concrete Agi	4 p.h.	4 p.h.	4 p.h.		2 weeks	108	-	111	-	-	
		Power Hand Tools	6	6	6		2 weeks	108	-	118	-	-	
		WSP / Scissor Lift	4	4	4		2 weeks	95	-	98	-	-	
		Mobile Crane 150T	1	1	1		2 weeks	104	-	108	-	-	
	Acoustic Shed Erection (east site)	Piling Rig (Bauer BG36)	1	-	-		14 weeks	107	-	116	-	X	Assumes piling in series (temp east then permanent west then permanent east)
		Concrete pump	1	4	1		14 weeks	103	-	107	-	-	Capping beam on Pyrmont Bridge Road will require OOHW due to ROL
		Concrete agitator	4	4	4		14 weeks	108	-	111	-	-	Capping beam on Pyrmont Bridge Road will require OOHW due to ROL
		Compressor	2	2	2		14 weeks	102	-	103	-	-	Capping beam on Pyrmont Bridge Road will require OOHW due to ROL
		Crawler Crane 100t	1	-	-		14 weeks	104	-	108	-	-	
		Delivery truck	1	-	-		14 weeks	106	-	111	-	-	
Mined tunnel	Shaft excavation	Power hand tools	1	-	-		14 weeks	108	-	118	-	-	
		Jackhammer	1	-	-		14 weeks	111	5	121	HN	X	
		Mobile Crane 150T	1	1	1		6 weeks	104	-	108	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL
		Franna Crane	2	2	2		6 weeks	98	-	102	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL
		Delivery Trucks	4 p.h.	4 p.h.	4 p.h.		6 weeks	106	-	111	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL
		WSP	2	2	2		16 weeks	95	-	98	-	-	Shed facade on Pyrmont Bridge Road and Pyrmont Street will require OOHW due to ROL
	Support works (concreting)	Dri ling machine (ECM 660IV)	1	-	-		16 weeks	106	-	116	-	X	
		Power hand tools	1	-	-		16 weeks	108	-	118	-	-	
		Generator	1	-	-		16 weeks	94	-	95	-	-	
		Excavator with cutter attachment	0	-	-		16 weeks	121	5	129	HN	X	
		Site Forklift	1	-	-		16 weeks	99	-	103	-	-	
		Water pump (diaphragm pump)	2	-	-		16 weeks	106	-	109	-	-	
		Excavator w rockhammer	2	-	-		16 weeks	118	5	123	HN	X	
		Excavator with saw attachment	1	-	-		16 weeks	121	5	129	HN	X	
		Compressor	1	-	-		16 weeks	102	-	103	-	-	
		FE Loader (CAT980)	1	-	-		16 weeks	110	-	115	-	-	
		Gantry Crane	-	-	-		16 weeks	106	-	110	-	-	
		Truck (spoil haulage)	4-6 p.h.	-	-		16 weeks	106	-	111	-	-	no truck and dogs allowed
	Tunnel Lining (concreting)	FE Loader (CAT980)	1	-	-		16 weeks	110	-	115	-	-	
		Road sweeper truck	1	-	-		16 weeks	107	-	111	-	-	
		Dri ling machine (ECM 660IV)	1	-	-		32 weeks	106	-	116	-	X	
		Concrete truck	4 p.h.	4 p.h.	-		32 weeks	108	-	111	-	-	
		Concrete pump	1	1	-		32 weeks	103	-	107	-	-	6-10pm only if we can't finish the concrete pour in time & low impact
		Shotcrete rig	1	1	-		32 weeks	104	-	107	-	-	6-10pm only if we can't finish the concrete pour in time & low impact
Mined tunnel	Cavern excavation & support	Welding equipment	1	1	-		32 weeks	96	-	107	-	-	6-10pm only if we can't finish the concrete pour in time & low impact
		Road Header 1 000V Electric	2	2	2		16 weeks	104	-	108	-	-	
		Bolting rig Robodrill 525	1	1	1		16 weeks	106	-	116	-	X	Adits
		Shotcrete rig (Potenza)	1	1	1		16 weeks	104	-	107	-	-	Adits
		Concrete site agitator	2	2	2		16 weeks	108	-	111	-	-	Adits
		Concrete road agitator	2 p.h.	2 p.h.	2 p.h.		16 weeks	108	-	111	-	-	Shaft / Adits
	Spoil Handling	Skid steer	1	1	1		16 weeks	109	-	113	-	-	Inside shed
		Excavator 25t w hammer	1	-	-		16 weeks	118	5	126	HN	X	Adits
		Excavator 8t w hammer	1	-	-		16 weeks	118	5	123	HN	X	Adits
		Dust Scrubber with silencer	2	2	2		16 weeks	104	-	107	-	-	Adits
		Ventilation fan with silencer	2	2	2		16 weeks	98	-	102	-	-	Shaft from commencement - to be acoustically treated
		Dump truck (Moxy CAT 725)	3	3	3		16 weeks	109	-	119	-	-	Inside shed - to be acoustically treated
		Excavator 25t w bucket	1	1	1		16 weeks	103	-	108	-	-	Cavern / temp shaft
		Excavator 8t w bucket	1	1	1		16 weeks	103	-	108	-	-	Cavern
		Excavator 30T w bucket	1	1	1		16 weeks	103	-	108	-	-	Cavern
		Gantry Crane	2	2	2		16 weeks	106	-	110	-	-	Inside shed at bottom of shaft
		Truck (spoil haulage)	8-9 p.h.	8-9 p.h.	-		16 weeks	106	-	111	-	-	Inside shed
		Concrete pump	2				20 weeks	103	-	107	-	-	Inside shed
	Tunnel Lining (concreting)	Compressor	1				20 weeks	102	-	103	-	-	Adit - form pumps
		Genset	1				20 weeks	94	-	95	-	-	On form for vibrators
		Ventilation fan with silencer	2	2	2		20 weeks	98	-	102	-	-	2 / 3 days usage for form power
		pneumatic vibrator	40				20 weeks	97	-	100	-	-	Same fans from excavation
		Concrete road agitator	6 p.h.				20 weeks	108	-	111	-	-	During crown concrete pours - every 2-3 days significantly less during invert and kicker works
		Concrete site agitator	5				20 weeks	108	-	111	-	-	Inside shed during concrete pours - every 2-3 days
		Telehandler	1				20 weeks	98	-	102	-	-	

Table C2-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

PYRMONT STATION

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity	Sound Power Level (Lw re: 1pW) in Noise Model dB(A)			High noise plant	Vibration intensive plant	Notes
			7am - 6pm	6pm - 10pm	10pm - 7am		L _{Aeq}	Penalty	L _{Amax}			
Permanent Shaft	Piling and capping beams	Piling Rig (Bauer BG36)	0	-	-	8 weeks	107	-	116	-	X	Assumes piling in series (temp east then permanent west then permanent east)
		Concrete pump	1	1	1	8 weeks	103	-	107	-	-	Capping beam on Pyrmont Bridge Road will require OOHW due to ROL
		Concrete agitator	4	4	4	8 weeks	108	-	111	-	-	Capping beam on Pyrmont Bridge Road will require OOHW due to ROL
		Compressor	2	2	2	8 weeks	102	-	103	-	-	Capping beam on Pyrmont Bridge Road will require OOHW due to ROL
		Crawler Crane 100t	1	-	-	8 weeks	104	-	108	-	-	
		Delivery truck	1	-	-	8 weeks	106	-	111	-	-	
		Power hand tools	1	-	-	8 weeks	108	-	118	-	-	
		Jackhammer	1	-	-	8 weeks	111	5	121	HN	X	
		Compressor	2	-	-	8 weeks	102	-	103	-	-	
	Shaft excavation	Dri ling machine (ECM 660IV)	1	-	-	8 months	106	-	116	-	X	
		Power hand tools	1	-	-	8 months	108	-	118	-	-	
		Generator	1	-	-	8 months	94	-	95	-	-	
		Excavator with cutter attachment	1	-	-	8 months	121	5	129	HN	X	
		Site Forklift	1	-	-	8 months	99	-	103	-	-	
		Water pump (diaphragm pump)	2	-	-	8 months	106	-	109	-	-	
		Excavator w rockhammer	5	-	-	8 months	118	5	123	HN	X	
		Excavator with saw attachment	1	-	-	8 months	121	5	129	HN	X	
		Compressor	1	-	-	8 months	102	-	103	-	-	
		FE Loader (CAT980)	1	-	-	8 months	110	-	115	-	-	
		Gantry Crane	1	1*	1*	8 months	106	-	110	-	-	*OOHW where low impact requirements of Condition D23(b) can be met
		Truck (spoil haulage)	4-6 p.h	-	-	8 months	106	-	111	-	-	
		FE Loader (CAT980)	1	-	-	8 months	110	-	115	-	-	
		FE Loader (CAT980)	0	-	-	8 months	110	-	115	-	-	
		Road sweeper truck	1	-	-	8 months	107	-	111	-	-	Loading spoil into kibble at bottom of shaft.
	Support works (concreting)	Dri ling machine (ECM 660IV)	1	1*	-	6 months	106	-	116	-	X	*OOHW where low impact requirements of Condition D23(b) can be met
		Concrete truck	4 p.h.	4 p.h.*	-	6 months	108	-	111	-	-	
		Concrete pump	1	1*	-	6 months	103	-	107	-	-	
		Shotcrete r g	1	2*	-	6 months	104	-	107	-	-	
		Welding equipment	1	1*	-	6 months	96	-	107	-	-	

Table C2-2: Construction Noise Management Schedule**INDICATIVE NOISE AND VIBRATION MITIGATION****PYRMONT STATION**

Area to be Managed		Specific Mitigation/ Management Measure		Details
Airborne Noise				
1	Shaft excavation			
1.1	Work during Standard Construction Hours	DAY	Standard hours activities	see Table C1 for details
1.2	Work outside Standard Construction Hours	D(O)/EVE/ NGT	OOHW activities limited as noted below and in Table C1	see Table C1 for details
1.3	Acoustic enclosures/sheds			
	Acoustic shed and cover over WEST shaft	D(O)/EVE	Acoustic shed to allow OOHW concrete delivery, ground-support/ temporary lining of shaft	see Table C4 for details
		D(O)/EVE/ NGT	Rapid roller door on the southern and eastern side of the shed to be closed in the evening and at night.	see Table C4 for details
	Acoustic shed and cover over EAST shaft	D(O)/EVE	Acoustic shed to allow OOHW concrete delivery, ground-support/ temporary lining of shaft	see Table C4 for details
		D(O)/EVE/ NGT	Rapid roller door on the eastern and western side of the shed to be closed in the evening and at night.	see Table C4 for details
1.4	Truck restrictions during the OOHW period		Avoid the use of park air brakes outside the sheds at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving the site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site.	
	Deliveries (concrete)	D(O)/EVE	≤ 4 per hour (concrete trucks afor ground support/ temporary lining following shaft excavation)	see Table C1 for details
	SPOIL trucks on site	D(O)/EVE	≤ 4 per hour	see Table C1 for details
		NIGHT	No spoil trucks after 6pm	
1.5	Ventilation Fan (TBC)		Ventilation fans with silencer + additional attenuation (duct lining/ inlet attenuator/ plenum room). Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
1.6	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
1.7	Residual impacts		Marginal impacts likely at nearest receivers to WEST shaft on PYRMONT STREET and PATERNOSTER ROW	See Table C6
2	Mined tunnelling			
2.1	Work during Standard Construction Hours	DAY	Standard hours activities	see Table C1 for details
2.2	Work outside Standard Construction Hours	D(O)/EVE/ NGT	OOHW activities limited as noted below and in Table C1	see Table C1 for details
2.3	Acoustic enclosures/sheds			
	Acoustic shed and cover over WEST shaft	D(O)/EVE/ NGT	Acoustic shed to allow OOHW concrete delivery, spoil handling and loading	see Table C4 for details
		D(O)/EVE/ NGT	1 Gantry Crane inside acoustic shed; excavator with bucket loading kibble; kibble loads directly to spoil truck.	see Table C1 for details
		D(O)/EVE/ NGT	Rapid roller door on the southern and eastern side of the shed to be closed in the evening and at night.	see Table C4 for details
	Acoustic shed and cover over EAST shaft	D(O)/EVE/ NGT	Acoustic shed to allow OOHW concrete delivery, spoil handling and loading	see Table C4 for details
		D(O)/EVE/ NGT	1 Gantry Crane inside acoustic shed; excavator with bucket loading kibble; kibble loads directly to spoil truck.	see Table C1 for details
		D(O)/EVE/ NGT	Rapid roller door on the eastern and western side of the shed to be closed in the evening and at night.	see Table C4 for details
2.4	Truck restrictions during the OOHW period		Avoid the use of park air brakes outside the sheds at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving the site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site.	
	Deliveries (concrete)	D(O)/EVE/NGT	≤ 4 per hour (concrete trucks at night essential for ground support following mined-tunnel excavation)	see Table C1 for details
	SPOIL trucks on site	D(O)/EVE	≤ 9 per hour	see Table C1 for details
		NIGHT	No spoil trucks after 10pm	
2.5	Ventilation Fan (TBC)		Ventilation fans with silencer + additional attenuation (duct lining/ inlet attenuator/ plenum room). Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
2.6	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
2.7	Residual impacts		Marginal impacts likely at nearest receivers to WEST shaft on PYRMONT STREET and PATERNOSTER ROW	See Table C6
Ground-borne Noise				
3	Shaft excavation	(where airborne noise not significant, i.e. where works are inside shed, or where receivers have treated facade to reduce external noise transmission)		
3.1	GBN impacts from rockhammer excavation of shaft (assumes discontinuity through secant line drilling to 9m deep on boundary)	DAY	Shaft up to 8 m deep Properties within 40m of shaft excavation area are GBN affected (> 50 dB(A)) - provide respite during excavation works to manage high GBN impacts Shaft >8m to 17 m deep Properties within 35m of shaft excavation area are GBN affected (> 50 dB(A)) - provide respite during excavation works to manage high GBN impacts Shaft >17m to 26 m deep Properties within 30m of shaft excavation area are GBN affected (> 50 dB(A)) - provide respite during excavation works to manage high GBN impacts Shaft up to 8 m deep Properties within 25m of shaft excavation area are highly GBN affected (> 60 dB(A)) - consider project specific respite offer during excavation works to manage high GBN impacts Shaft >8m to 17 m deep Properties within 16m of shaft excavation area are highly GBN affected (> 60 dB(A)) - consider project specific respite offer during excavation works to manage high GBN impacts Shaft >17m to 26 m deep Properties within 10m of shaft excavation area are highly GBN affected (> 60 dB(A)) - consider project specific respite offer during excavation works to manage high GBN impacts	
3.2	GBN impacts from secant line drilling - boundary (no disconnectivity)	DAY	Shaft up to 9 m deep Properties adjacent to western shaft excavation area to be consulted regarding respite periods during excavation works to manage high GBN impacts (> 50 dB(A))	
3.3	Respite periods	GBN affected sensitive receivers require consultation to identify sensitive times where respite should be provided. Highly GBN affected may be eligible for project specific respite offer, subject to detailed design, programming and verification monitoring. Consider temporary relocation of 4 properties adjacent to western shaft due to GBN and vibration during western shaft excavation (127 Pyrmont Street, 28 Paternoster Row, 125 Pyrmont Street, 26 Paternoster Row)		

Table C2-2: Construction Noise Management Schedule**INDICATIVE NOISE AND VIBRATION MITIGATION****PYRMONT STATION**

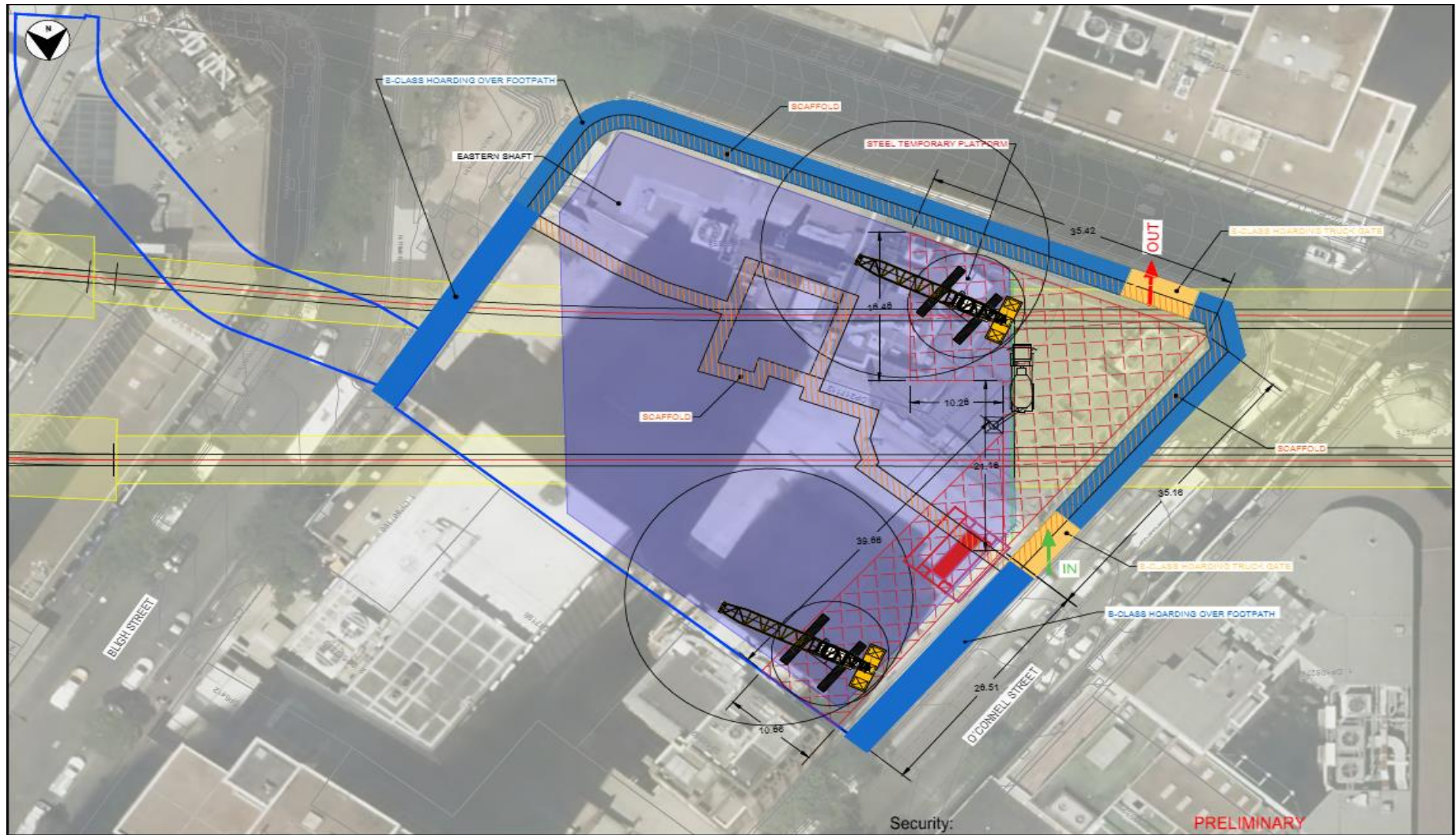
Area to be Managed		Specific Mitigation/ Management Measure		Details
Vibration Assessment				
4	Shaft excavation			
4.1	Structural damage	Reinforced or frame structures	Minimum working distance > 5m	
		Screening criteria - non-heritage, unreinforced structures	Minimum working distance > 10m	
		Screening criteria - heritage structures	Minimum working distance > 20m	
4.2	Human disturbance	DAY/EVE		
		Human disturbance screening	15 residences above human disturbance screening limit for excavation works (up to 50 above screening limit for vibratory rolling)	
			1 hotel above human disturbance screening limit [1. The Sebel Darling Harbour]	
			1 commercial premise above human disturbance screening limit (up to 15 above screening limit for vibratory rolling)	
4.3	Mined tunnel excavation	Residential		
		Structural Damage 20m	None, see Appendix D.2.3	
		Human Disturbance 70m	None, see Appendix D.2.3	
		Commercial/Industrial		
		Structural Damage 10m	None, see Appendix D.2.3	
		Human Disturbance 30m	None, see Appendix D.2.3	
4.4	Minimum working distances	Measurement of vibration on site from rockhammers and other vibration inducing equipment to establish site specific minimum working distances		
4.5	Alternative low vibration excavation techniques	The use of rock saws, dozers and surface miners should be always considered whenever reasonable and feasible. Strong justification should be provided for standard construction		
4.6	Long-term monitoring	Long-term monitoring TBC following MWD monitoring and confirmation of works relative to heritage items		
4.7	Dilapidation survey and structural engineering assessment	General	Consistent with the EIS, building dilapidation surveys would be required on all buildings located within the minimum working distances for cosmetic damage prior to commencement, and after completion.	
		Heritage items	Structural assessment of the heritage items around the site to identify more specific vibration criteria.	
4.8	Notification	Notification should be sent to all vibration affected receivers		
Traffic on Public Roads				
1	Heavy Vehicle Movements	DAY/ NIGHT	As per EIS	
2	Light Vehicle Movements		As per EIS	

C.3 Hunter Street Station Worksite

Figure C3-1: Site Layout and Hoardings

INDICATIVE NOISE MITIGATION

HUNTER STREET STATION EAST



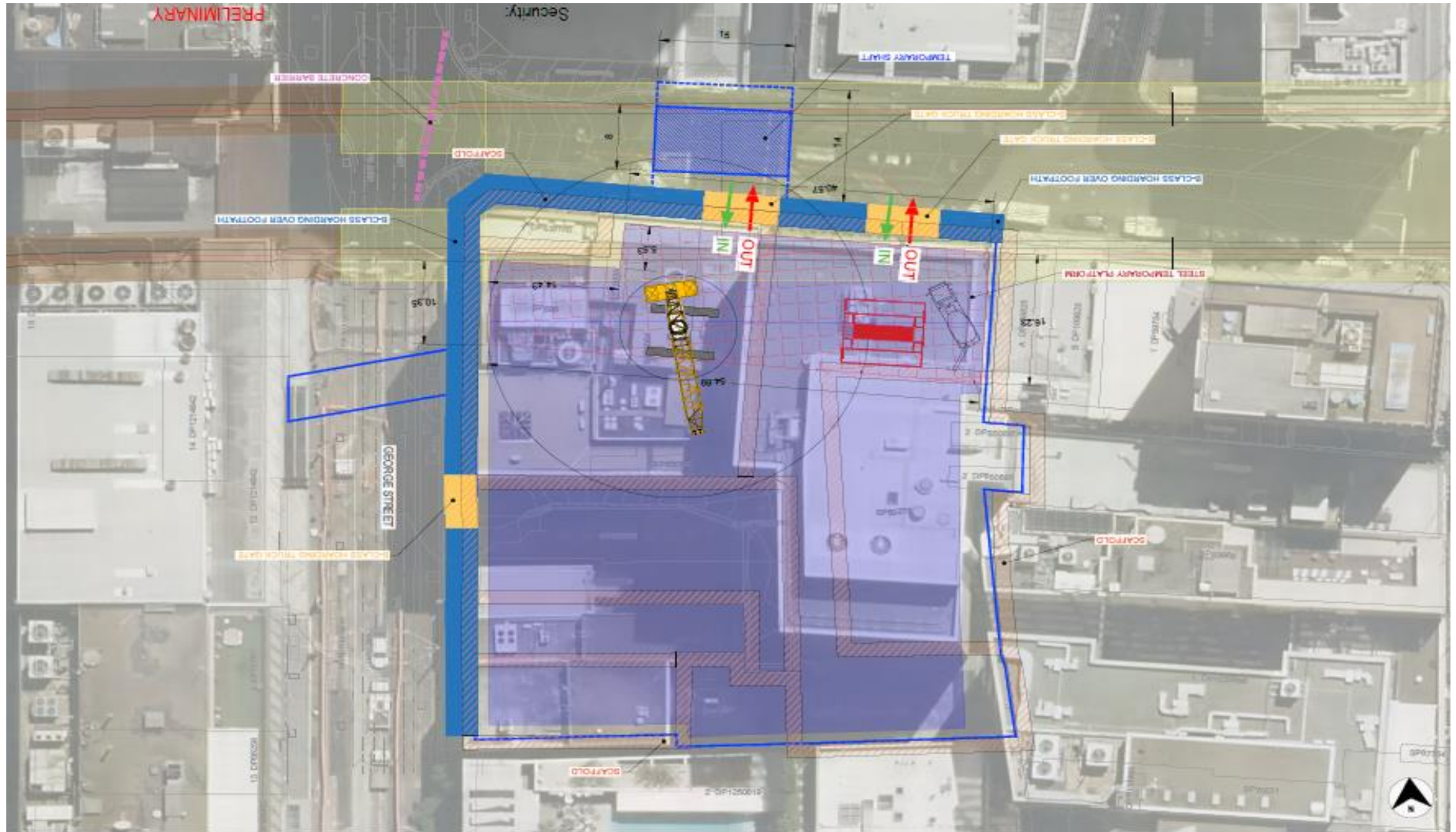


Table C3-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

HUNTER STREET STATION

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity		Sound Power Level (Lw re: 1pW) in Noise Model dBA)			High noise plant	Vibration intensive plant	Notes
			7am - 6pm	6pm - 10pm	10pm - 7am	Start Date	Duration	L _{Aeq}	Penalty	L _{Amax}			
WEST WORKSITE													
Compound	Deliveries Maintenance Office areas Storage areas Car parking	Delivery truck	4 per hour	-	-			106	-	111	-	-	
		Light vehicle	180 in/ out	60 in/ out	60 in/ out			89	-	100	-	-	
		Water treatment plant pump	1	-	-			99	-	101	-	-	
		Workshop Hand Tools	1	-	-			105	-	118	-	-	
		Franna Crane	1	-	-			98	-	102	-	-	
Site Establishment	Demolition	Water cart/ Street Sweeper	1	-	-			107	-	111	-	-	
		Excavator 30T with shears grabs and bucket	4	-	-		6 weeks	103	-	108	-	-	
		Trucks	10 p.h.	-	-		6 weeks	106	-	111	-	-	
		Water cart	1	-	-		6 weeks	107	-	111	-	-	
		Hand Tools	1	-	-		6 weeks	105	-	118	-	-	
		Oxy Acetylene	2	-	-		6 weeks	96	-	107	-	-	
		EWP / Scissor Lift	4	-	-		6 weeks	95	-	98	-	-	
	Service Relocation	Workshop Hand tools	1	-	-		3 weeks	105	-	118	-	-	
		Generator	1	-	-		3 weeks	94	-	95	-	-	
		Water pump	2	-	-		3 weeks	99	-	101	-	-	
		Excavator 12T w rockhammer	2	-	-		3 weeks	118	5	126	HN	X	
		Road saw	1	-	-		3 weeks	121	5	129	HN	X	
		Pipe cutter	1	-	-		3 weeks	96	-	107	-	-	
		Concrete Aai	1	-	-		3 weeks	108	-	111	-	-	
		Delivery truck	2	-	-		3 weeks	106	-	111	-	-	
		Slew Crane	1	-	-		3 weeks	104	-	108	-	-	
		Tipper Truck 12T	1	-	-		3 weeks	103	-	111	-	-	
	Prelim Earthworks and Piling Pad Construction	Excavator 35T w hammer	1	-	-		4 weeks	118	5	126	HN	X	Stripping and loading of subgrade
		Excavator 30T w bucket	2	-	-		4 weeks	103	-	108	-	-	Spread and place fill for piling pad
		Vibratory Roller 16T (Smoothdrum)	1	-	-		4 weeks	108	5	113	HN	X	
	Hoarding Erection and Site Offices	Trucks	10 p.h.	-	-		4 weeks	106	-	111	-	-	Import / export material
		Franna Crane / Manitou	2	-	-		6 weeks	98	-	102	-	-	
		Concrete Aai	4 p.h.	-	-		6 weeks	108	-	111	-	-	
		Power Hand Tools	4	-	-		6 weeks	108	-	118	-	-	
		EWP / Scissor Lift	2	-	-		6 weeks	95	-	98	-	-	
Permanent Shaft Excavation	Piling (King Piles)	Piling Rig (Bauer BG36)	1	-	-		8 weeks	107	-	116	-	X	BG40 Rig using coring barrel. No shaking of bucket
		Crawler Crane 100t	1	-	-		8 weeks	104	-	108	-	-	
		Concrete truck	8 p.h.	-	-		8 weeks	108	-	111	-	-	Concrete works not occurring at same time as piling rig. (either piling or pouring)
		Concrete pump	1	-	-		8 weeks	103	-	107	-	-	Concrete works not occurring at same time as piling rig. (either piling or pouring)
		Delivery truck	1 p.h.	-	-		8 weeks	106	-	111	-	-	Delivery of cages / misc goods. Up to 1 per hr expected
		Welding equipment	1	1	-		8 weeks	96	-	107	-	-	Welding of cages
		Jackhammer	1	-	-		8 weeks	111	5	121	HN	X	
		Compressor	2	-	-		8 weeks	102	-	103	-	-	
	Excavation of soil & rock Hammering/rock breaking Loading Haulage.	Crane (100t)	1	-	-		10 months	104	-	110	-	-	
		Generator	2	-	-		10 months	94	-	95	-	-	Located at level RL 1??? (static plant)
		Water pump (diaphraqm pump)	2	-	-		10 months	106	-	109	-	-	Pumps will be required to run 24/7
		Excavator w bucket	1	-	-		10 months	103	-	108	-	-	
	Support works (concreting)	FE Loader (CAT980)	1	-	-		10 months	110	-	115	-	-	
		Drilling machine (ECM 660IV)	1	1	-		10 months	106	-	116	-	X	As required
		Concrete truck	4 p.h.	4 p.h.	-		10 months	108	-	111	-	-	As required
		Concrete pump	1	1	-		10 months	103	-	107	-	-	Concrete pump not requ red full time only as required.
		Shotcrete rig	2	2	-		10 months	104	-	107	-	-	Not working at some time as Roadheader or excavators
Mined tunnel excavation (Adits)	Tunnel excavation & support	Welding equipment	1	1	-		10 months	96	-	107	-	-	Miq welders required to setup site
		Road Header 1 000V Electric	1	1	-			104	-	108	-	-	Adits
		Bolting rig Robodrill 525	1	1	-			106	-	116	-	X	Adits
		Shotcrete rig (Potenza)	1	1	-			104	-	107	-	-	Adits
		Concrete site agitator	2	2	-			108	-	111	-	-	Shaft / Adits
		Concrete road agitator	2 p.h	2 p.h	-			108	-	111	-	-	Inside shed
		Skid steer	1	1	-			109	-	113	-	X	Adits
		Excavator 25t w hammer	1	-	-			118	5	126	HN	X	Adits
		Excavator 8t w hammer	1	-	-			118	5	123	HN	X	Adits
		Excavator 25t w bucket	1	1	-			103	-	108	-	-	Adits
		Excavator 8t w bucket	1	1	-			103	-	108	-	-	Adits
		Dust Scrubber with silencer	4	4	-			104	-	107	-	-	Shaft from commencement - to be acoustically treated
		Ventilation fan with silencer	2	2	-			98	-	102	-	-	Inside shed (eastern worksite) - to be acoustically treated
	Spoil Handling	Dump truck (Moxv CAT 725)	3	3	-			109	-	119	-	-	Adit / temp shaft
		FE Loader (CAT980)	1	1	-			110	-	115	-	-	Loading spoil into kibble at bottom of shaft.
		FE Loader (CAT980)	1	1	-			110	-	115	-	-	Loading spoil into trucks in spoil shed
		Excavator 30T w bucket	1	1	-			103	-	108	-	-	Shaft
		Trucks (spoil haulage)	4-6 p.h.	4 p.h.	-			106	-	111	-	-	Inside shed (eastern worksite)

Table C3-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

HUNTER STREET STATION

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day	Evening	Night	Timing of Activity		Sound Power Level (Lw re: 1pW) in Noise Model dBA)			High noise plant	Vibration intensive plant	Notes			
			7am - 6pm	6pm - 10pm	10pm - 7am	Start Date	Duration	L _{Aeq}	Penalty	L _{Amax}						
	Tunnel Lining (concreting)	Concrete pump	2	2	-					103	-	107	-	-	Adit - form pumps	
		Compressor	1	1	-					102	-	103	-	-	On form for vibrators	
		Genset	1	1	-					94	-	95	-	-	2 / 3 days usage for form power	
		Ventilation fan with silencer	2	2	-					98	-	102	-	-	Same fans from excavation	
		Pneumatic vibrator	40	41	-					97	-	100	-	-	During crown concrete pours - every 2-3 days significantly less during invert and kicker works	
		Concrete road agitator	5 p.h	6 p.h	-					108	-	111	-	-	Inside shed (eastern worksite) during concrete pours - every 2-3 days	
		Concrete site agitator	3	3	-					108	-	111	-	-	Adits	
		Telehandler	1	1	-					98	-	102	-	-	Adits	
EAST WORKSITE																
Compound	Deliveries Maintenance Office areas Storage areas Car parking	Delivery truck	4 per hour	-	-					106	-	111	-	-		
		Light vehicle	180 in/ out	60 in/ out	60 in/ out					89	-	100	-	-		
		Wheel wash unit	1	1	-					99	-	101	-	-		
		Water treatment plant pump	2	2	2					99	-	101	-	-		
		Compressor	2	-	-					102	-	103	-	-		
		Workshop Hand Tools	1	-	-					105	-	118	-	-		
		Franna Crane	1	-	-					98	-	102	-	-		
		Water cart/ Street Sweeper	1	-	-					107	-	111	-	-		
Site Establishment	Demolition	Excavator 30T with shears grabs and bucket	4	-	-		6 weeks			103	-	108	-	-		
		Trucks	10 p.h.	-	-		6 weeks			106	-	111	-	-		
		Water cart	1	-	-		6 weeks			107	-	111	-	-		
		Hand Tools	1	-	-		6 weeks			105	-	118	-	-		
		Oxy Acetylene	2	-	-		6 weeks			96	-	107	-	-		
		EWP / Scissor Lift	4	-	-		6 weeks			95	-	98	-	-		
		Excavator 25T w grabs and bucket	1	-	-		1 week			103	-	108	-	-		
		Chainsaw	1	-	-		1 week			116	5	120	HN	-		
	Tree Clearing	Truck & Wood Chipper	1	-	-		1 week			120	5	124	HN	-		
		Mobile Crane	1	-	-		1 week			104	-	108	-	-		
		Site boogie	1	-	-		1 week			103	-	111	-	-		
		Excavator 12T w rockhammer	1	-	-		3 weeks			105	-	118	-	-		
	Service Relocation	Generator	1	-	-		3 weeks			94	-	95	-	-		
		Water pump	2	-	-		3 weeks			99	-	101	-	-		
		Excavator 12T w rockhammer	2	-	-		3 weeks			118	5	126	HN	X		
		Road saw	1	-	-		3 weeks			121	5	129	HN	X		
		Pipe cutter	1	-	-		3 weeks			96	-	107	-	-		
		Trench roller	1	-	-		3 weeks			112	5	120	HN	X		
		Asphalt roller	1	-	-		3 weeks			105	-	112	-	-		
		Concrete Aqi	1	-	-		3 weeks			108	-	111	-	-		
		Delivery truck	2	-	-		3 weeks			106	-	111	-	-		
		Slew Crane	1	-	-		3 weeks			104	-	108	-	-		
		Tipper Truck 12T	2	-	-		3 weeks			103	-	111	-	-		
		Prelim Earthworks and Piling Pad Construction	Excavator 35T w hammer	1	-	-		4 weeks			118	5	126	HN	X	Stripping and loading of subgrade
	Excavator 30T w bucket		2	-	-		4 weeks			103	-	108	-	-	Spread and place fill for piling pad	
	Vibratory Roller 16T (Smoothdrum)		1	-	-		4 weeks			108	5	113	HN	X		
	Vibratory Roller 16T (Padfoot)		0	-	-		4 weeks			108	5	113	HN	X		
	Trucks		10 p.h.	-	-		4 weeks			106	-	111	-	-	Import / export material	
	Moxy 20T		2	-	-		4 weeks			109	-	119	-	-	Cart to/from stockpile	
	Excavator 20T w bucket and auger		2	-	-		6 weeks			103	-	108	-	-		
	Franna Crane / Manitou		2	-	-		6 weeks			98	-	102	-	-		
	Hoarding Erection and Site Offices	Concrete Aqi	4 p.h.	-	-		6 weeks			108	-	111	-	-		
Power Hand Tools		6	-	-		6 weeks			108	-	118	-	-			
EWP / Scissor Lift		4	-	-		6 weeks			95	-	98	-	-			
Mobile Crane 150T		1	-	-		6 weeks			104	-	108	-	-			
Temporary Shaft Excavation (within existing Bligh St shed)		Piling and capping beams	Piling Rig (Bauer BG36)	2	-	-		13 weeks			107	-	116	-	X	Assumes piling in series
			Concrete pump	1	-	-		13 weeks			103	-	107	-	-	(temp east then permanent west then permanent east)
			Concrete agitator	4 per hour	-	-		13 weeks			108	-	111	-	-	
			Compressor	2	-	-		13 weeks			102	-	103	-	-	
	Crawler Crane 100t		1	-	-		13 weeks			104	-	108	-	-		
	Delivery truck		1	-	-		13 weeks			106	-	111	-	-		
	Power hand tools		1	-	-		13 weeks			108	-	118	-	-		
	Jackhammer		1	-	-		13 weeks			111	5	121	HN	X		
	Compressor		2	-	-		13 weeks			102	-	103	-	-		

Table C3-1: Construction timetable/ activities/ equipment

INDICATIVE TIMETABLE/ ACTIVITIES/ EQUIPMENT

HUNTER STREET STATION

Activity/ Work Area	Aspect	Plant/ Equipment (as provided by client)	Day			Timing of Activity		Sound Power Level (Lw re: 1pW) in Noise Model dBA			High noise plant	Vibration intensive plant	Notes
			7am - 6pm	6pm - 10pm	10pm - 7am	Start Date	Duration	L _{Aeq}	Penalty	L _{Amax}			
Temporary shaft excavation		Drilling machine (ECM 660IV)	1	-	-		36 weeks	106	-	116	-	X	
		Power hand tools	1	-	-		36 weeks	108	-	118	-	-	
		Generator	1	-	-		36 weeks	94	-	95	-	-	
		Excavator with cutter attachment	1	-	-		36 weeks	121	5	129	HN	X	
		Site Forklift	1	-	-		36 weeks	99	-	103	-	-	
		Water pump (diaphragm pump)	2	-	-		36 weeks	106	-	109	-	-	
		Excavator w rockhammer	2	-	-		36 weeks	118	5	123	HN	X	
		Excavator with saw attachment	1	-	-		36 weeks	121	5	129	HN	X	
		Compressor	1	-	-		36 weeks	102	-	103	-	-	
		FE Loader (CAT980)	1	-	-		36 weeks	110	-	115	-	-	
		Gantry Crane	1	1	1		36 weeks	106	-	110	-	-	
		Trucks (spoil haulage)	4-6 p.h	-	-		36 weeks	106	-	111	-	-	
		FE Loader (CAT980)	1	-	-		36 weeks	110	-	115	-	-	Loading spoil into kibble at bottom of shaft.
		FE Loader (CAT980)	1	-	-		36 weeks	110	-	115	-	-	Inside shed
		Road sweeper truck	1	-	-		36 weeks	107	-	111	-	-	
	Support works (concreting)	Drilling machine (ECM 660IV)	1	1	-		36 weeks	106	-	116	-	X	
		Concrete truck	4 p.h.	4 p.h.	-		36 weeks	108	-	111	-	-	
		Concrete pump	1	1	-		36 weeks	103	-	107	-	-	
		Shotcrete rig	2	2	-		36 weeks	104	-	107	-	-	
		Welding equipment	1	1	-		36 weeks	96	-	107	-	-	
Mined tunnel excavation (Station Cavern/ Turnback)	Tunnel excavation & support	Road Header 1 000V Electric	4	4	4			104	-	108	-	-	Cavern/ Turnback
		Bolting rig Robodrill 525	1	1	-			106	-	116	-	X	Cavern/ Turnback
		Shotcrete rig (Potenza)	1	1	-			104	-	107	-	-	Cavern/ Turnback
		Concrete site agitator	2	2	-			108	-	111	-	-	Shaft / Cavern/ Turnback
		Concrete road agitator	2 p.h	2 p.h	-			108	-	111	-	-	Treatment?
		Skid steer	1	1	-			109	-	113	-	-	Cavern/ Turnback
		Excavator 25t w hammer	1	1	-			118	5	126	HN	X	Cavern/ Turnback
		Excavator 8t w hammer	1	1	-			118	5	123	HN	X	Cavern/ Turnback
		Excavator 25t w bucket	1	1	-			103	-	108	-	-	Cavern/ Turnback
		Excavator 8t w bucket	1	1	-			103	-	108	-	-	Cavern/ Turnback
	Spoil Handling	Dust Scrubber with silencer	4	4	-			104	-	107	-	-	Shaft from commencement - to be acoustically treated
		Ventilation fan with silencer	2	2	-			98	-	102	-	-	Inside shed - to be acoustically treated
		Dump truck (Mox CAT 725)	3	3	-			109	-	119	-	-	Cavern/ Turnback/ Temp shaft
		FE Loader (CAT980)	1	1	-			110	-	115	-	-	Loading spoil into kibble at bottom of shaft.
		Excavator 30T w bucket	1	1	-			103	-	108	-	-	Loading spoil into trucks inside shed
		Trucks (spoil haulage)	4-6 p.h.	4 p.h.	-			106	-	111	-	-	Inside shed
		Concrete pump	2	2	-			103	-	107	-	-	Cavern/ Turnback - form pumps
	Tunnel Lining (concreting)	Compressor	1	1	-			102	-	103	-	-	On form for vibrators
		Genset	1	1	-			94	-	95	-	-	2 / 3 days usage for form power
		Ventilation fan with silencer	2	2	-			98	-	102	-	-	Same fans from excavation
		Pneumatic vibrator	40	40	-			97	-	100	-	-	During crown concrete pours - every 2-3 days significantly less during invert and kicker works
		Concrete road agitator	5 p.h	5 p.h	-			108	-	111	-	-	Inside shed during concrete pours - every 2-3 days
		Concrete site agitator (10m3 transmix)	3	3	-			108	-	111	-	-	Cavern/ Turnback
		Telehandler	1	1	-			98	-	102	-	-	Cavern/ Turnback
Permanent Shaft Excavation	Piling (King Piles)	Piling Rig (Bauer BG36)	1	4	-		8 weeks	107	-	116	-	X	Adits
		Tower Crane M1280D (150T)	1	4	-		8 weeks	115	5	122	HN	-	Assumes piling in series (temp east then permanent west then permanent east)
		Crane (100t)	1	4	-		8 weeks	104	-	110	-	-	
		Concrete Truck	8 p. h.	8 p. h.	-		8 weeks	108	-	111	-	-	
		Concrete Pump	1	4	-		8 weeks	103	-	107	-	-	
		Delivery Truck	1 p. h.	1 p. h.	-		8 weeks	106	-	111	-	-	
		Welding equipment	1	4	-		8 weeks	96	-	107	-	-	
		Jackhammer	1	-	-		8 weeks	111	5	121	HN	X	
		Compressor	2	-	-		8 weeks	102	-	103	-	-	
		Tower Crane M1280D (150T)	1	4	-		10 months	115	5	122	HN	-	Tower crane not operating at night whilst excavation works in progress.
	Shaft excavation	Crane (100t)	1	4	-		10 months	104	-	110	-	-	
		Generator	2	2	-		10 months	94	-	95	-	-	Located at level RL 1??? (static plant)
		Water pump (diaphragm pump)	2	2	-		10 months	106	-	109	-	-	Pumps will be required to run 24/7
		Excavator w bucket	1	4	-		10 months	103	-	108	-	-	
		Excavator 45T w rockhammer	1	4	-		10 months	118	5	126	HN	X	Excavating (below RL???)
		Compressor	2	2	-		10 months	102	-	103	-	-	Excavating (below RL???)
		Truck (spoil haulage)	10 p.h.	10 p.h.	-		10 months	106	-	111	-	-	
		FE Loader (CAT980)	1	4	-		10 months	110	-	115	-	-	
	Support works (concreting)	Drilling machine (ECM 660IV)	1	4	-		10 months	106	-	116	-	X	As required
		Concrete truck	4 p.h.	4 p.h.	-		10 months	108	-	111	-	-	As required
		Concrete pump	1	4	-		10 months	103	-	107	-	-	Concrete pump not required full time only as required.
		Shotcrete rig	2	2	-		10 months	104	-	107	-	-	Not working at some time as Roadheader or excavators
		Welding equipment	1	4	-		10 months	96	-	107	-	-	Mig welders required to setup site

Table C3-2: Construction Noise Management Schedule**INDICATIVE NOISE AND VIBRATION MITIGATION****HUNTER STREET STATION**

Area to be Managed		Specific Mitigation/ Management Measure		Details
Airborne Noise				
1	Temporary shaft excavation (eastern site)			
1.1	Work during Standard Construction Hours	DAY	Standard hours activities	see Table C1 for details
1.2	Work outside Standard Construction Hours	D(O)/EVE/ NGT	OOHW activities limited as noted below and in Table C1	see Table C1 for details
1.3	Acoustic enclosures/sheds			
	Acoustic shed (existing) EAST worksite over tempary shaft	D(O)/EVE D(O)/EVE/ NGT	Acoustic shed to allow OOHW concrete delivery, ground-support/ temporary lining of shaft Roller door on the western side of the shed to be closed in the evening and at night.	see Table C4 for details
1.4	Truck restrictions during the OOHW period			
		D(O)/EVE/ NGT	Avoid the use of park air brakes outside the sheds at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving the site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site.	
	Deliveries (concrete)	D(O)/EVE	≤ 4 per hour (concrete trucks afor ground support/ temporary lining following shaft excavation)	see Table C1 for details
	SPOIL trucks on site	D(O)/EVE	≤ 4 per hour	see Table C1 for details
1.5	Ventilation Fan (TBC)		Ventilation fans with silencer + additional attenuation (duct lining/ inlet attenuator/ plenum room). Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
1.6	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
1.7	Residual impacts		Marginal impacts likely at nearest receivers to WEST shaft on PYRMONT STREET and PATERNOSTER ROW	See Table C6
2	Permanent shaft excavation (eastern and western site)			
2.1	Work during Standard Construction Hours	DAY	Standard hours activities	see Table C1 for details
2.2	Respite periods	DAY	Rockhammering with respite periods and consultation may be required. Respite periods are likely to be triggered at all depths.	
2.3	Work outside Standard Construction Hours	D(O)/EVE/ NGT	OOHW activities limited as noted below and in Table C1 OOH excavation of permanent shaft on eastern site subject to consultation with sensitive receivers [1. Radisson Blu; 2. Tank Stream Hotel; 3. Sofitel Sydney Wentworth]	see Table C1 for details
2.4	Noise barriers/ construction hoarding		Boundary hoardings to protect ground floor cafes, restaurants and pedestrian areas during shaft excavation.	See Table C3 for details
2.5	Truck restrictions during the OOHW period			
	Spoil trucks and concrete deliveries (Eastern site inside acoustic shed)	D(O)/EVE	≤ 12 per hour Avoid the use of park air brakes outside the shed at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving the site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site.	see Table C1 for details
2.6	Ventilation Fan (TBC)		Ventilation fans with silencer + additional attenuation (duct lining/ inlet attenuator/ plenum room). Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
2.7	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
2.8	Residual impacts			
3	Mined tunnelling			
3.1	Work during Standard Construction Hours	DAY	Standard hours activities	see Table C1 for details
3.2	Work outside Standard Construction Hours	D(O)/EVE/ NGT	OOHW activities limited as noted below and in Table C1	see Table C1 for details
3.3	Acoustic enclosures/sheds			
	Acoustic shed and cover over temporary shaft	D(O)/EVE/ NGT D(O)/EVE/ NGT D(O)/EVE/ NGT	Acoustic shed to allow OOHW concrete delivery, spoil handling and loading 1 Gantry Crane inside acoustic shed; excavator with bucket loading kibble; kibble loads directly to spoil truck. Roller door on the southern and eastern side of the shed to be closed in the evening and at night.	Existing acoustic shed
3.4	Truck restrictions during the OOHW period			
	Spoil trucks and concrete deliveries (Eastern site inside acoustic shed)	D(O)/EVE	≤ 12 per hour Avoid the use of park air brakes outside the shed at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving the site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site.	see Table C1 for details
3.5	Ventilation Fan (TBC)		Ventilation fans with silencer + additional attenuation (duct lining/ inlet attenuator/ plenum room). Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
3.6	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
Ground-borne Noise				
4	Shaft excavation -	(where airborne noise not significant, i.e. where works are inside shed, or where receivers have treated facade to reduce external noise transmission)		
4.1	West Shaft - assume shaft 10m deep to start	DAY	GBN impacts from rockhammer excavation of shaft (no disconnectivity) Hotels above NML Up to 4 above NML 40 dB; 3 within 10 dB of NML; 2 within 20 dB of NML [1. A by Adina; 2.Comfort Hotel Sydney City; 3. The Grand Hotel; 4. Tank Stream Hotel] Commercial above NML Up to 10 above NML 50 dB; 5 within 10 dB of NML; 2 within 20 dB of NML [1. 9 Hunter St; 2. 316 George St]	
4.2	Shaft excavation - East Shaft	(where airborne noise not significant, i.e. where works are inside shed, or where receivers have treated facade to reduce external noise transmission)		
		DAY	GBN impacts from rockhammer excavation of shaft (no disconnectivity) - assume shaft 10m deep to start Hotels above NML Up to 4 above NML 40 dB; 2 within 10 dB of NML; 1 within 20 dB of NML [1. Radisson Blu; 2. Tank Stream Hotel; 3. Sofitel Sydney Wentworth; 4. The Grand Hotel] Commercial above NML Up to 20 above NML 50 dB; 12 within 10 dB of NML; 3 within 20 dB of NML [1. 16 O'Connell St; 2. 29 Bligh St; 3. 37 Bligh St]	
4.3	Respite periods	GBN affected sensitive receivers require consultation to identify sensitive times where respite should be provided.		

Table C3-2: Construction Noise Management Schedule

INDICATIVE NOISE AND VIBRATION MITIGATION

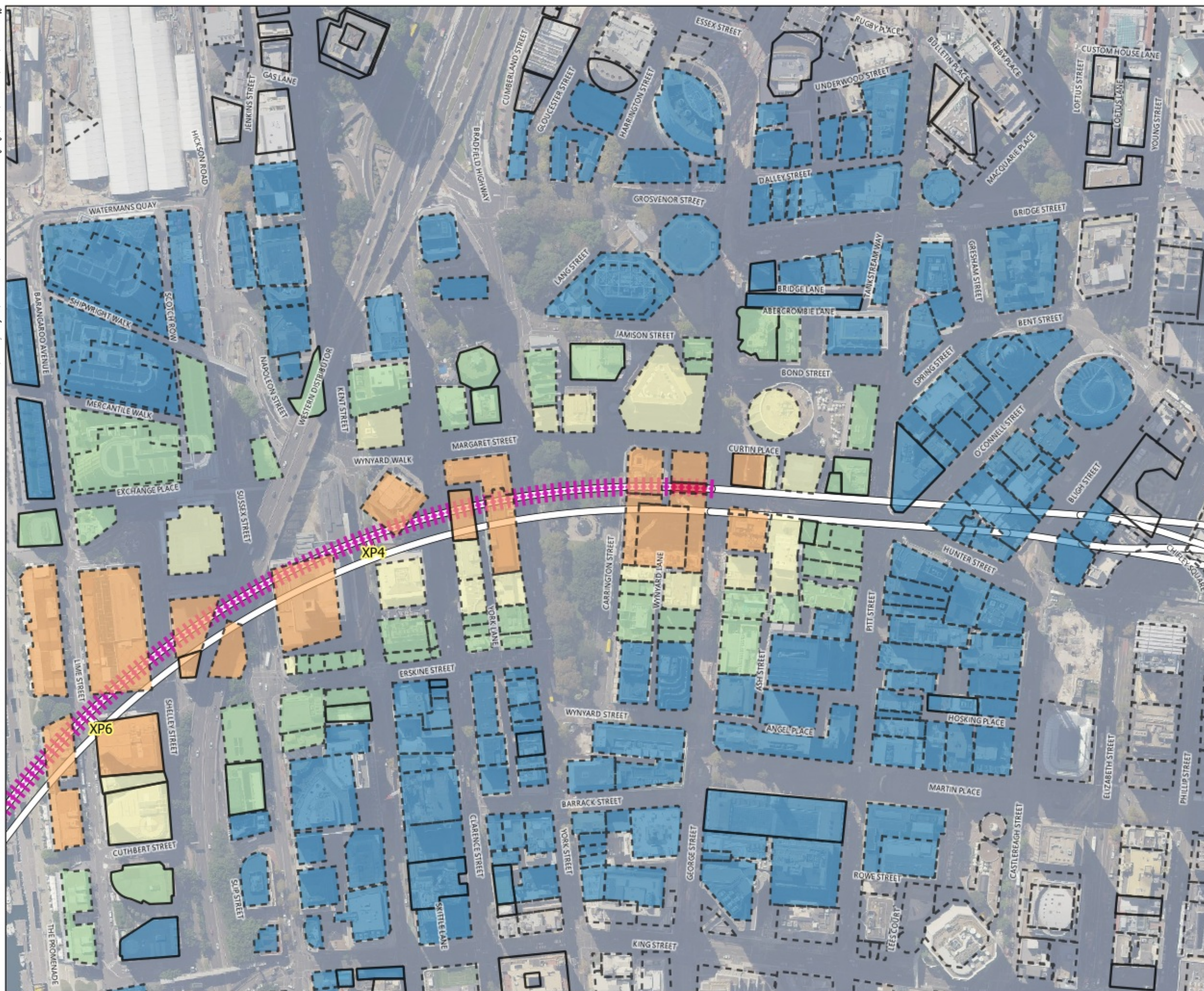
HUNTER STREET STATION

Area to be Managed		Specific Mitigation/ Management Measure		Details
Vibration Assessment				
5	Shaft excavation -			
5.1	Structural damage	Reinforced or frame structures	Minimum working distance > 5m	
		Screening criteria - non-heritage, unreinforced structures	Minimum working distance > 10m	
		Screening criteria - heritage structures	Minimum working distance > 20m	
5.2	Human disturbance	DAY/EVE	West Shaft	
		Human disturbance screening	2 hotels within human disturbance screening limit [1. A by Adina 2. Comfort Hotel Sydney City]	
			8 commercial properties within human disturbance screening limit [surrounding worksite]	
			East Shaft	
		Human disturbance screening	1 hotel within human disturbance screening limit [1. Radisson Blu]	
			10 commercial properties within human disturbance screening limit [surrounding worksite]	
5.3	Mined tunnel excavation	Residential		
		Structural Damage 20m	None, see Appendix D.2.4	
		Human Disturbance 70m	None, see Appendix D.2.4	
		Commercial/Industrial		
		Structural Damage 10m	None, see Appendix D.2.4	
		Human Disturbance 30m	None, see Appendix D.2.4	
5.4	Respite periods	Vibration affected sensitive receivers require consultation to identify sensitive times where respite should be provided.		
5.5	Minimum working distances	Measurement of vibration on site from rockhammers and other vibration inducing equipment to establish site specific minimum working distances		
5.6	Alternative low vibration excavation techniques	The use of rock saws, dozers and surface miners should be always considered whenever reasonable and feasible. Strong justification should be provided for standard construction methodology with rockhammers. However, when vibration measurements show exceedance of relevant vibration criteria, alternative low vibration plant are strongly recommended.		
5.7	Long-term monitoring	TBC following MWD monitoring and confirmation of works relative to heritage items		
5.8	Dilapidation survey and structural engineering assessment	General	Consistent with the EIS, building dilapidation surveys would be required on all buildings located within the minimum working distances for cosmetic damage prior to commencement, and after completion.	
		Heritage items	Structural assessment of the heritage items around the site to identify more specific vibration criteria.	
5.9	Notification	Notification should be sent to all vibration affected receivers		
Traffic on Public Roads				
1	Heavy Vehicle Movements	DAY/ NIGHT	As per EIS	
2	Light Vehicle Movements		As per EIS	

Appendix D Tunnelling works: ground-borne noise and vibration predictions

D.1 Mainline Tunnel Ground-borne Noise

300 m
200
100
0



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

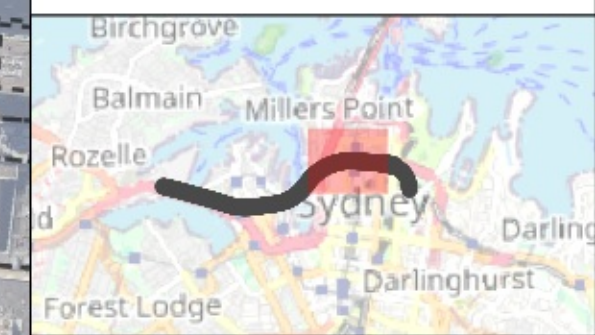
- Overall Tunnel Alignment
- Eastbound Tunnel Alignment

Maximum GBN levels dB(A) during TBM excavation

- < 30
- 30 - 35
- 35 - 40
- 40 - 45
- > 45

Notes:

- Predicted levels represent the typical maximum Ground Borne Noise (GBN) level that the receivers may experience for a limited time when the excavation plant is in the closest section of the tunnel and will reduce as the underground works move further away.
- The predicted GBN levels are calculated at the ground floor level.
- The crown of Eastbound Tunnel is assumed to be 3.5 metres above the axis of the TBM.



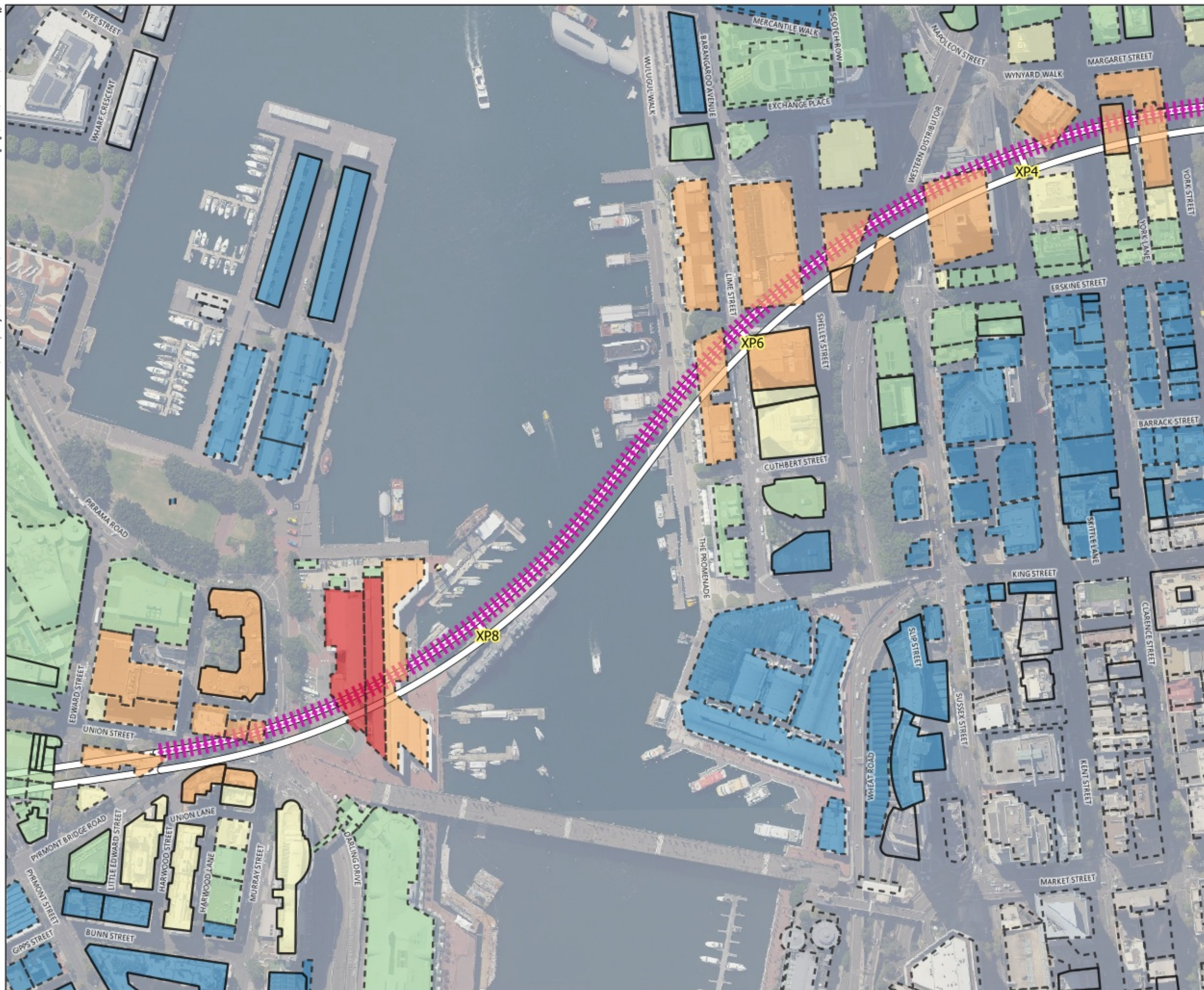
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AS Original			Co-ordinate System: MGA Zone 56	

0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBN level during Eastbound Tunnel excavation (TBM)	



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

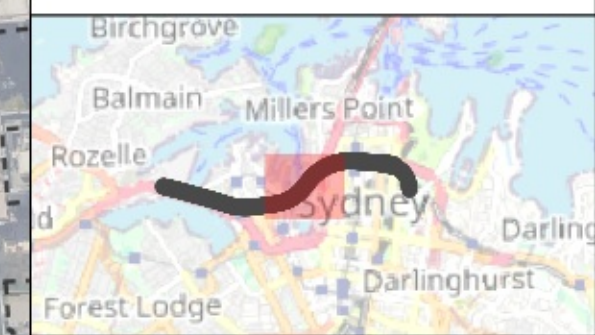
- Overall Tunnel Alignment
- Eastbound Tunnel Alignment

Maximum GBN levels dB(A) during TBM excavation

- < 30
- 30 - 35
- 35 - 40
- 40 - 45
- > 45

Notes:

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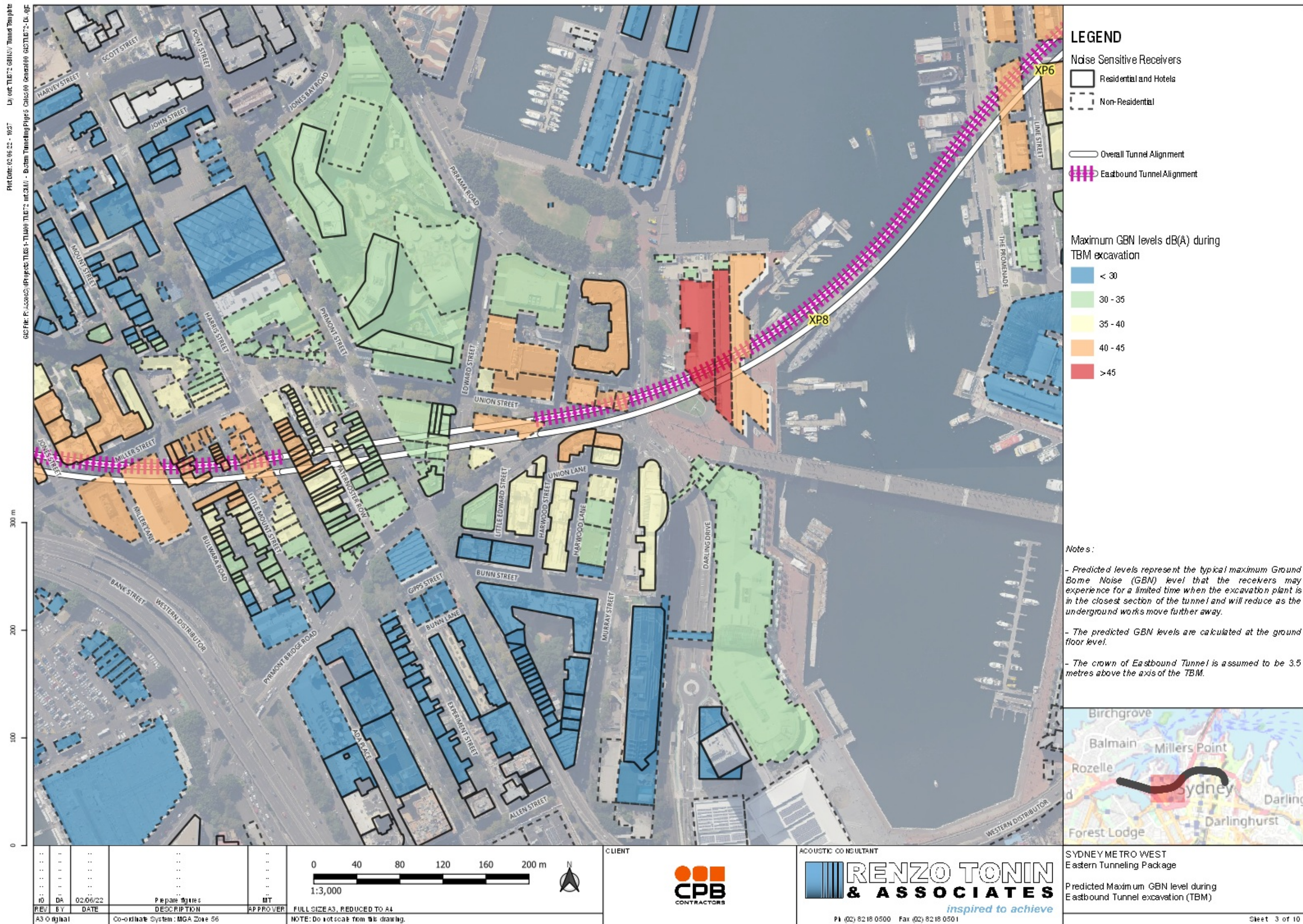
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AS Original			Co-ordinate System: MGA Zone 56	

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1:3,000					

CLIENT	

ACOUSTIC CONSULTANT	

SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBN level during Eastbound Tunnel excavation (TBM)	





LEGEND

Noise Sensitive Receivers

Residential and Hotels

Non-Residential

Overall Tunnel Alignment

Eastbound Tunnel Alignment

Maximum GBN levels dB(A) during TBM excavation

< 30

30 - 35

35 - 40

40 - 45

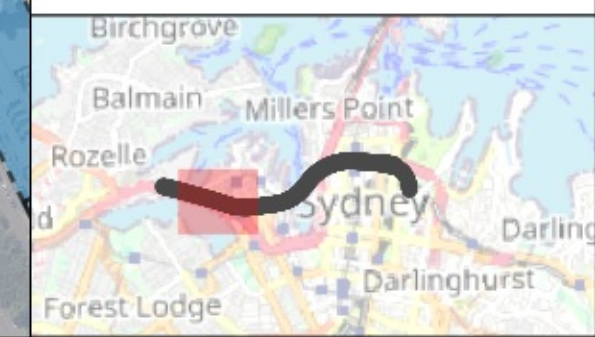
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REV	BY	DATE	DESCRIPTION	APPROVER
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AS Original				

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1:3,000					

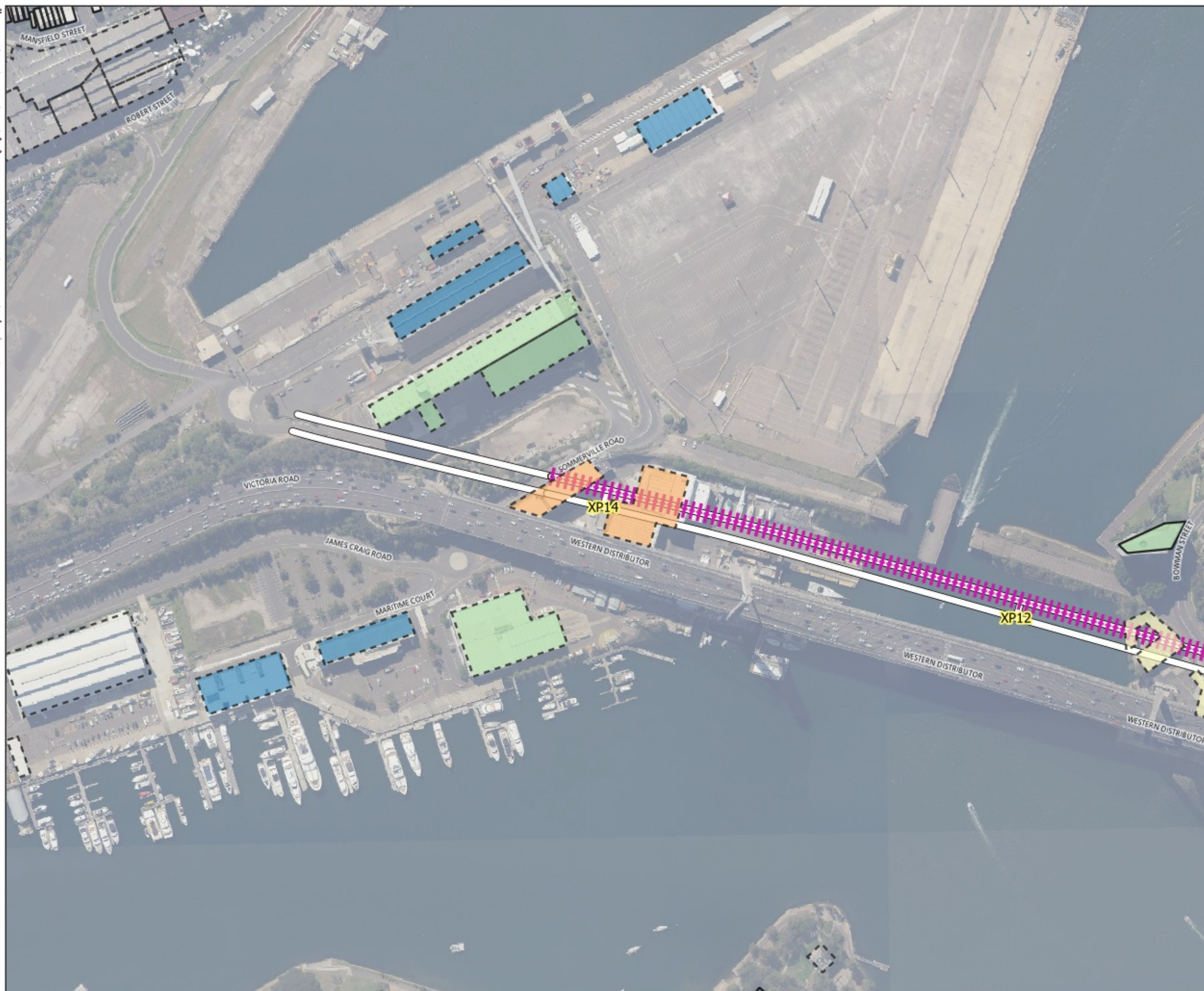
CLIENT	

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RENZO TONIN & ASSOCIATES	
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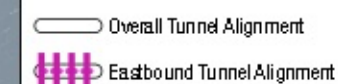
SYDNEY METRO WEST	
Eastern Tunneling Package	
Predicted Maximum GBN level during Eastbound Tunnel excavation (TBM)	

300 m
200
100
0

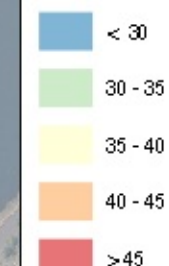


LEGEND

Noise Sensitive Receivers



Maximum GBN levels dB(A) during TBM excavation

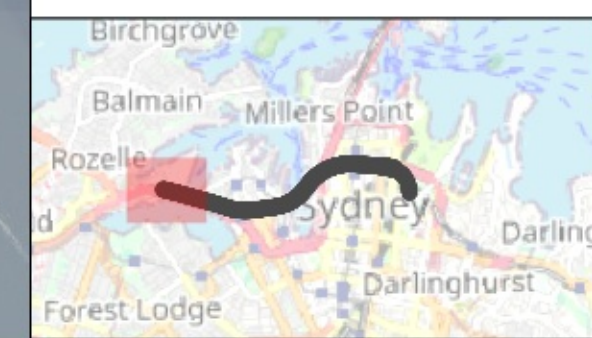


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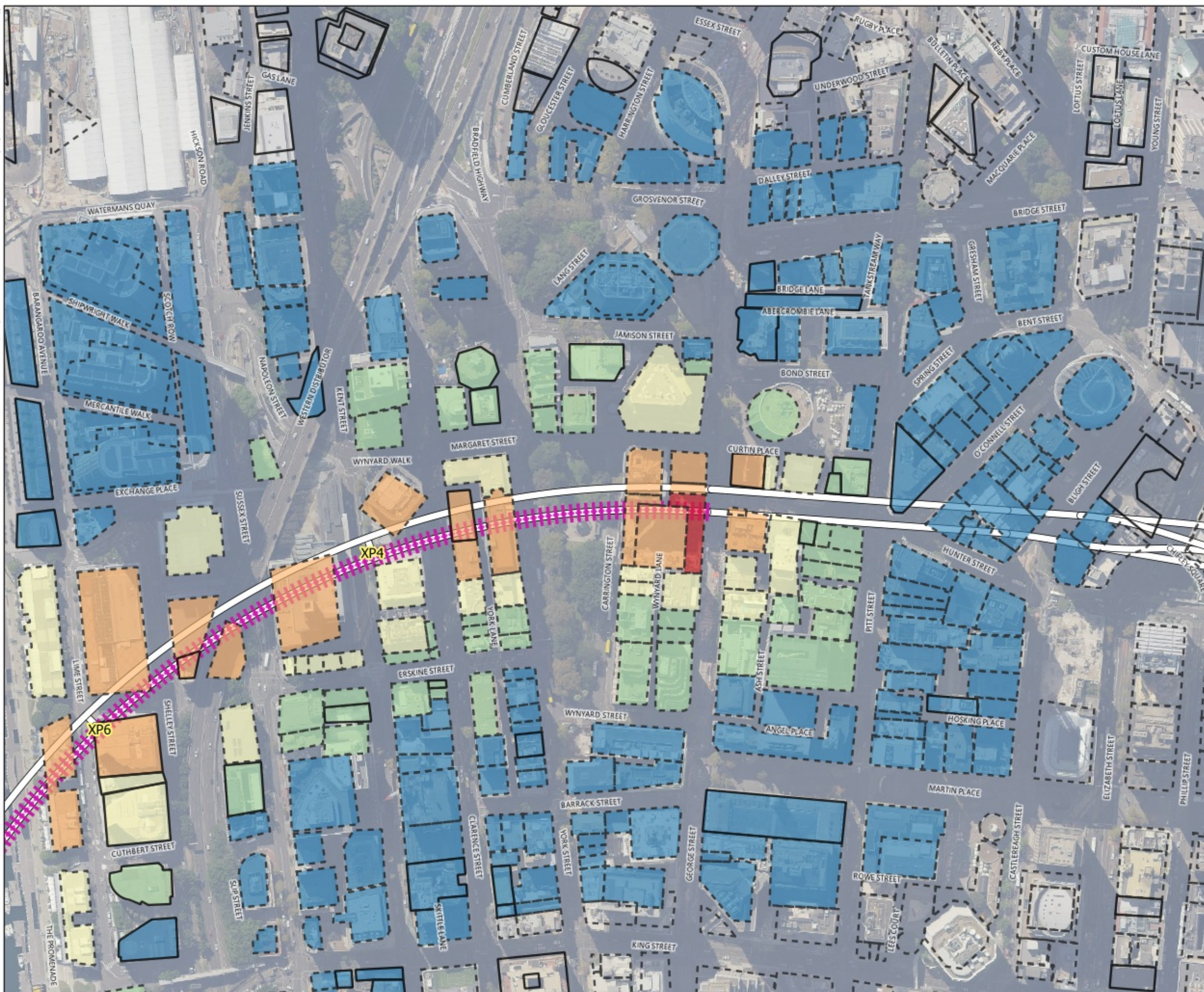
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A3 Original			Co-ordinate System: MGA Zone 56	

0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBN level during Eastbound Tunnel excavation (TBM)	



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

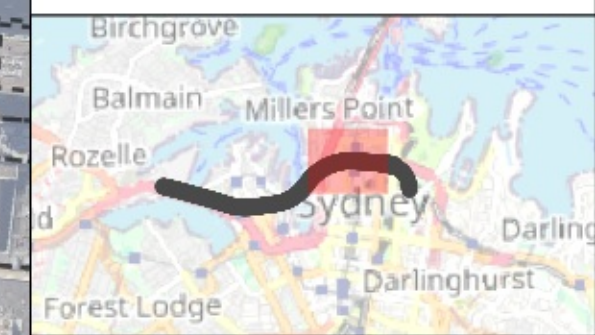
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- Westbound Tunnel Alignment

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REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare Titles	MT
AS Original			Co-ordinate System: MGA Zone 56	

0	40	80	120	160	200 m
1:3,000					

CLIENT	

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SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBN level during Westbound Tunnel excavation (TBM)	



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

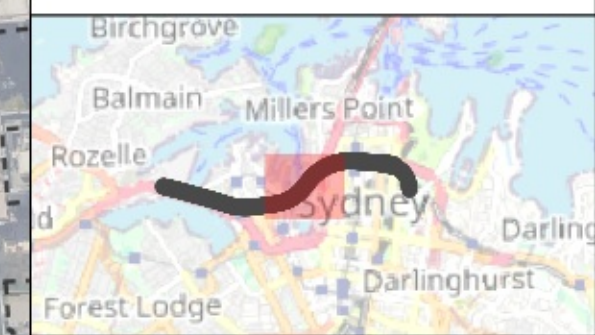
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- Westbound Tunnel Alignment

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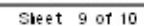
0	40	80	120	160	200 m
1:3,000					

CLIENT	

ACOUSTIC CONSULTANT	

SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBN level during Westbound Tunnel excavation (TBM)	



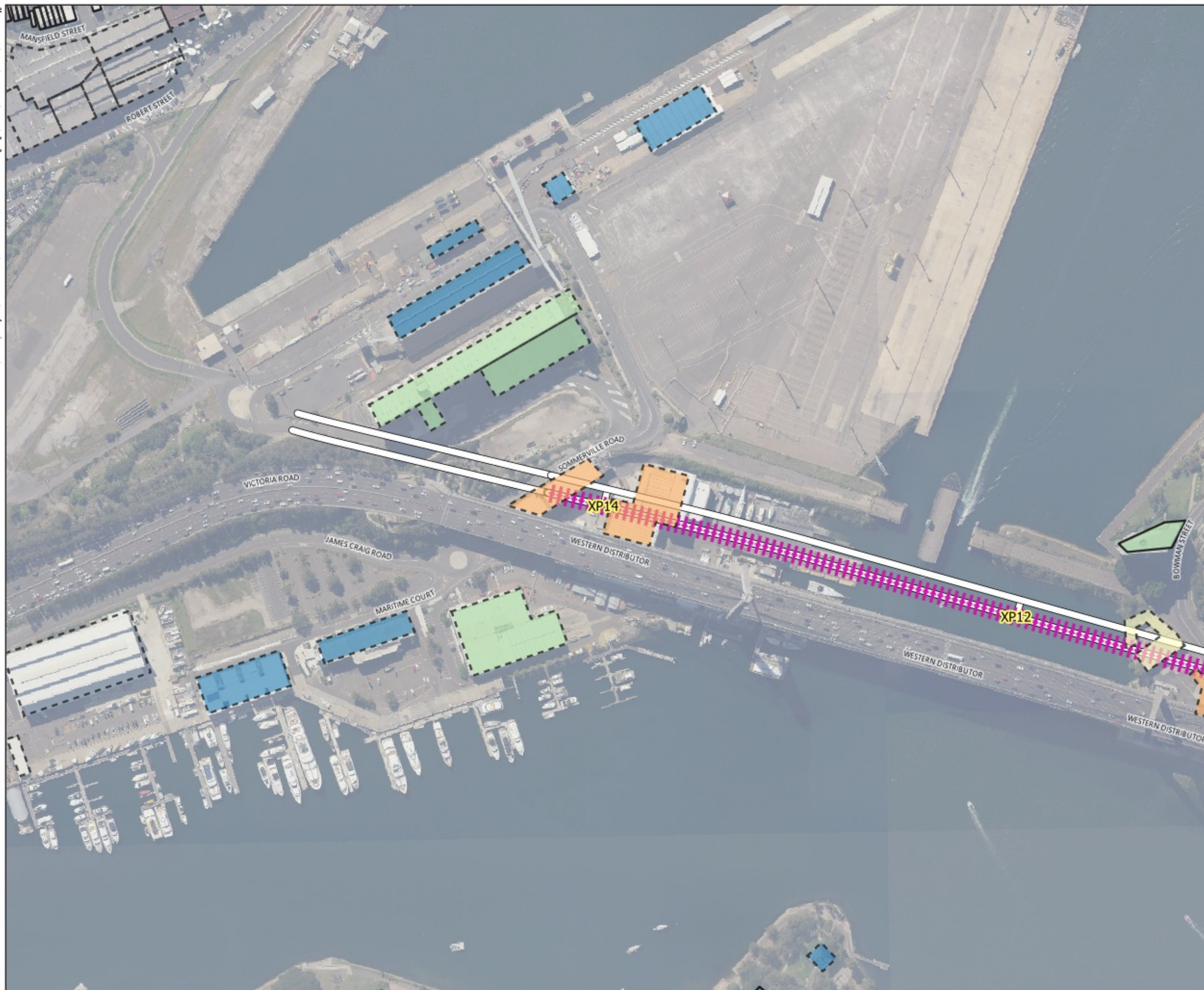


300 m

200

100

0



LEGEND

Noise Sensitive Receivers

Residential and Hotels

Non-Residential

Overall Tunnel Alignment

Westbound Tunnel Alignment

Maximum GBN levels dB(A) during TBM excavation

< 30

30 - 35

35 - 40

40 - 45

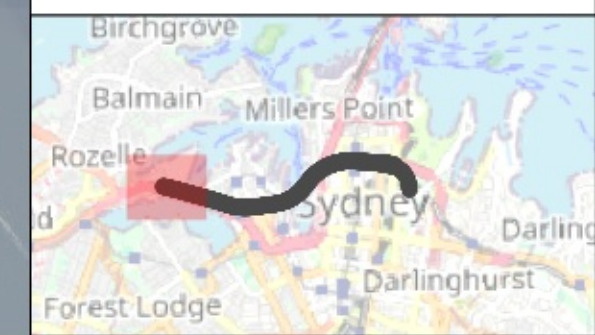
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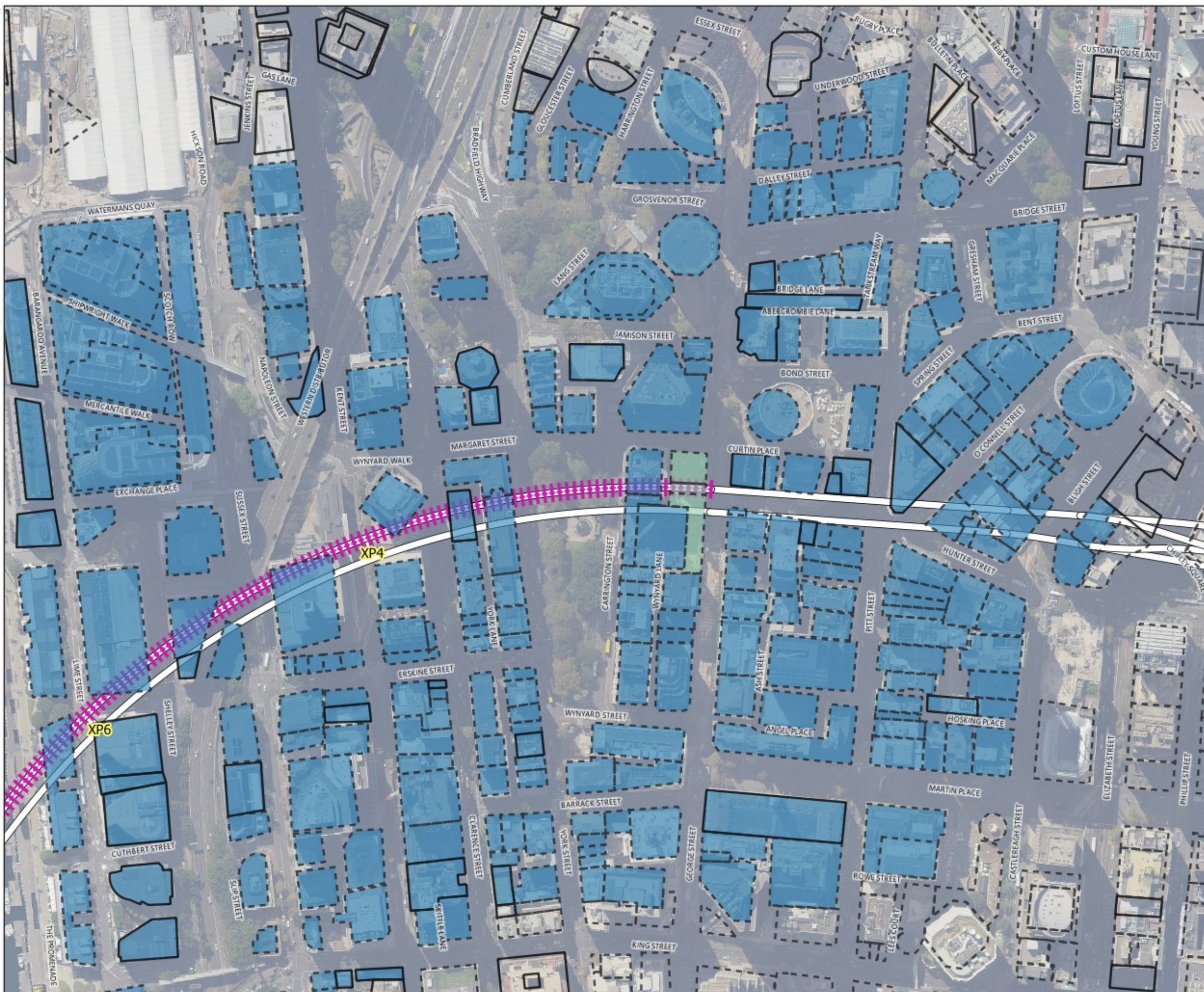
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1:3,000					
FULL SIZE A3, REDUCED TO A4					
NOTE: Do not scale from this drawing.					

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SYDNEY METRO WEST Eastern Tunneling Package
Predicted Maximum GBN level during Westbound Tunnel excavation (TBM)
SHEET 10 OF 10

D.2 Mainline Tunnel Ground-borne Vibration



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

- Overall Tunnel Alignment
- Eastbound Tunnel Alignment

Maximum GBV levels PPV(mm/s) during TBM operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
- 1.1 - 2.2
- >2.2

Notes:

- This assessment is based on the underground excavation works being undertaken at the closest location to the nearby receivers.
- The maximum vibration levels are based on the initial screening approach which assumes continuous vibration levels.
- Building occupants often assume that building damage is occurring when they feel vibration or observe rattling of loose objects. However the level of vibration which people perceive is far lower than the vibration levels that could cause damage to structures.
- The crown of Tunnels is assumed to be 3.5 metres above the axis of the TBM.



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99	DA	02/06/22	Prepare Titles	MT
100	DA	02/06/22	Prepare Titles	MT

0 40 80 120 160 200 m

1:3,000

CLIENT

CPB CONTRACTORS

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES

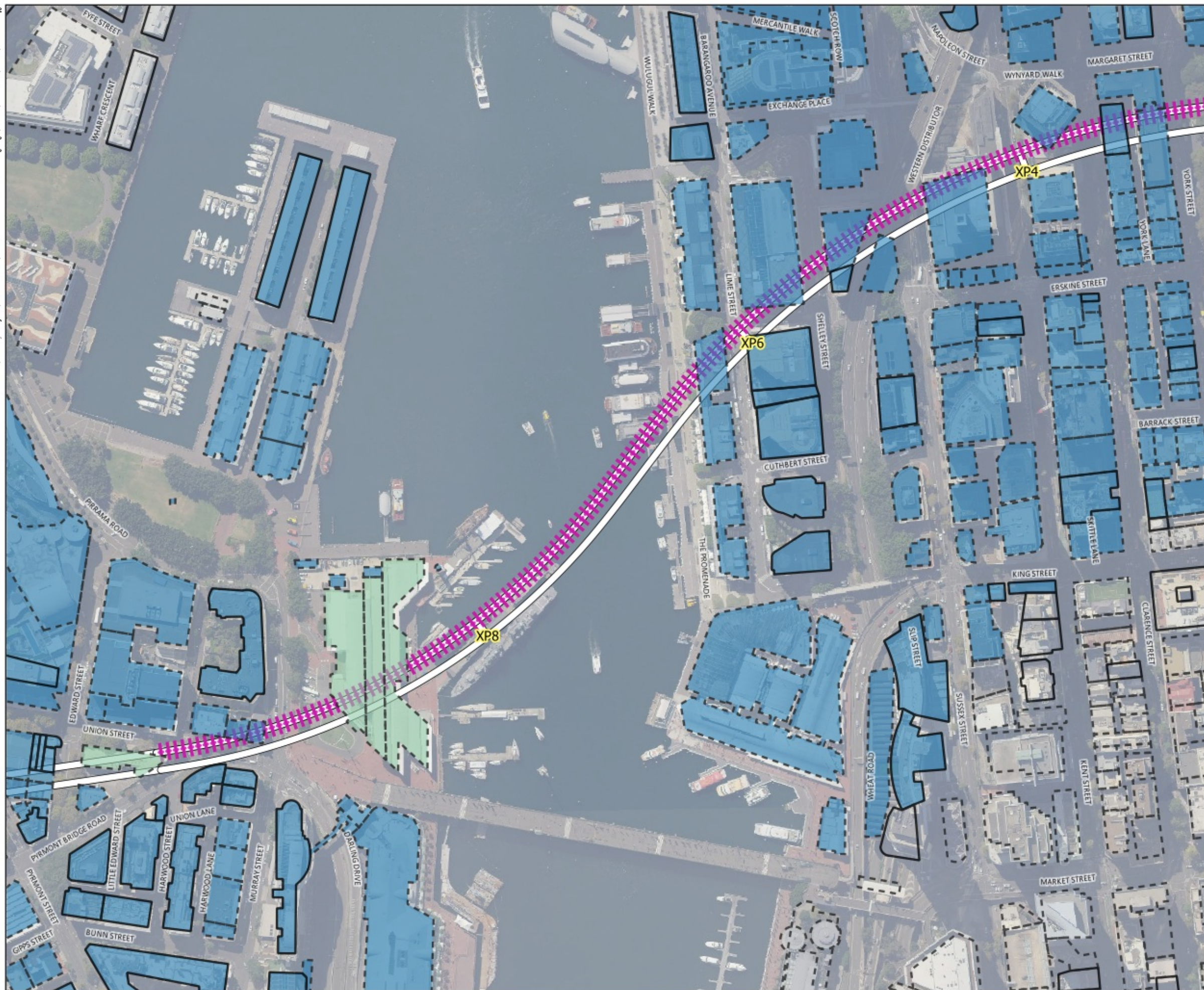
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SYDNEY METRO WEST Eastern Tunneling Package

Predicted Maximum GBV level during Eastbound Tunnel excavation (TBM)

Sheet 1 of 10



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

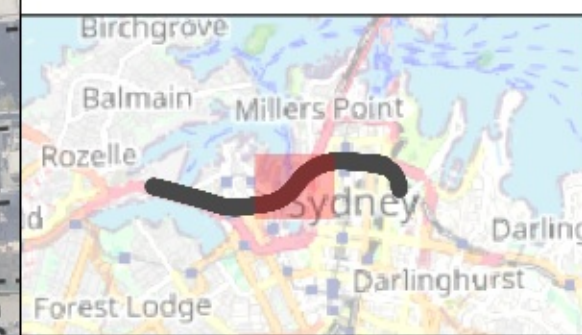
- Overall Tunnel Alignment
- Eastbound Tunnel Alignment

Maximum GBV levels PPV(mm/s) during TBM operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
- 1.1 - 2.2
- >2.2

Notes:

- This assessment is based on the underground excavation works being undertaken at the closest location to the nearby receivers.
- The maximum vibration levels are based on the initial screening approach which assumes continuous vibration levels.
- Building occupants often assume that building damage is occurring when they feel vibration or observe rattling of loose objects. However the level of vibration which people perceive is far lower than the vibration levels that could cause damage to structures.
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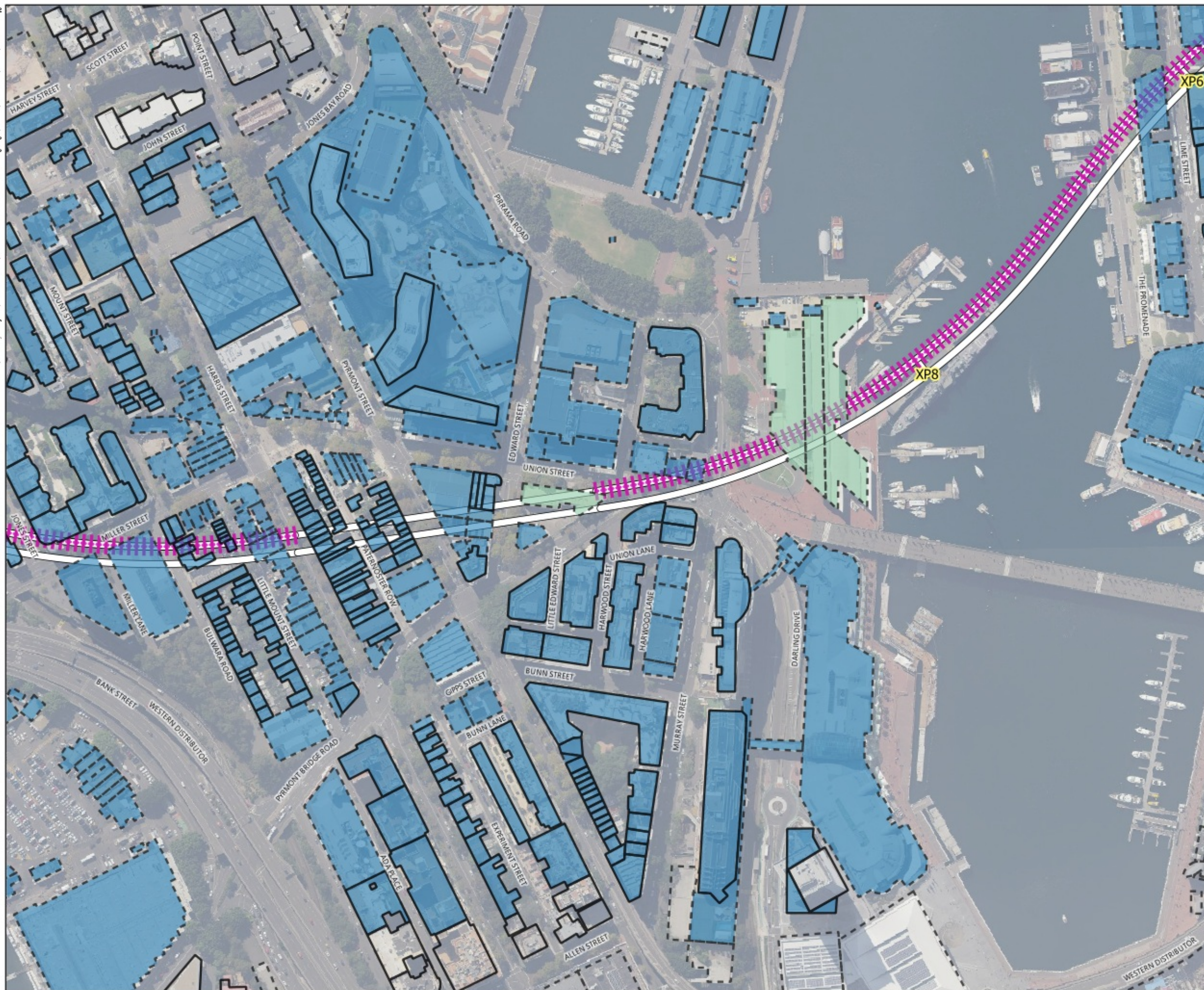
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AS Original			Co-ordinate System: MGA Zone 56	

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1:3,000					

CLIENT	

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SYDNEY METRO WEST Eastern Tunneling Package
Predicted Maximum GBV level during Eastbound Tunnel excavation (TBM)



LEGEND

Noise Sensitive Receivers

Residential and Hotels

Non-Residential

Overall Tunnel Alignment

Eastbound Tunnel Alignment

Maximum GBV levels PPV(mm/s) during TBM operation

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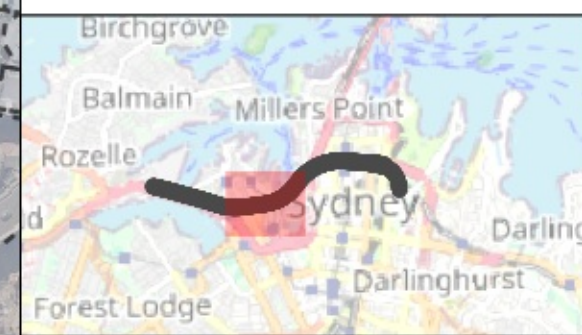
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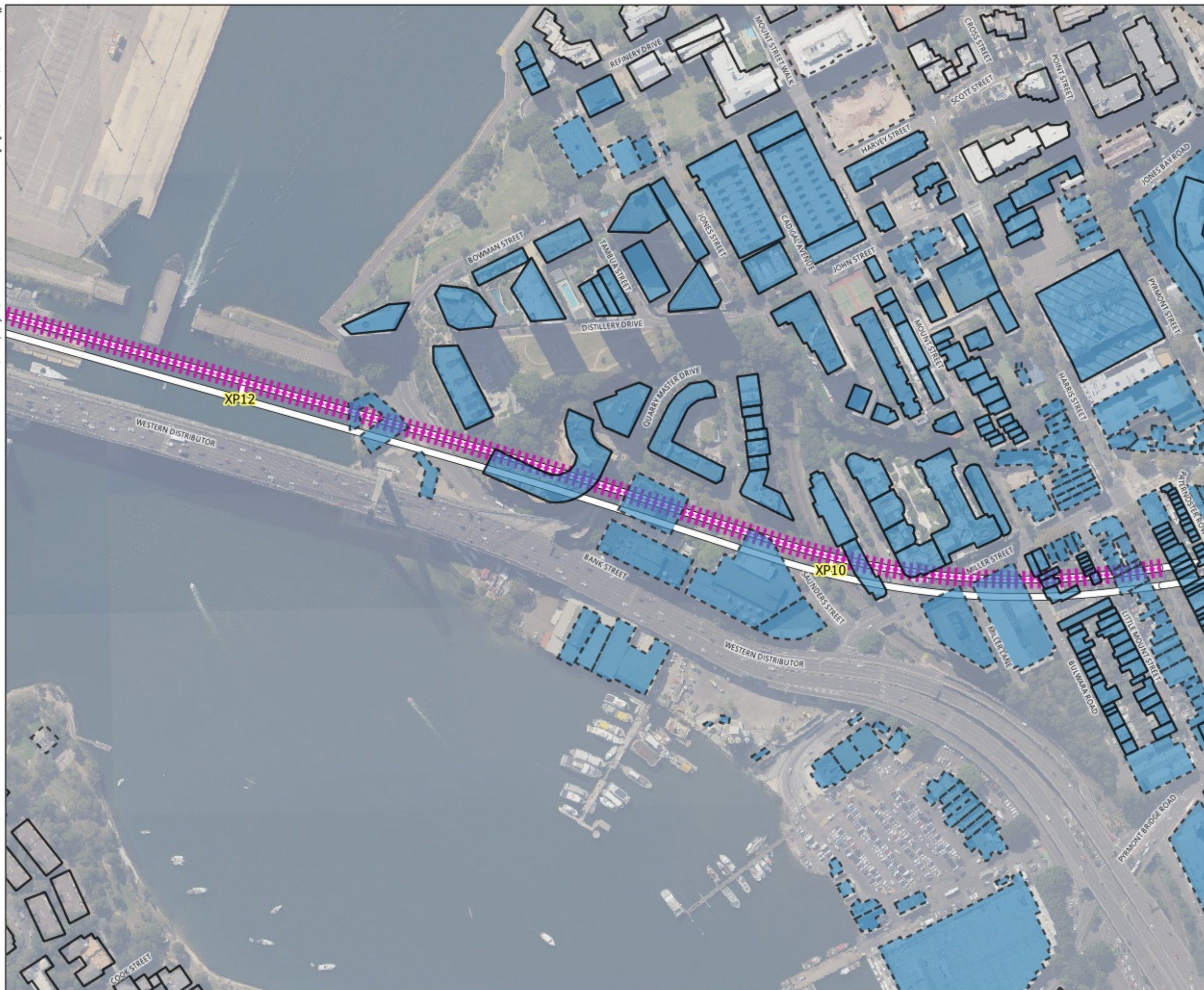


REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare Titles	MT
AS Original				

0	40	80	120	160	200 m
1:3,000					



SYDNEY METRO WEST Eastern Tunneling Package
Predicted Maximum GBV level during Eastbound Tunnel excavation (TBM)



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

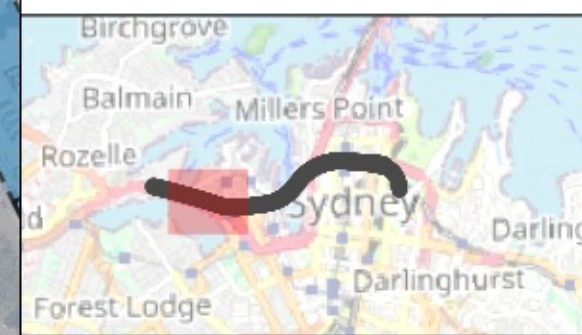
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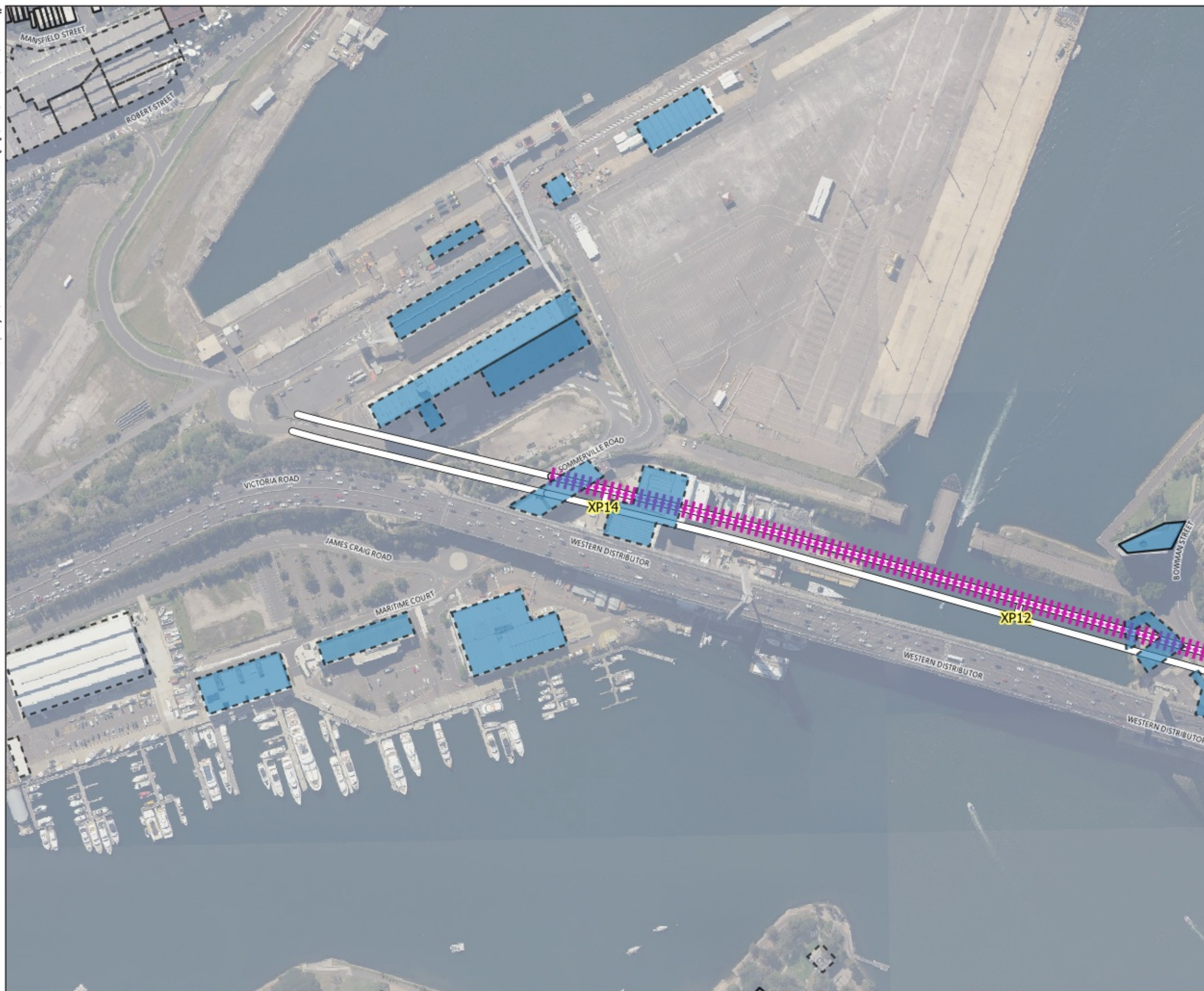
REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare Titles	MT
AS Original				

0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST Eastern Tunnel Package
Predicted Maximum GBV level during Eastbound Tunnel excavation (TBM)



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

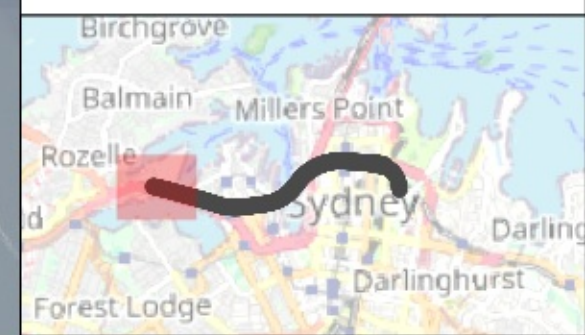
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REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare Titles	MT
A3 Original				

0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBV level during Eastbound Tunnel excavation (TBM)	





LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

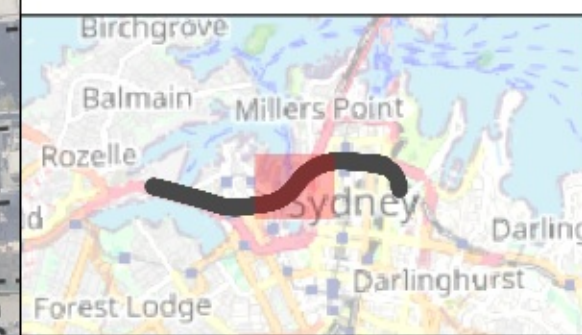
- Overall Tunnel Alignment
- Westbound Tunnel Alignment

Maximum GBV levels PPV(mm/s) during TBM operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
- 1.1 - 2.2
- >2.2

Notes:

- This assessment is based on the underground excavation works being undertaken at the closest location to the nearby receivers.
- The maximum vibration levels are based on the initial screening approach which assumes continuous vibration levels.
- Building occupants often assume that building damage is occurring when they feel vibration or observe rattling of loose objects. However the level of vibration which people perceive is far lower than the vibration levels that could cause damage to structures.
- The crown of Tunnels is assumed to be 3.5 metres above the axis of the TBM.



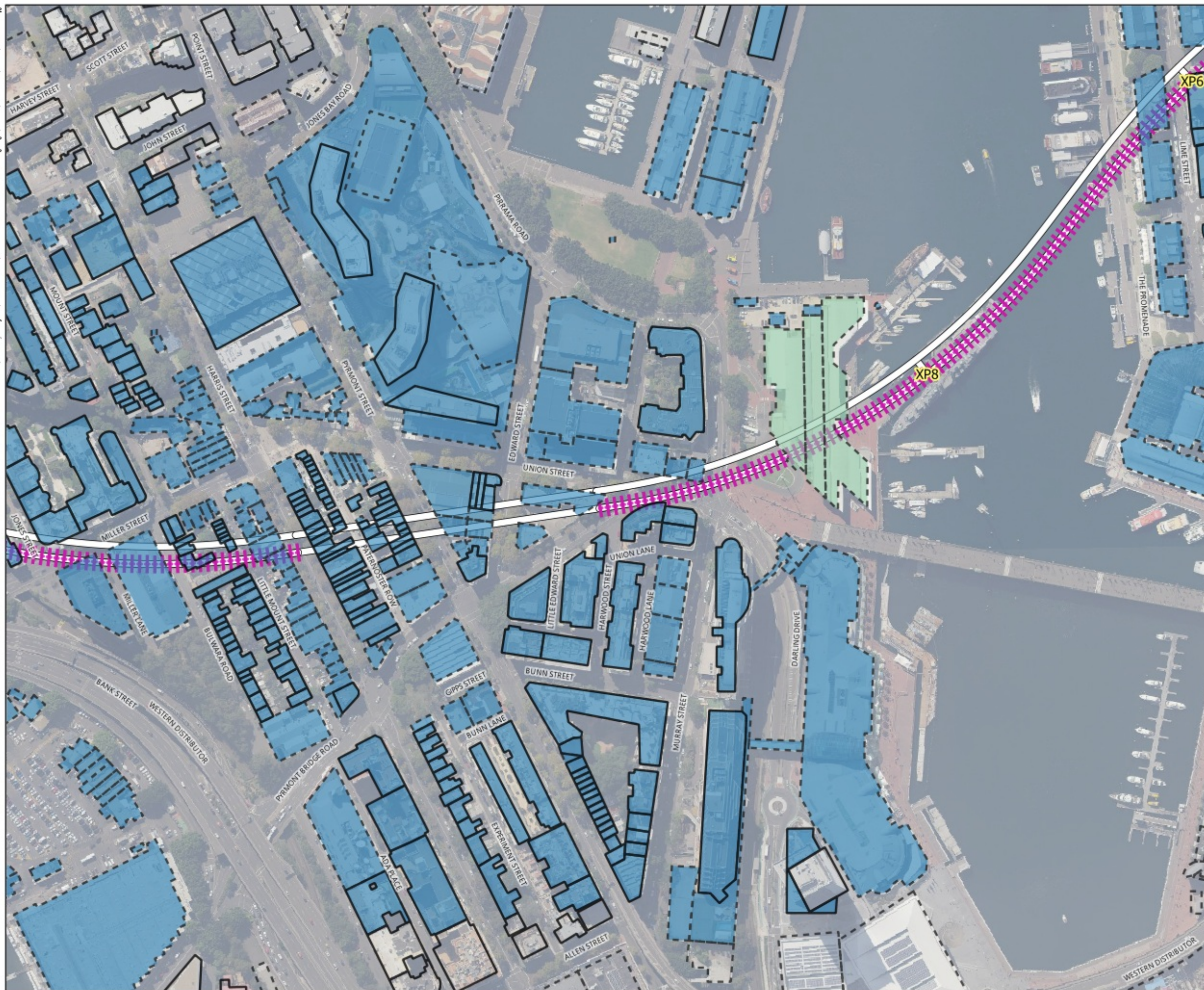
REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare Titles	MT
AS Original			Co-ordinate System: MGA Zone 56	

0	40	80	120	160	200 m
1:3,000					

CLIENT	

ACOUSTIC CONSULTANT	

SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBV level during Westbound Tunnel excavation (TBM)	



LEGEND

Noise Sensitive Receivers

Residential and Hotels

Non-Residential

Overall Tunnel Alignment

Westbound Tunnel Alignment

Maximum GBV levels PPV(mm/s) during TBM operation

<0.28

0.28 - 0.4

0.4 - 0.56

0.56 - 1.1

1.1 - 2.2

>2.2

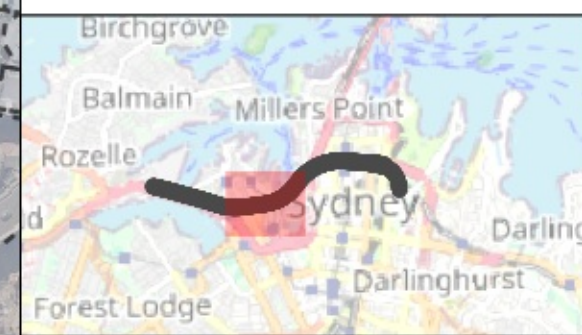
Notes:

- This assessment is based on the underground excavation works being undertaken at the closest location to the nearby receivers.

- The maximum vibration levels are based on the initial screening approach which assumes continuous vibration levels.

- Building occupants often assume that building damage is occurring when they feel vibration or observe rattling of loose objects. However the level of vibration which people perceive is far lower than the vibration levels that could cause damage to structures.

- The crown of Tunnels is assumed to be 3.5 metres above the axis of the TBM.



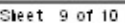
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10	DA	02/06/22	Prepare Titles	MT
AS Original			Co-ordinate System: MGA Zone 56	

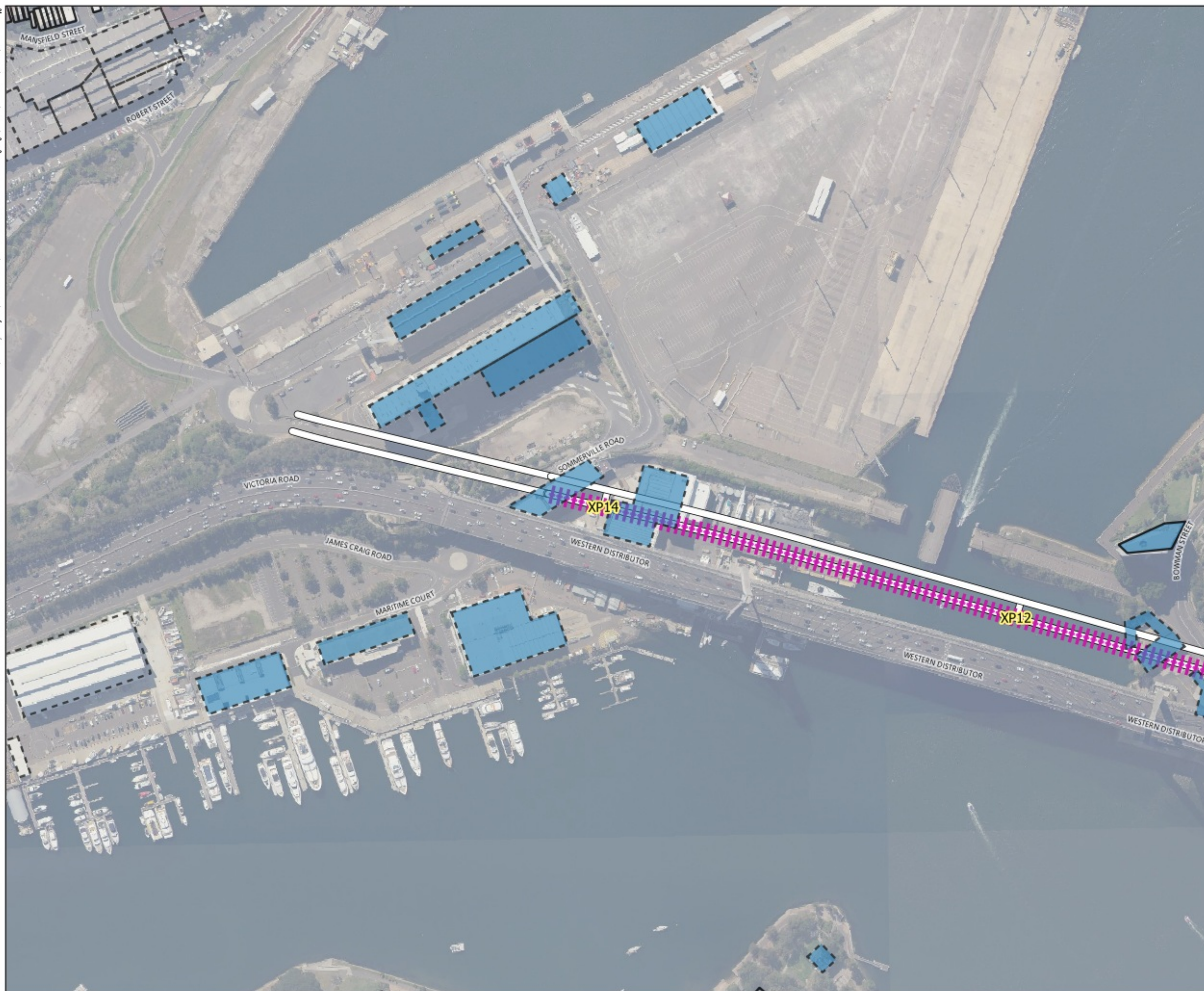
0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBV level during Westbound Tunnel excavation (TBM)	





LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

Overall Tunnel Alignment

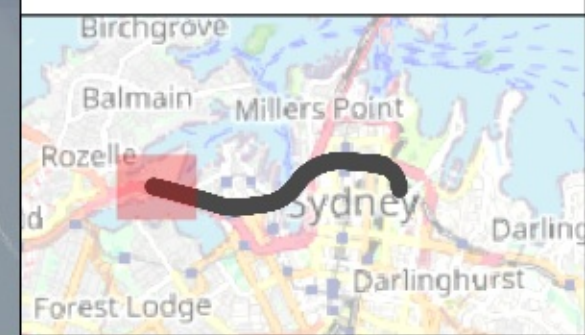
Westbound Tunnel Alignment

Maximum GBV levels PPV(mm/s) during TBM operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
- 1.1 - 2.2
- >2.2

Notes:

- This assessment is based on the underground excavation works being undertaken at the closest location to the nearby receivers.
- The maximum vibration levels are based on the initial screening approach which assumes continuous vibration levels.
- Building occupants often assume that building damage is occurring when they feel vibration or observe rattling of loose objects. However the level of vibration which people perceive is far lower than the vibration levels that could cause damage to structures.
- The crown of Tunnels is assumed to be 3.5 metres above the axis of the TBM.



REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare Titles	MT
A3 Original				

0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST Eastern Tunneling Package	
Predicted Maximum GBV level during Westbound Tunnel excavation (TBM)	

D.3 Cross Passages Ground-borne Noise



LEGEND

Noise Sensitive Receivers

Residential and Hotels

Non-Residential

Overall Tunnel Alignment

Cross Passage Tunnel Alignment

Maximum GBN levels dB(A) during
 Light Rockhammer excavation

< 30

30 - 35

35 - 40

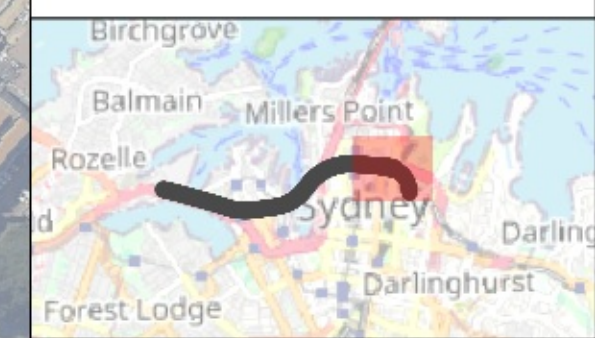
40 - 45

> 45

Notes:

- Predicted levels represent the typical maximum Ground Borne Noise (GBN) level that the receivers may experience for a limited time when the excavation plant is in the closest section of the tunnel and will reduce as the underground works move further away.

- The predicted GBN levels are calculated at the ground floor level.



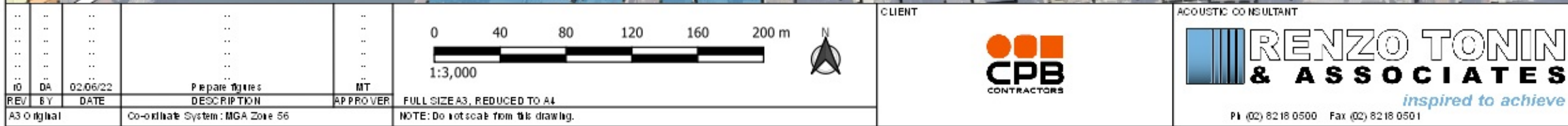
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5	DA	02/06/22	Prepare Notes	MT
6	DA	02/06/22	Prepare Notes	MT
7	DA	02/06/22	Prepare Notes	MT
8	DA	02/06/22	Prepare Notes	MT
9	DA	02/06/22	Prepare Notes	MT
10	DA	02/06/22	Prepare Notes	MT

0	40	80	120	160	200 m
1:3,000					
NOTE: Do not scale from this drawing.					

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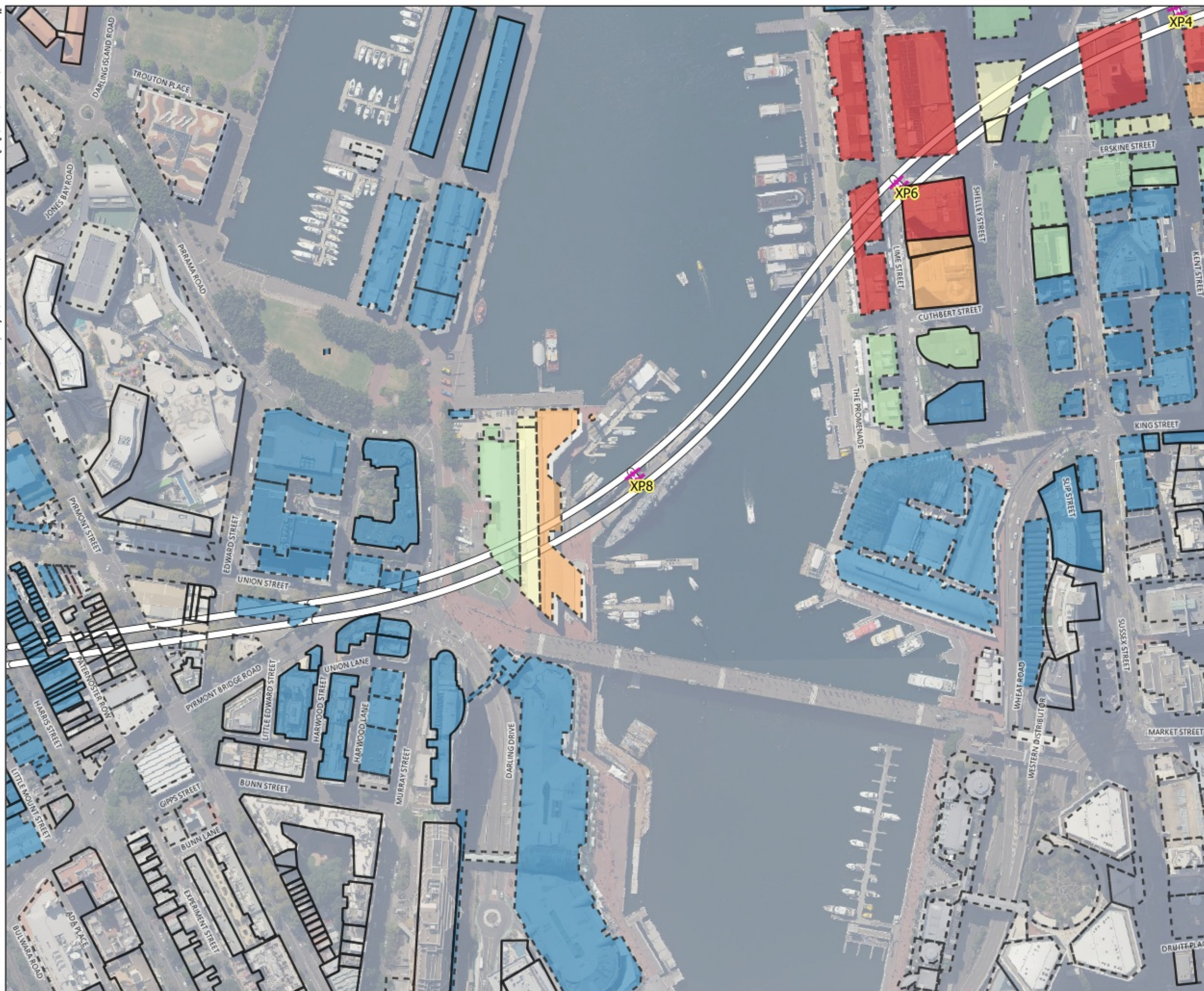
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RENZO TONIN & ASSOCIATES
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SYDNEY METRO WEST
 Eastern Tunneling Package
 Predicted Maximum GBN level during
 Cross Passages excavation (Light Rockhammer)
 Sheet 1 of 5



SYDNEY METRO WEST Eastern Tunneling Package Predicted Maximum GBN level during Cross Passages excavation (Light Rockhammer)	Sheet 2 of 5
---	---------------------

300 m
200
100
0



LEGEND

Noise Sensitive Receivers

Residential and Hotels

Non-Residential

Overall Tunnel Alignment

Cross Passage Tunnel Alignment

Maximum GBN levels dB(A) during
Light Rockhammer excavation

< 30

30 - 35

35 - 40

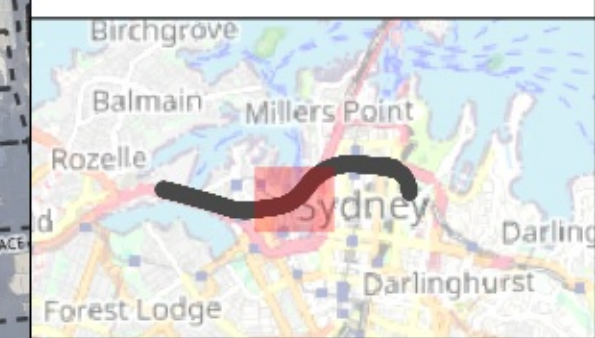
40 - 45

> 45

Notes:

- Predicted levels represent the typical maximum Ground Borne Noise (GBN) level that the receivers may experience for a limited time when the excavation plant is in the closest section of the tunnel and will reduce as the underground works move further away.

- The predicted GBN levels are calculated at the ground floor level.



REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare Titles	MT
AS Original			Co-ordinate System: MGA Zone 56	

0	40	80	120	160	200 m
1:3,000					

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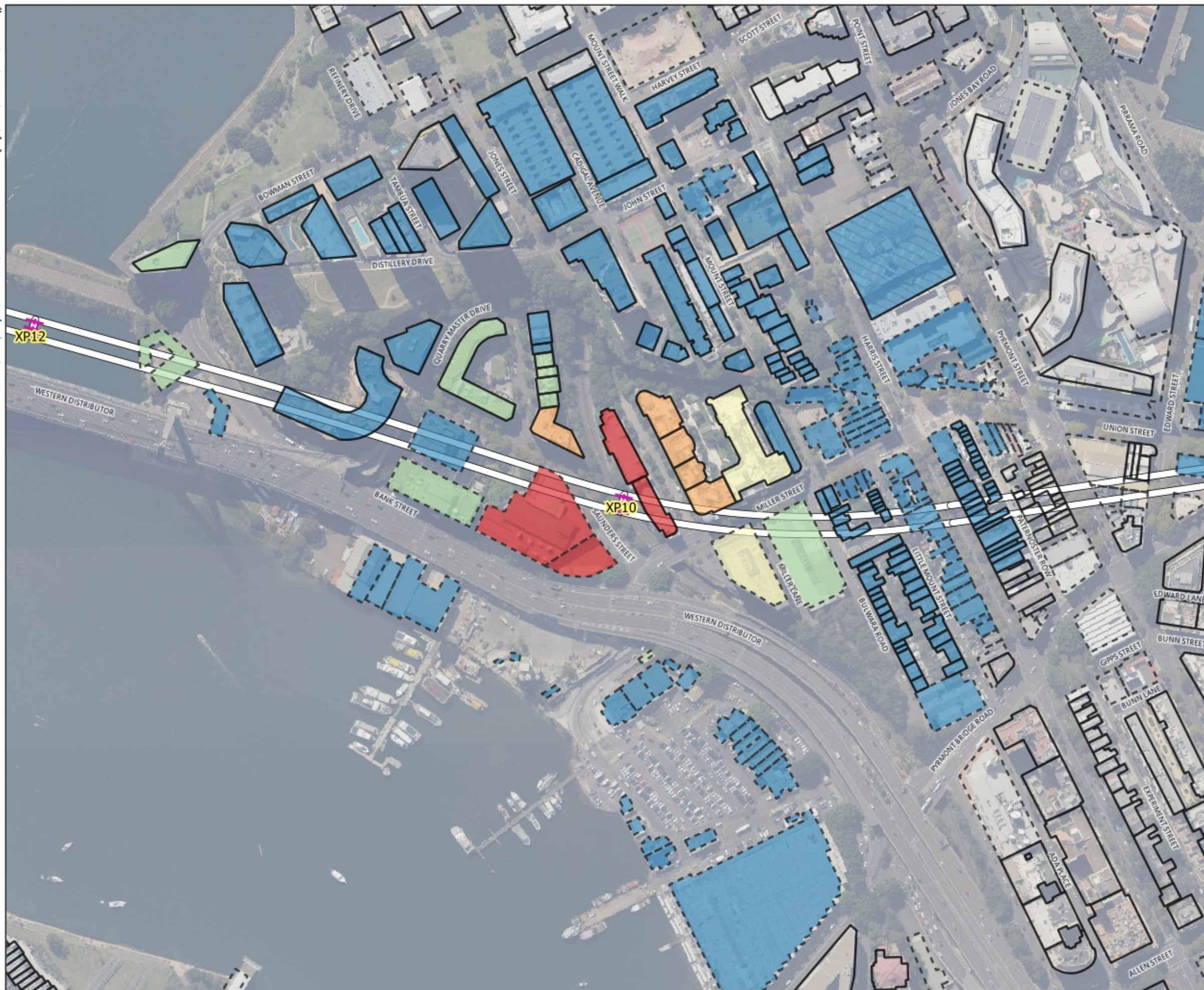
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SYDNEY METRO WEST
 Eastern Tunneling Package
 Predicted Maximum GBN level during
 Cross Passages excavation (Light Rockhammer)

Sheet 3 of 5



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

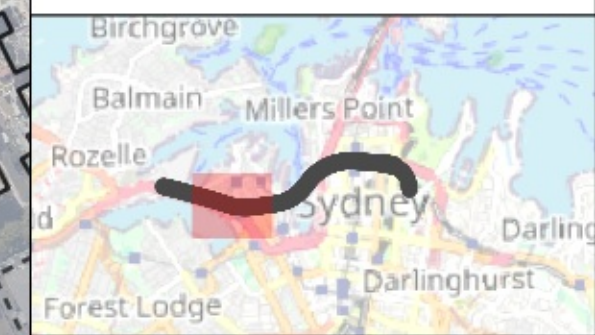
- Overall Tunnel Alignment
- Cross Passage Tunnel Alignment

Maximum GBN levels dB(A) during Light Rockhammer excavation

- < 30
- 30 - 35
- 35 - 40
- 40 - 45
- > 45

Notes:

- Predicted levels represent the typical maximum Ground Borne Noise (GBN) level that the receivers may experience for a limited time when the excavation plant is in the closest section of the tunnel and will reduce as the underground works move further away.
- The predicted GBN levels are calculated at the ground floor level.



REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare titles	MT
AS Original				

0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST Eastern Tunneling Package
Predicted Maximum GBN level during Cross Passages excavation (Light Rockhammer)



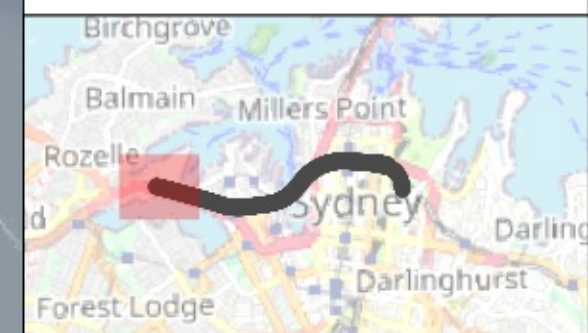
Noise Sensitive Receivers

-  Overall Tunnel Alignment
 Cross Passage Tunnel Alignment

	< 30
	30 - 35
	35 - 40
	40 - 45
	> 45

- Predicted levels represent the typical maximum Ground Borne Noise (GBN) level that the receivers may experience for a limited time when the excavation plant is in the closest section of the tunnel and will reduce as the underground works move further away.

- The predicted GBN levels are calculated at the ground floor level.



0 40 80 120 160 200 m
1:3,000

FULL SIZE A3, REDUCED TO A4
NOTE: Do not scale from this drawing.



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SYDNEY METRO WEST Eastern Tunneling Package	Predicted Maximum GBN level during Cross Passages excavation (Light Rockhammer)
--	--

D.4 Cross Passages Ground-borne Vibration

300 m

200

100

0



LEGEND

Noise Sensitive Receivers

Residential and Hotels

Non-Residential

Overall Tunnel Alignment

Cross Passage Tunnel Alignment

Maximum GBV levels PPV(mm/s) during Light Rockhammer operation

<0.28

0.28 - 0.4

0.4 - 0.56

0.56 - 1.1

1.1 - 2.2

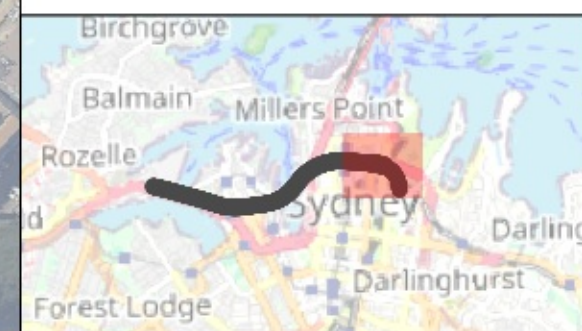
>2.2

Notes:

- This assessment is based on the underground excavation works being undertaken at the closest location to the nearby receivers.

- The maximum vibration levels are based on the initial screening approach which assumes continuous vibration levels.

- Building occupants often assume that building damage is occurring when they feel vibration or observe rattling of loose objects. However the level of vibration which people perceive is far lower than the vibration levels that could cause damage to structures.



REV	BY	DATE	DESCRIPTION	APPROVER
1	DA	02/06/22	Prepare Notes	MT
2	DA	02/06/22	Prepare Notes	MT
3	DA	02/06/22	Prepare Notes	MT
4	DA	02/06/22	Prepare Notes	MT
5	DA	02/06/22	Prepare Notes	MT
6	DA	02/06/22	Prepare Notes	MT
7	DA	02/06/22	Prepare Notes	MT
8	DA	02/06/22	Prepare Notes	MT
9	DA	02/06/22	Prepare Notes	MT
10	DA	02/06/22	Prepare Notes	MT

0	40	80	120	160	200 m
1:3,000					
NOTE: Do not scale from this drawing.					

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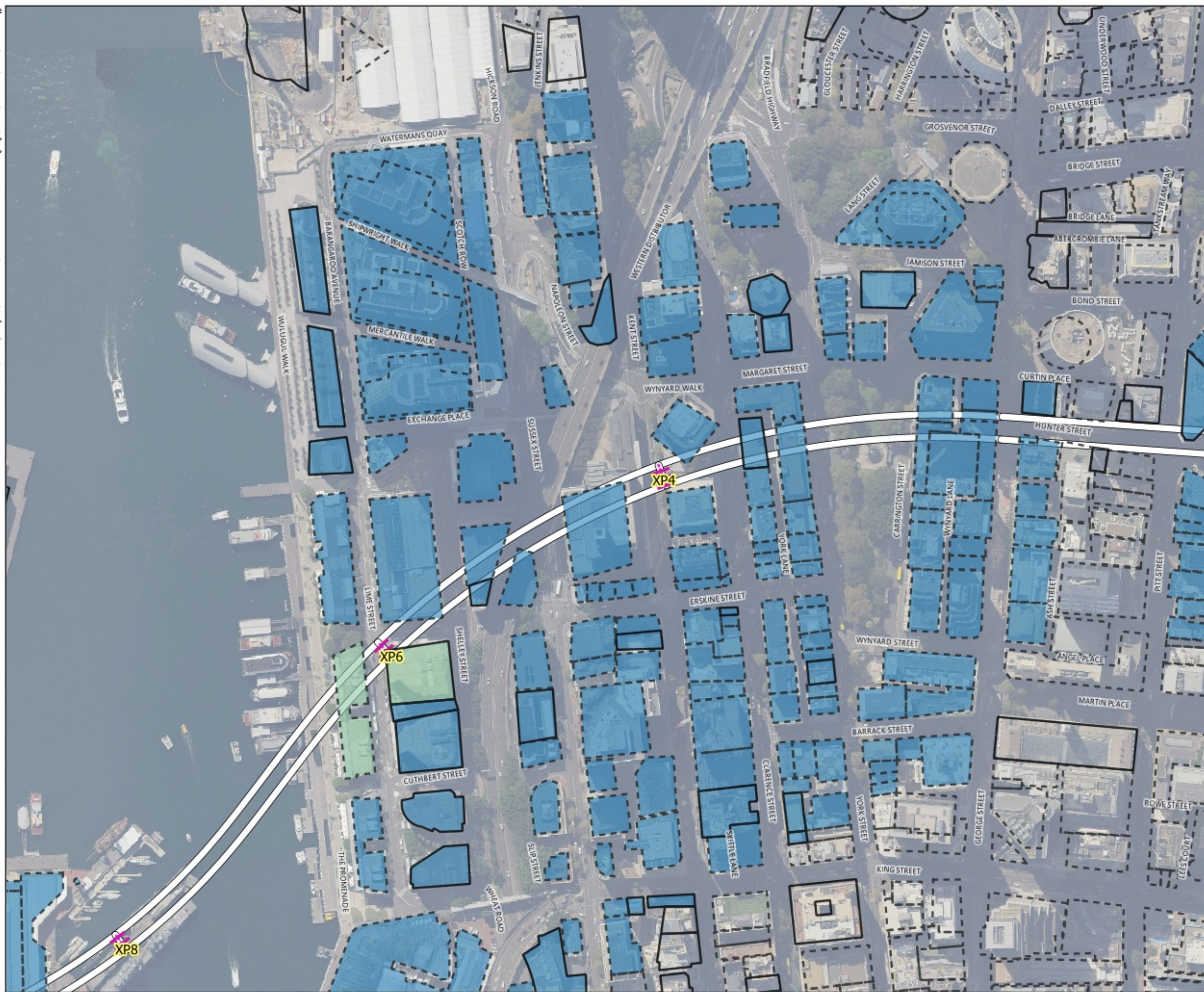
SYDNEY METRO WEST
 Eastern Tunneling Package
 Predicted Maximum GBV level during
 Cross Passages excavation (Light Rockhammer)
 Sheet 1 of 5

300 m

200

100

0



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

Overall Tunnel Alignment

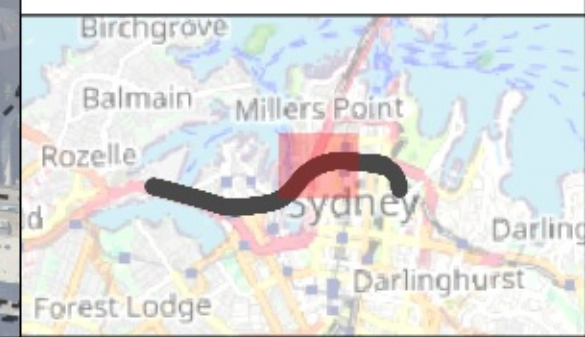
Cross Passage Tunnel Alignment

Maximum GBV levels PPV(mm/s) during Light Rockhammer operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
- 1.1 - 2.2
- >2.2

Notes:

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REV	BY	DATE	DESCRIPTION	APPROVER
1	DA	02/06/22	Prepare Notes	MT
2	DA	02/06/22	Finalize Notes	MT
3	DA	02/06/22	Finalize Notes	MT
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6	DA	02/06/22	Finalize Notes	MT
7	DA	02/06/22	Finalize Notes	MT
8	DA	02/06/22	Finalize Notes	MT
9	DA	02/06/22	Finalize Notes	MT
10	DA	02/06/22	Finalize Notes	MT

0	40	80	120	160	200 m
1:3,000					
NOTE: Do not scale from this drawing.					

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SYDNEY METRO WEST Eastern Tunneling Package
Predicted Maximum GBV level during Cross Passages excavation (Light Rockhammer)



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

- Overall Tunnel Alignment
- Cross Passage Tunnel Alignment

Maximum GBV levels PPV(mm/s) during Light Rockhammer operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
- 1.1 - 2.2
- >2.2

Notes:

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REV	BY	DATE	DESCRIPTION	APPROVER
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AS Original			Co-ordinate System: MGA Zone 56	

0	40	80	120	160	200 m
1:3,000					

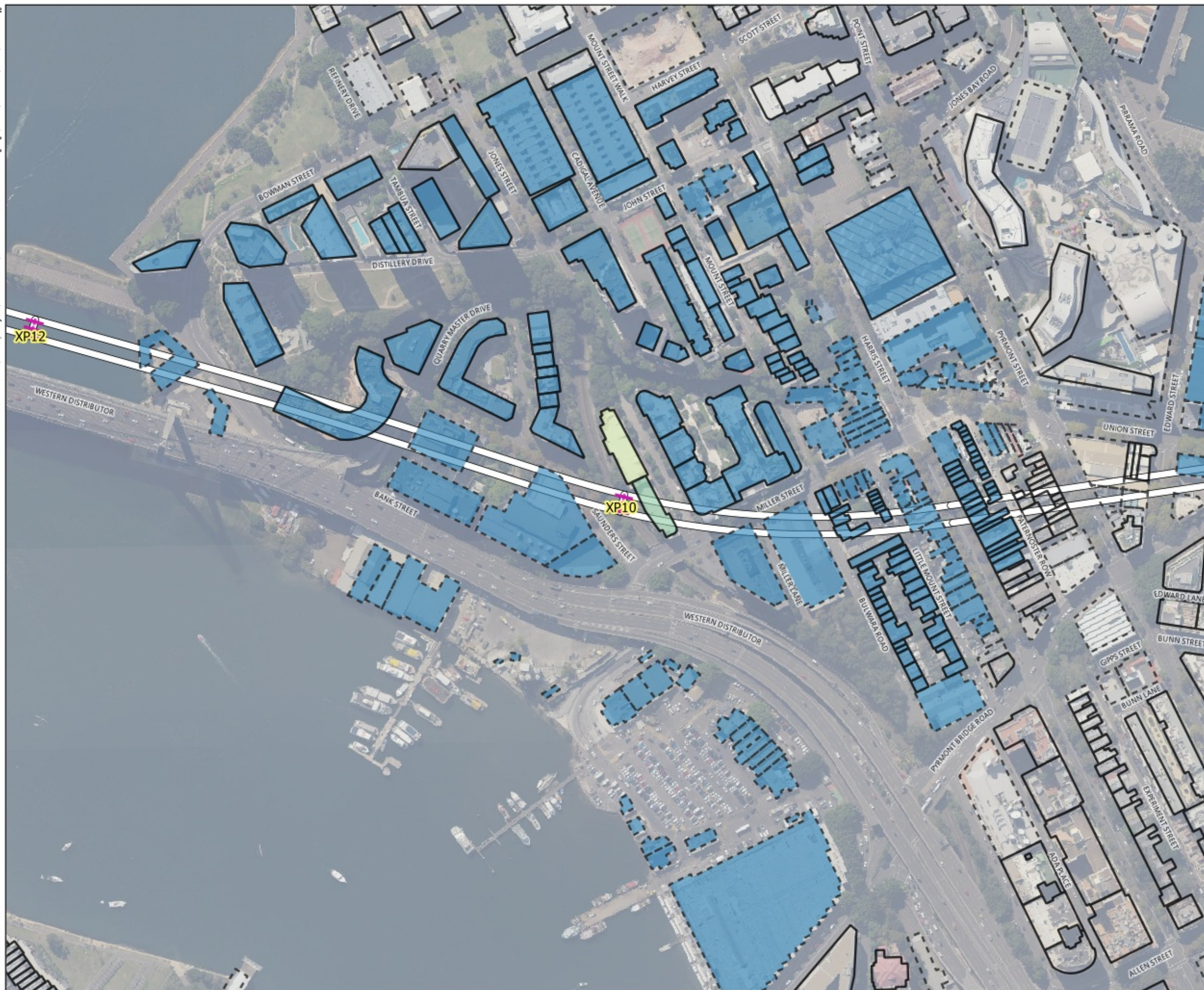


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Sydney Metro West Eastern Tunneling Package
Predicted Maximum GBV level during Cross Passages excavation (Light Rockhammer)
Sheet 3 of 5



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

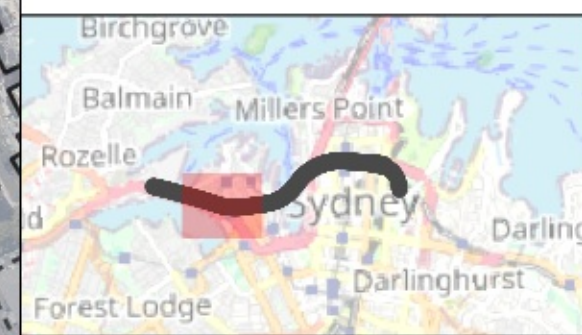
- Overall Tunnel Alignment
- Cross Passage Tunnel Alignment

Maximum GBV levels PPV(mm/s) during Light Rockhammer operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
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Notes:

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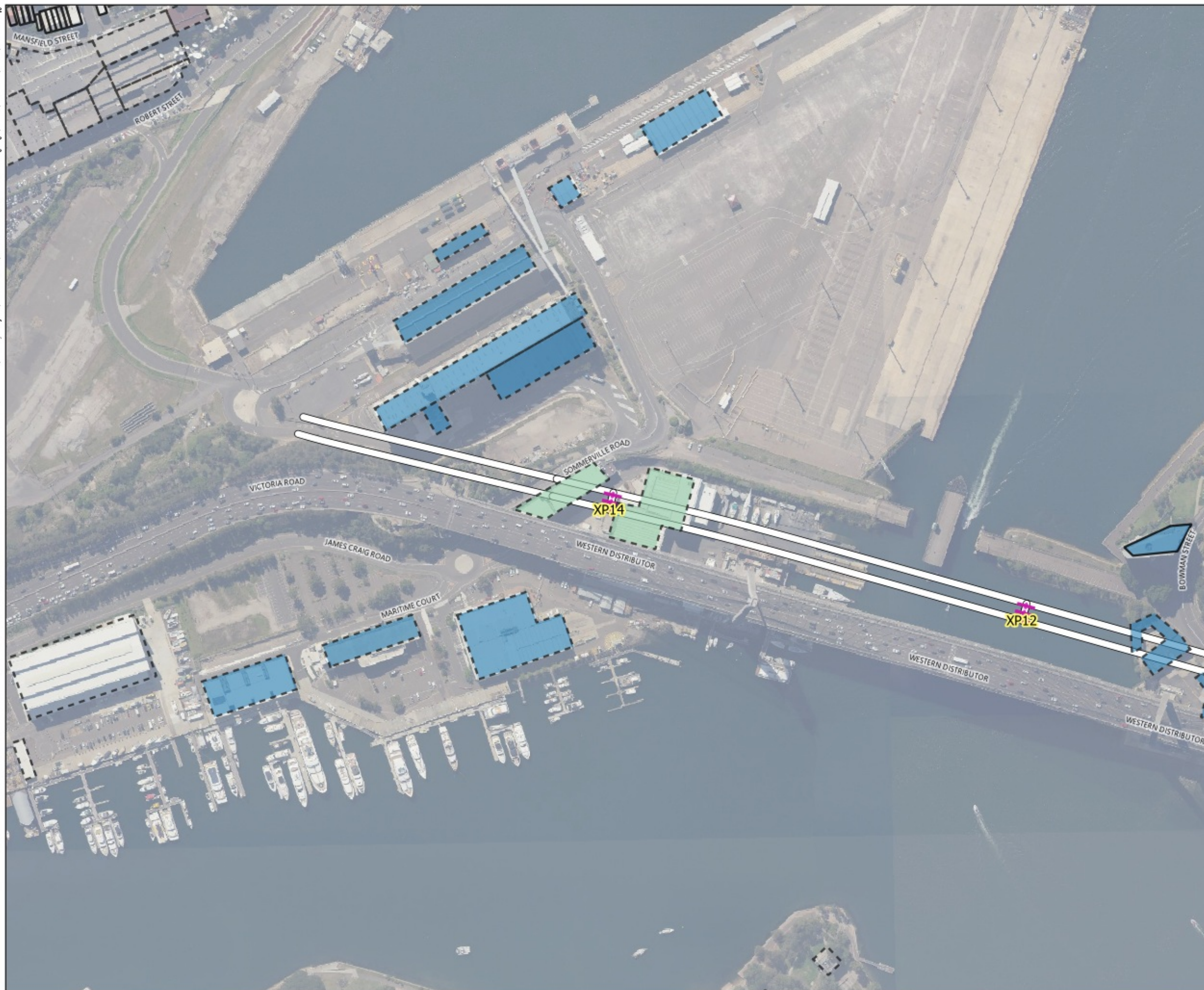
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13	DA	02/06/22	Prepare titles	MT
14	DA	02/06/22	Prepare titles	MT
15	DA	02/06/22	Prepare titles	MT
16	DA	02/06/22	Prepare titles	MT
17	DA	02/06/22	Prepare titles	MT
18	DA	02/06/22	Prepare titles	MT
19	DA	02/06/22	Prepare titles	MT
20	DA	02/06/22	Prepare titles	MT

0	40	80	120	160	200 m
1:3,000					

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SYDNEY METRO WEST	
Eastern Tunneling Package	
Predicted Maximum GBV level during	
Cross Passages excavation (Light Rockhammer)	



LEGEND

Noise Sensitive Receivers

- Residential and Hotels
- Non-Residential

Overall Tunnel Alignment

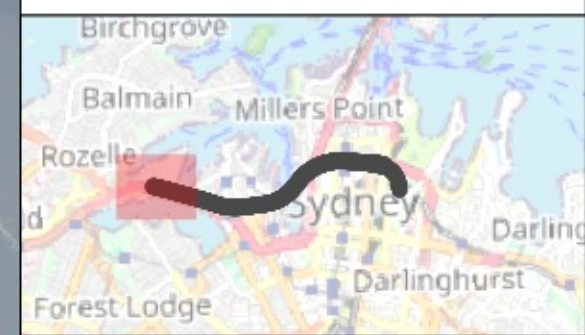
Cross Passage Tunnel Alignment

Maximum GBV levels PPV(mm/s) during Light Rockhammer operation

- <0.28
- 0.28 - 0.4
- 0.4 - 0.56
- 0.56 - 1.1
- 1.1 - 2.2
- >2.2

Notes:

- This assessment is based on the underground excavation works being undertaken at the closest location to the nearby receivers.
- The maximum vibration levels are based on the initial screening approach which assumes continuous vibration levels.
- Building occupants often assume that building damage is occurring when they feel vibration or observe rattling of loose objects. However the level of vibration which people perceive is far lower than the vibration levels that could cause damage to structures.



REV	BY	DATE	DESCRIPTION	APPROVER
10	DA	02/06/22	Prepare titles	MT
A3 Original			Co-ordinate System: MGA Zone 56	

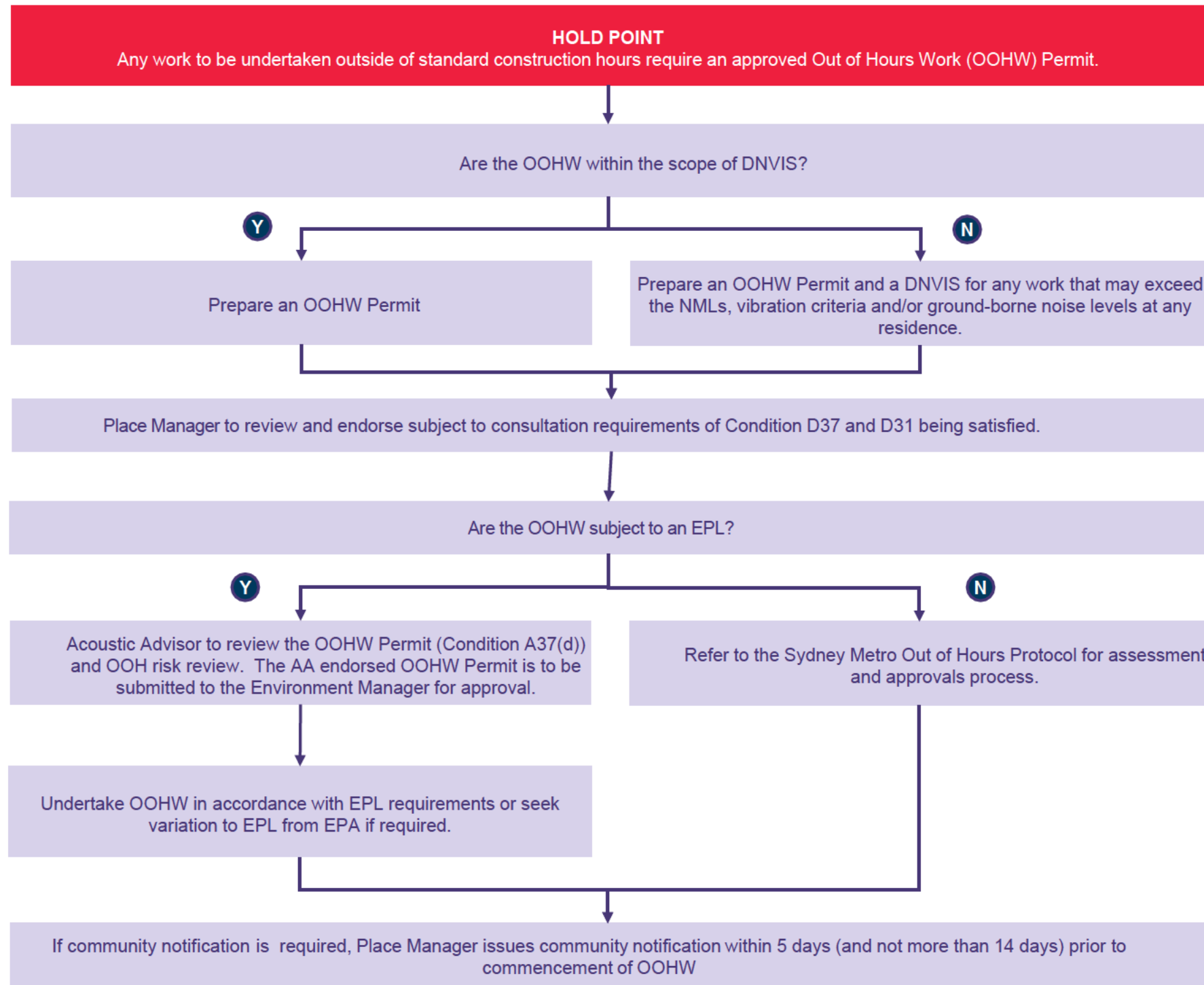
0	40	80	120	160	200 m
1:3,000					
NOTE: Do not scale from this drawing.					

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Sydney Metro West Eastern Tunneling Package
Predicted Maximum GBV level during Cross Passages excavation (Light Rockhammer)
Sheet 5 of 5

OUT OF HOURS WORKS MANAGEMENT PROCEDURE



Site Supervisor
Project Engineer

Environmental
Advisor

Environmental
Advisor

Place Manager

Environmental
Advisor

Environment
Manager
ER and AA

Environment Advisor
Project Engineer
ER and AA

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 and Environment



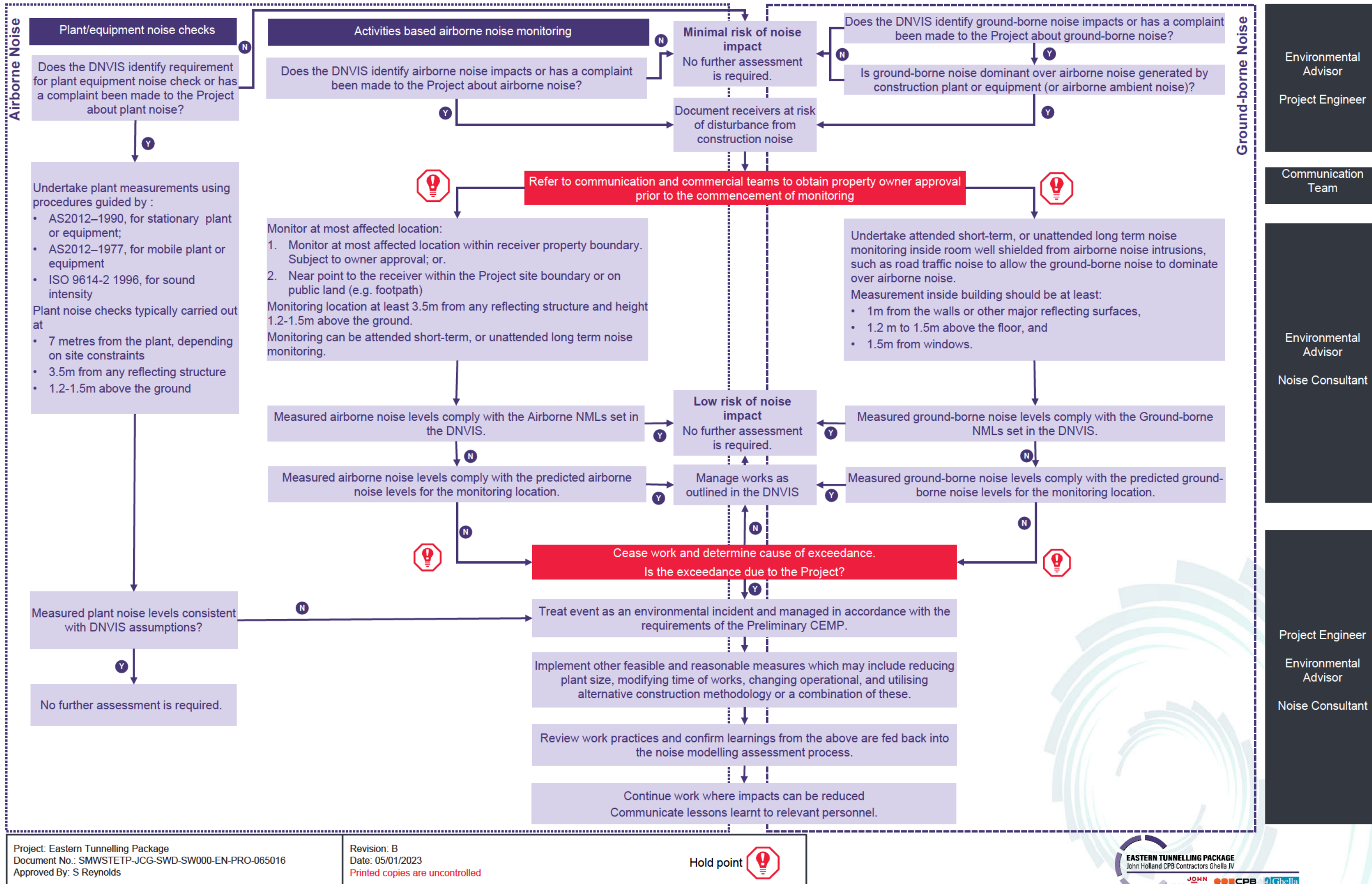
Hold point

NOISE ASSESSMENT PROCEDURE

**JOHN
HOLLAND**

**CPB
CONTRACTORS**

Ghella
1994 5 Generations of Tunnelers



VIBRATION ASSESSMENT PROCEDURE (building damage)

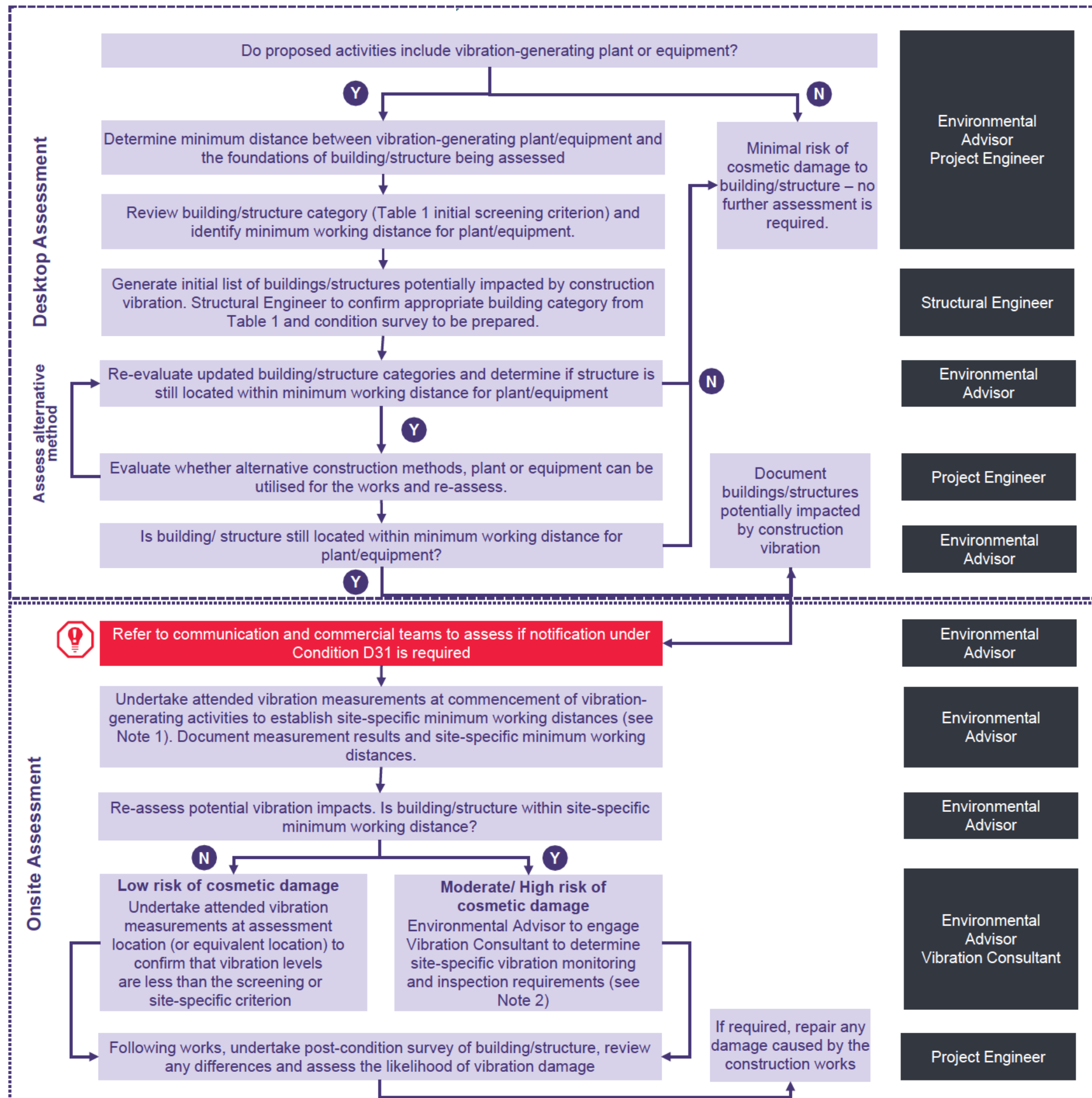


Table 1: Building/structure categories

Category	Initial screening criterion for cosmetic damage	Detailed criterion for cosmetic damage
A. Important/heritage buildings that are difficult to repair or are not confirmed to be structurally sound	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:

- Seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring at Heritage items. The installation of noise and vibration equipment must not impact on the heritage value of the heritage items.
- Before conducting at-property treatment at any Heritage item, obtain and implement the advice of a suitably qualified and experienced built heritage expert to ensure any such work does not have an adverse impact on the heritage significance of the item
- 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. The Environment, Approvals and Sustainability Director will determine the need for continuous vibration monitoring in consultation with the Vibration Consultant, AA and relevant stakeholder(s).
- Regular inspections (e.g crack monitoring) may be required.
- Proposed monitoring and inspection plan to be documented.
- All predicted and measured exceedances of the initial screening criteria (Table 1) shall be investigated by the Environmental Coordinator in consultation with the Vibration Consultant to determine the applicable safe vibration level for the relevant location. Measured exceedances that are determined to be non-compliant with the Planning Approval shall be reported as a non-compliance to Sydney Metro, the ER and the AA.

VIBRATION ASSESSMENT PROCEDURE (human annoyance)

Table 1: Vibration Dose Value Ranges (eVDV) above which various degrees of Adverse Comment may be expected

Sensitive land user	A. Low probability of adverse comment (m/s ^{1.75}) ¹	B. Adverse comment possible (m/s ^{1.75})	C. Adverse comment probable (m/s ^{1.75}) ²
Residential buildings 16hr day (6am-10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr day (10pm-6am)	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

Note 1: Below these ranges adverse comment is not expected, i.e. there is minimal risk of human disturbance

Note 2: Above these ranges adverse comment is very likely.

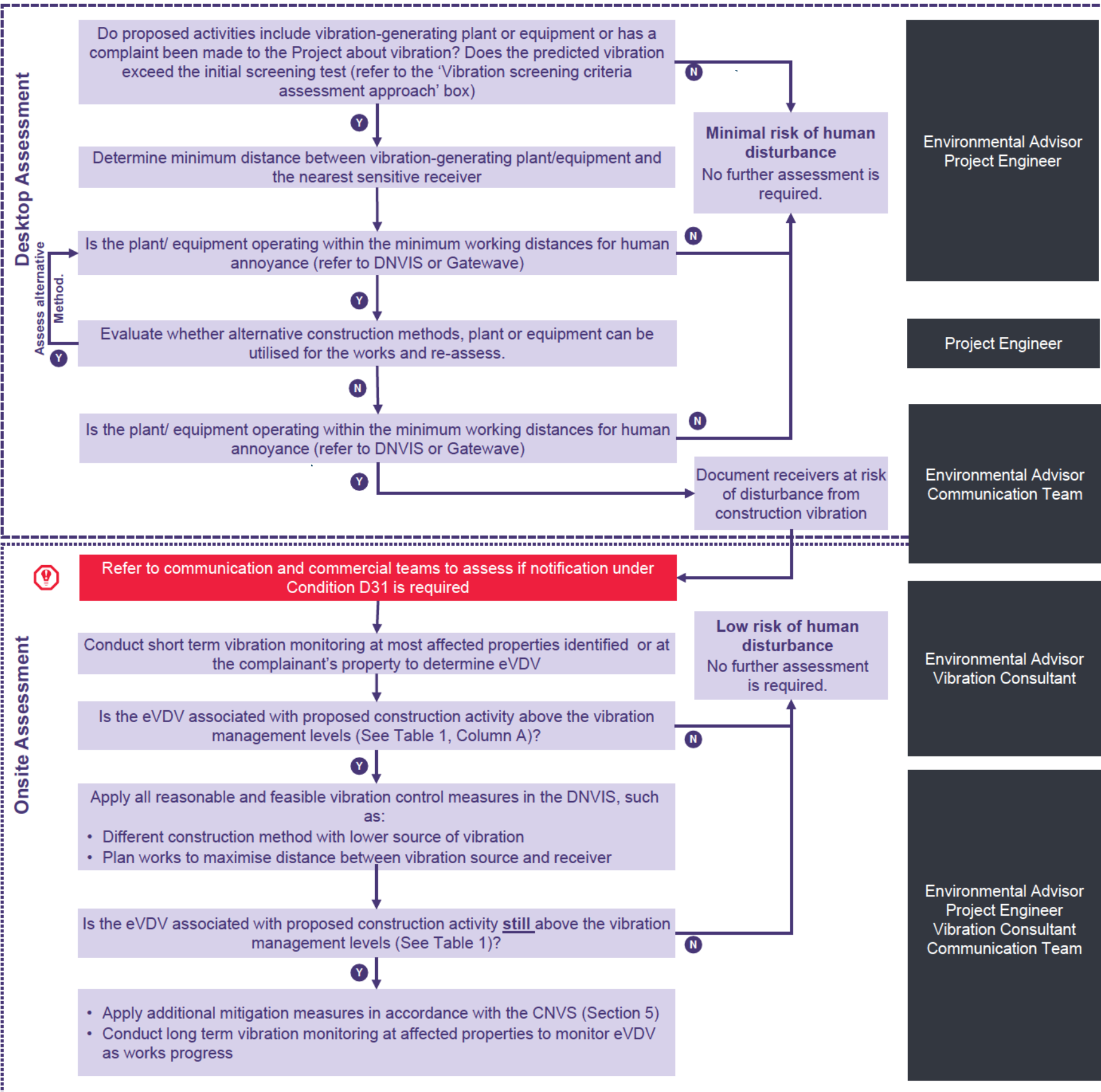
Vibration screening criteria assessment approach

To simplify the assessment approach for human disturbance, an initial (conservative) screening test can 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).

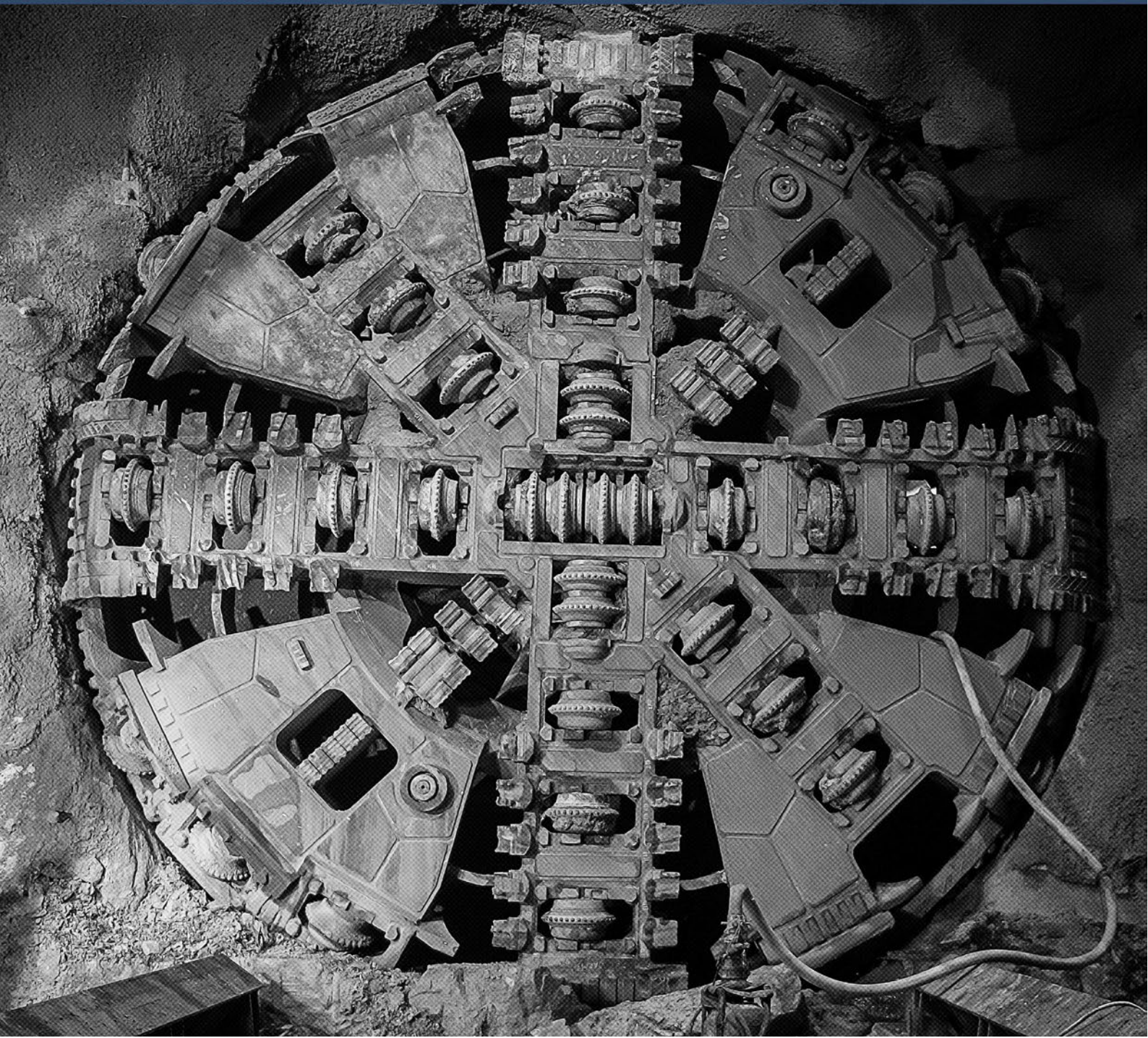
The initial screening test values, taken from Table C1.1 of Assessing Vibration: A technical Guideline are:

- 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 Table 1 (Column A)



Consultation Report Noise and Vibration Management Sub-plan



CONSULTATION REPORT

Noise and Vibration Management Sub-plan

Project number	7040
----------------	------

Document approval

Rev	Date	Prepared by	Reviewed by	Comments	Approved by
A	13-Feb-2023	D Corish	S Reynolds	For submission to the ER for endorsement	
Signature:					
B					
Signature:					

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1. Introduction

1.1. Background

Sydney Metro West is a new 24-kilometre metro line that will connect Greater Parramatta with the Sydney CBD via stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD).

The planning process for Sydney Metro West was assessed as a staged infrastructure application under section 5.20 of the *Environment Planning and Assessment Act 1979* (EP&A Act). Stage 2 of the planning approval process, the Eastern Tunnelling Package (ETP Works or Project), includes all major civil construction work including station excavation (Pyrmont Station and Hunter Street Station (Sydney CBD) and tunnelling between The Bays and Sydney CBD.

The Project was approved by the Minister for Planning on 24 August 2022 (SSI 19238057) under section 5.19 of the EP&A Act and will be delivered by the John Holland CPB Ghella Joint Venture (JCG).

1.2. Report scope

Reflecting the requirements of the SSI 19238057 Planning Approval, this report has been prepared to provide the evidence of consultation with the identified parties during the development of the Noise and Vibration Management Sub-plan and the Noise and Vibration Monitoring Program (Subject Documents).

2. Consultation requirements

2.1. SSI 19238057 Planning Approval

The Conditions of Approval relevant to stakeholder consultation on the Subject Documents are listed in Table 1.

Table 1: Conditions of Approval

Ref	Condition
A6	Where the conditions of this approval require a document or monitoring program to be prepared, or a review to be undertaken, in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Planning Secretary with the document. The evidence must include: (a) documentation of the engagement with the party identified in the condition of approval that has occurred before submitting the document for approval; (b) a log of the dates of engagement or attempted engagement with the identified party and a summary of the issues raised by them; (c) documentation of the follow-up with the identified party(s) where feedback has not been provided to confirm that the party(s) has none or has failed to provide feedback after repeated requests; (d) outline of the issues raised by the identified party(s) and how they have been addressed; and (e) a description of the outstanding issues raised by the identified party(s) and the reasons why they have not been addressed. <i>Note: *Consultation with the community and businesses will be undertaken in accordance with the Overarching Community Communication Strategy required under Condition B1.</i>
C5	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 must be included in the relevant CEMP Sub-plan, including copies of all correspondence from those government agencies as required by Condition A6. 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: (a) Noise and vibration: Place Management NSW (in respect of The Bays) and Relevant Council(s) (b) Flora and fauna: DPE Environment and Heritage Group, DPI Fisheries, and Relevant Council(s) (c) Heritage (Non-Aboriginal and Aboriginal): Heritage NSW, Place Management NSW (in respect of The Bays) and Relevant Council(s) (d) Spoil: Relevant council(s) (e) Soil and water: DPE Water and Relevant Council(s)
C14	The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies 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: (a) Noise and vibration: EPA, Place Management NSW (in respect of The Bays) and Relevant Council(s) (b) Surface water quality: DPE Water, Relevant Council(s) and Sydney Water (if any Sydney Water assets are impacted) (c) Groundwater: DPE Water

2.2. Revised Environmental Mitigation Measures

There are no Revised Environmental Mitigation Measures (REMMs) relevant to stakeholder consultation on the Subject Documents.

3. Consultation summary

In accordance with the SSI 19238057 Planning Approval, the Subject Documents have been prepared in consultation with the identified parties. A summary of the consultation is provided in Table 2.

Table 2: Stakeholder consultation summary

Stakeholder	Consultation Summary	Status	Reference
City of Sydney Council	Stakeholder confirmed that there are no issues with the Subject Documents.	No action required.	Appendix A
Inner West Council	Issues raised have been adequately addressed in the Subject Documents; there are no outstanding issues.	Addressed and closed.	Appendix B
Place Management NSW	Issues raised have been adequately addressed in the Subject Documents; there are no outstanding issues.	Addressed and closed.	Appendix C
Environment Protection Authority (EPA)	Stakeholder confirmed that there are no issues with the Subject Documents.	No action required.	Appendix D

Appendix A City of Sydney Council Consultation Evidence

Table 3: Consultation Log

In/Out	Date	Medium	Details of Contact
Out	13 December 2022, 5:36pm	Email	Sydney Metro issues Subject Document to Tegan Mitchell (Manager Major Transport Projects) and specifies dates of review period.
In	14 December 2022, 3:00pm	Email	Tegan Mitchell (Manager Major Transport Projects) acknowledges receipt of Subject Document.
Out	15 December 2022, 7:42pm	TeamBinder Transmittal	Subject Document is provided to stakeholder via TeamBinder.
Out	10 January 2023, 1:22pm	Email	Sydney Metro follows up with Nathan English (Planning Coordinator, Major Transport Projects) regarding progress of Subject Document review. Sydney Metro offers to set up a meeting to clarify any outstanding questions and provide additional information.
In	12 January 2023, 11:17am	Email	Stakeholder advises they do not have any questions regarding the Subject Document.
Out	18 January 2023	Phone call	Sydney Metro requests update on the Subject Document review and reminds stakeholder that feedback is due 27/1/2023. Sydney Metro confirms that consultation includes DPE.
Out	24 January 2023	Phone call	Sydney Metro clarifies with stakeholder the process for returning feedback comments. Sydney Metro confirms that stakeholder has been granted an extension until 1/02 to provide feedback.
In	27 January 2023, 10:50am	Email	Stakeholder provides Sydney Metro with feedback on Subject Document.

Table 4: Issues Raised by Stakeholder

No	Issues Raised	How Addressed	Subject document ref
Noise and Vibration Management Sub-plan			
1	No issues with this Construction Noise and Vibration Management Plan. We accept that noise and vibration will be minimised to acceptable levels if the plan is fully implemented.	No action required.	N/A
Noise and Vibration Monitoring Program			
2	No comments provided.	No action required.	N/A

[REDACTED]

Subject: Review of Environmental Management Plans - Sydney Metro West - Eastern Tunnelling Package

Hi [REDACTED]

Sydney Metro is providing City of Sydney with environmental management plans for review as part of the consultation process for the preparation of these plans.

These plans are required for the Eastern Tunnelling Package (ETP) Package that was recently awarded to John Holland CPB Ghella Joint Venture (JCG) for works that form part of Sydney Metro West – Stage 2 (major civil construction between The Bays to Sydney CBD) planning approval located [here](#).

The review period is from 13 December 2022 to 27 January 2023. Please advise in the coming days if you require a meeting during this time to go through the plans.

We have sent these documents via secure transmittal, in addition to this email. We will also issue them via TeamBinder (our document management system).

If you have any questions please feel free to reach out.

Best regards

[REDACTED]
Manager, Stakeholder Engagement
Sydney Metro West

[REDACTED]
Level 43, 680 George Street, Sydney NSW 2000
PO Box K659, Haymarket NSW 1240



13 December 2022

[REDACTED]
Manager Major Transport Projects
City of Sydney
PO Box 1591
SYDNEY NSW 2001

Dear Ms Mitchell,

Sydney Metro SSI 19238057 – Eastern Tunnelling Package – John Holland CPB Ghella Joint Venture – Construction Flora and Fauna Management Sub-plan; Heritage Management Sub-plan; Noise and Vibration Management Sub-plan; Noise and Vibration Monitoring Program; Soil and Water Management Sub-plan; Spoil Management Sub-plan; Surface Water Quality Monitoring Program

The Eastern Tunnelling Package (ETP) Package was recently awarded to John Holland CPB Ghella Joint Venture (JCG). These works form part of the Sydney Metro West – Stage 2 (major civil construction between The Bays to Sydney CBD) planning approval.

The planning approval requires the preparation of environmental management plans prior to construction commencing. Please find attached the ETP:

- Construction Flora and Fauna Management Sub-plan
- Heritage Management Sub-plan
- Noise and Vibration Management Sub-plan
- Noise and Vibration Monitoring Program
- Soil and water Management Sub-plan
- Spoil Management Sub-plan
- Surface Water Quality Monitoring Program

Prepared by JCG and issued to the City of Sydney for consultation in accordance with SSI 19238057 Conditions of Approval C5 and C14.

We are commencing a 6-week consultation process with you as of 13 December 2022 with this submission. In recognition of the Christmas holiday period, an extended consultation period has been nominated to allow sufficient time for review of the document(s). It is requested that comments (or confirmation of no comments) are provided by **27 January 2023**. In addition, if you would like to discuss the sub-plan details, please advise and we can arrange a specific meeting.

Should you have any questions or comments on the attached, please do not hesitate to contact A [REDACTED]

Sydney Metro
Level 43, 680 George Street, Sydney NSW 2000 | PO Box K659, Haymarket NSW 1240
T 02 8265 9400 | sydneymetro.info | ABN 12 354 063 515

Yours sincerely

[REDACTED]
Director, Project Environment, Sustainability & Planning
Metro West
Sydney Metro

From: [REDACTED]

Sent: Wednesday, 14 December 2022 3:00 PM

Subject: JV - Team introduction and meeting

CAUTION: This email is sent from an external source. Do not click any links or open attachments unless you recognise the sender and know the content is safe.

Hi Marion and Phillip

Thanks for sending through various sub plans etc.. – we will make every attempt to provide feedback by 27th, as I said yesterday the City is 150% supportive of the Metro project.

Yesterdays meeting was constructive , there are many issues still to discuss. Nathan will set up meetings as discussed 31 Jan.

Can you please confirm whether you will be sending through actions from yesterdays meeting?
I recall 4 actions (Other than the response to your plans) :

1. JV requested an up to date list of property owners for area around the Pymont station
2. JV request assistance in passing on quality furniture to charity organisations (JV to provide pack with details of items etc..)
3. City to provide contact details of Homeless unit
4. City to provide assistance with first nations artists to potentially prepare art for the wall for the Hunter connection food court.

The City asked for information about impacts to trees to be provided as soon as possible, noting trimming also has an impact on tree health and the City has ambitious tree canopy targets .

Please let me know if I have missed anything?
Can you please confirm this with the JV?
Many Thanks

Happy Christmas

Tegan

From: [REDACTED]
Sent: Tuesday, 13 December 2022 5:36 PM
To: [REDACTED]
Cc: [REDACTED]
Subject: Review of Environmental Management Plans - Sydney Metro West - Eastern Tunnelling Package

Caution: This email came from outside the organisation. Don't click links or open attachments unless you know the sender, and were expecting this email.

Hi Tegan,

Sydney Metro is providing City of Sydney with environmental management plans for review as part of the consultation process for the preparation of these plans.

These plans are required for the Eastern Tunnelling Package (ETP) Package that was recently awarded to John Holland CPB Ghella Joint Venture (JCG) for works that form part of Sydney Metro West – Stage 2 (major civil construction between The Bays to Sydney CBD) planning approval located [here](#).

The review period is from 13 December 2022 to 27 January 2023. Please advise in the coming days if you require a meeting during this time to go through the plans.

We have sent these documents via secure transmittal, in addition to this email. We will also issue them via TeamBinder (our document management system).

If you have any questions please feel free to reach out.

Best regards

[REDACTED]
Manager, Stakeholder Engagement
Sydney Metro West
M 0437 046 349
Level 43, 680 George Street, Sydney NSW 2000
PO Box K659, Haymarket NSW 1240

From: [REDACTED]
Sent: Tuesday, 10 January 2023 1:24 PM
To: [REDACTED]
Subject: RE: Review of documents from JCG JV

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Not sure yet – I'll get back to you.

Nathan.

From: [REDACTED]
Sent: Tuesday, 10 January 2023 1:22 PM
To: [REDACTED]
Subject: Review of documents from JCG JV

Caution: This email came from outside the organisation. Don't click links or open attachments unless you know the sender, and were expecting this email.

Hi [REDACTED]

I'm just following up on the review of the documents sent before Christmas. Just wondering if the reviewers have any questions on the documents transmitted. I'm happy to set up a meeting with the reviewers if they would like clarification or have any questions.

Best wishes

[REDACTED]
A/Senior Manager, Stakeholder Engagement
Sydney Metro West

From: [REDACTED]
Sent: Thursday, 12 January 2023 11:17 AM
To: [REDACTED]
Subject: Quick enquiry

CAUTION: This email is sent from an external source. Do not click any links or open attachments unless you recognise the sender and know the content is safe.

Hi [REDACTED]

I don't think anyone has any questions as yet regarding the Sub Plans for ETP. Since I went on leave, have any further elements been released? I've not received anything to my knowledge...

[REDACTED]
Planning Coordinator, Transport Major Projects
City Access



Mobile: [REDACTED]
cityofsydney.nsw.gov.au

From: [REDACTED]
Sent: Friday, 27 January 2023 10:50 AM
To: [REDACTED]
Cc: [REDACTED]
Subject: Feedback from City re: Sydney Metro Eastern Tunnelling Package Environmental Management sub plans Jan 2023

CAUTION: This email is sent from an external source. Do not click any links or open attachments unless you recognise the sender and know the content is safe.

Hi [REDACTED]

Please find attached feedback from City staff regarding the Environmental Management Sub

plans attached in 6 spread sheet documents

- Construction Flora and Fauna Management Sub-plan (Comments across two spread sheets)
- Heritage Management Sub-plan
- Noise and Vibration Management Sub-plan (includes comments on - Noise and Vibration Monitoring Program)
- Soil and water Management Sub-plan (Also contains comments on Surface Water Quality Monitoring Program)
- Spoil Management Sub-plan

Additional comments regarding feedback:

1. City staff have not provided feedback regarding ground water contamination – we require a few additional days to source this feedback. **ACTION:** City will update Metro Monday 30 Jan 2022.
2. City staff have emphasised that the removal of trees should be *minimised*. The City considers that mature trees have benefits for native and non-native fauna. In addition the Community place *a significant value on the amenity and shade* provided by these mature trees. **ACTION:** The City requests Mero reconsider the blanket removal of trees, and minimise impacts wherever possible. The City can provide advice on what measures can be taken to protect trees if requested.

Please let me know if you have any questions, I will pass on the next series of feedback as soon as it is completed.

Apologise for not providing the complete suite of responses, I will contact you on Monday with an update.

Tegan Mitchell
Manager Major Transport Projects
City Access



REVIEW COMMENTS SHEET



Transport
for NSW

DOCUMENT NO. ▼	DATE ▼	COMMENTS / RESPONSE ▼	COMMENT CATEGORY ▼	CLOSED OUT ▼
Noise and Vibration Management SubPlan SMWSTETP-JCG-SWD- SW000-EN-PLN-002019	25/11/2022	No issues with this Construction Noise and Vibration Management Plan. We accept that noise and vibration will be minimised to acceptable levels if the plan is fully implemented.		

Appendix B Inner West Council Consultation Evidence

Table 5: Consultation Log

In/Out	Date	Medium	Details of Contact
Out	13 December 2022	Email 5:42pm	Metro issues Subject Document to Ken Walsh (Team Lead – Strategic Transport Planning) and specifies dates of review period.
Out	15 December 2022	TeamBinder Transmittal 7:42pm	Subject Document is provided to stakeholder via TeamBinder
Out	10 January 2023	Email 1:18pm	Metro follows up with Ajnesh Sharma (Road Access Engineer) regarding progress of Subject Document review. Metro offers to set up a meeting to clarify any outstanding questions and provide additional information.
Out	13 January 2023	Phone call	Metro follows up with stakeholder regarding progress of Subject Document review and offers to clarify any questions.
Out	24 January 2023	Email 10:16am	Metro requests update on the Subject Document review.
In	24 January 2023	Phone call	Stakeholder confirms they are on-track to provide comments by 27/01/2023.
In	30 January 2023	Email 10:51am	Stakeholder provides Metro with feedback comments on the Subject Document.

Table 6: Issues Raised by Stakeholder

No	Issues Raised	How Addressed	Subject document ref
Noise and Vibration Management Sub-plan			
2	It is noted in Table 10 that there many out-of-hours (OOH) work periods are scheduled for The Bays precinct. Although (fortunately) most works will be underground, the main worksite will be covered by acoustic sheds and dwellings and other sensitive uses are not in very close proximity, noise from these works will add to existing night-time ambient noise, e.g. noise from cruise ship terminal. Cumulative noise impacts therefore need to be considered, particularly for OOH works.	Cumulative impacts have been considered during the preparation of the Noise and Vibration Management Plan and will continue to be assessed and managed during the ETP Works. Relevant references in the Noise and Vibration Management Sub-plan include: - Section 1.4.3 (Cumulative and consecutive noise impact) notes that ongoing stakeholder consultation will be undertaken during the ETP Works to coordinate activities and manage cumulative noise and vibration impacts. - Section 7.3 (Gatewave noise and vibration management tool) details the 3D construction noise and vibration management tool (Gatewave) that has been developed for the Project to enable work areas and activities	Section 1.4.3 (Cumulative and consecutive noise impact) Section 7.3 (Gatewave noise and vibration management tool)

No	Issues Raised	How Addressed	Subject document ref
		to be planned, assessed and managed. Data relating to cumulative noise impacts from other aspects of the Project or, where relevant, noise from other construction projects, will be entered into Gateway to ensure an accurate assessment is undertaken.	
3	The 'additional mitigation measures' are noted. Council would like to see a generous approach to offering residents relief from noise impacts if needed, such as alternative accommodation.	Noted. Refer to Figures 6 to 8 which detail the additional mitigation measures for standard hours and OOHW (including alternative accommodation) as recommended in the Sydney Metro Construction Noise and Vibration Standard. Additional details on alternative accommodation will also be provided in the DNVIS (discussed in Section 7.2). DNVISs must be submitted to the independent Acoustic Consultant and the Environmental Representative which provides assurance that the alternative accommodation control measure will be implemented as required.	Figures 6 to 8 Section 7.2 (Detailed Noise and Vibration Impact Statements)
Noise and Vibration Monitoring Program			
4	It is noted that Figure 3 shows there are many potential residential receivers in Balmain and Rozelle area.	Noted. As detailed in Section 7.2, the potential impact of the ETP Works on residential and other noise and vibration sensitive receivers will be assessed in a DNVIS for each worksite. The DNVIS will be prepared by an appropriately qualified and experienced acoustic consultant and will determine the management and mitigation measures that are required to be implemented.	Section 7.2 (Detailed Noise and Vibration Impact Statements)

From: [REDACTED]

Sent: Tuesday, 13 December 2022 5:42 PM

To: [REDACTED]

Cc: [REDACTED]
[REDACTED]

Subject: Review of Environmental Management Plans - Sydney Metro West - Eastern Tunnelling Package

Hi Ken,

Sydney Metro is providing Inner West Council with environmental management plans for review as part of the consultation process for the preparation of these plans.

These plans are required for the Eastern Tunnelling Package (ETP) Package that was recently awarded to John Holland CPB Ghella Joint Venture (JCG) for works that form part of Sydney Metro West – Stage 2 (major civil construction between The Bays to Sydney CBD) planning approval located [here](#).

The review period is from 13 December 2022 to 27 January 2023. Please advise in the coming days if you require a meeting during this time to go through the plans.

We have sent these documents via secure transmittal, in addition to this email. We will also issue them via TeamBinder (our document management system).

If you have any questions please feel free to reach out.

Best regards

[REDACTED]
Manager, Stakeholder Engagement
Sydney Metro West

[REDACTED]
Level 43, 680 George Street, Sydney NSW 2000
PO Box K659, Haymarket NSW 1240



13 December 2022

Attn [REDACTED]
Team Leader Transport Planning
Inner West Council
PO Box 14
PETERSHAM NSW 2049

Dear Mr Walsh,

Sydney Metro SSI 19238057 – Eastern Tunnelling Package – John Holland CPB Ghella Joint Venture – Construction Flora and Fauna Management Sub-plan; Heritage Management Sub-plan; Noise and Vibration Management Sub-plan; Noise and Vibration Monitoring Program; Soil and Water Management Sub-plan; Spoil Management Sub-plan; Surface Water Quality Monitoring Program

The Eastern Tunnelling Package (ETP) Package was recently awarded to John Holland CPB Ghella Joint Venture (JCG). These works form part of the Sydney Metro West – Stage 2 (major civil construction between The Bays to Sydney CBD) planning approval.

The planning approval requires the preparation of environmental management plans prior to construction commencing.

Please find attached the ETP:

- Flora and Fauna Management Sub-plan
- Heritage Management Sub-plan
- Noise and Vibration Management Sub-plan
- Noise and Vibration Monitoring Program
- Soil and Water Management Sub-plan
- Spoil Management Sub-plan
- Surface Water Quality Monitoring Program.

Prepared by JCG and issued to the Inner West Council for consultation in accordance with SSI 19238057 Conditions of Approval C5 and C14.

Sydney Metro

Level 43, 680 George Street, Sydney NSW 2000 | PO Box K659, Haymarket NSW 1240
T 02 8265 9400 | sydneymetro.info | ABN 12 354 063 515

OFFICIAL

We are commencing a 6-week consultation process with you as of 13 December 2022 with this submission. In recognition of the Christmas holiday period, an extended consultation period has been nominated to allow sufficient time for review of the document(s). It is requested that comments (or confirmation of no comments) are provided by **27 January 2023**. In addition, if you would like to discuss the sub-plan details, please advise and we can arrange a specific meeting.

Should you have any questions or comments on the attached, please do not hesitate to contact [REDACTED] Manager Environment on [REDACTED] or [REDACTED]

Yours sincerely,

[REDACTED]

Director, Project Environment, Sustainability & Planning
Metro West
Sydney Metro

Cc: [REDACTED]

From: [REDACTED]
Sent: Tuesday, 10 January 2023 1:18 PM
To: [REDACTED]
Subject: RE: Meeting with JCG JV & Sydney Metro

Hi [REDACTED]

Happy new year and hope you enjoyed some time off over the holiday season.

I'm following up on the review of the documents you received before Christmas. Do you or Brigid have any questions on the documents transmitted by JCG JV. Let me know how you are going and if you would like to set up a meeting to discuss the review.

Many thanks

[REDACTED]
A/Senior Manager, Stakeholder Engagement
Sydney Metro West

[REDACTED]
Subject: FW: Meeting with JCG JV & Sydney Metro

CAUTION: This email is sent from an external source. Do not click any links or open attachments unless you recognise the sender and know the content is safe.

Hi Marion,

Please find email from Brigid below. I am available from 3rd January onwards.

Have a great Christmas.

Regards

[REDACTED]

From: [REDACTED]
Sent: Friday, 23 December 2022 9:58 AM
To: [REDACTED]
Subject: Meeting with JCG JV & Sydney Metro

Hi Ajnesh,

I hope you're well. Can I just ask if you had any luck setting up the meeting around mid-January with your team. I'll need to have a few different dates and times to offer the contractor.

Many thanks
Marion
Stakeholder engagement manager
Sydney Metro West

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 Consider the environment. Please don't print this e-mail unless really necessary.

From: [REDACTED]
Sent: Monday, 30 January 2023 12:42 PM
To: [REDACTED]
Subject: Fw: Review Sydney Metro sub plans

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Hi Marion,

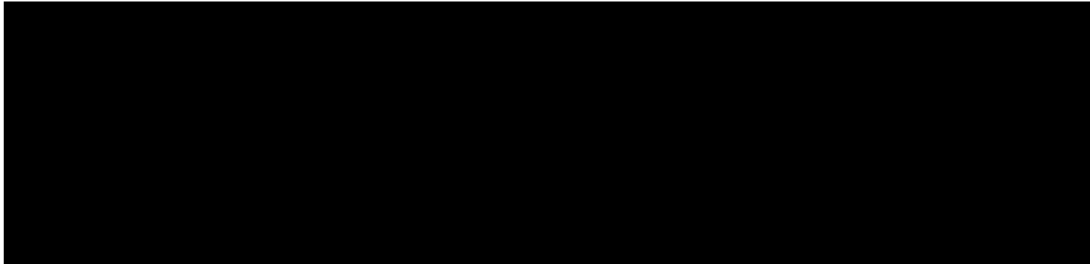
Hope you are well.

Apologies for sending this in late.

Please find a set of comments below from Inner West Council.

Thanks

[REDACTED]



Subject: RE: Review Sydney Metro sub plans

Hi 

Thanks for co-ordinating. I was able to access the files from your link to SharePoint (and I assume others can too), so no need to put them on the common drive. Apologies for not sending this to you last Fri. I was allowing time to run this by Ken, who has been the key Council person working on Metro West planning, but Ken is off sick this week.

I've had a quick look through all the plans, and am pleased to say that in general terms I can't see any significant impacts for our council area. That's not to say there are no impacts at all, and it needs to be kept in mind that the Rozelle/Balmain area continues to be subject to significant cumulative impacts from multiple major projects & activities. Unlike WestConnex & Western Harbour Tunnel, Metro West is public transport, so is supported at a strategic level by our council.

As these plans are concerned only with tunnel & station excavation from The Bays through to the CBD, the only construction activity within our council area is from one site within The Bays precinct. Most of this activity is underground and covered by acoustic sheds (which helps minimise impacts) and fortunately there doesn't appear to be any residential or other sensitive land uses within very close proximity to the construction site at The Bays. It's a different story over the border within the City of Sydney, where there are multiple construction sites with a variety of sensitive uses in very close proximity.

I also note that all spoil haulage will be along main roads like City West Link, not local roads. I'm pleased to see there's a condition of approval preventing spoil trucks operating from The Bays from using Robert Street (except in emergencies), which means they'll all be using James Craig Road to access City West Link.

As a transport planner I've focused on traffic/transport issues, but have included a few brief comments below on other topics based on my experience with WestConnex.

Hope these comments are useful, and happy to discuss any time - Kendall

Comments on the *Overarching Construction Traffic Management Plan*

- Table 5 shows that peak daily traffic movements for both heavy & light vehicles to be significant, although impacts should be minimised by Consent Condition D70, which requires all these movements to be via James Craig Road, not Robert Street. Council would like confirmation that there will not be unacceptable congestion along James Craig Road and at its intersection with City West Link. This confirmation should be part of the further assessment in the forthcoming site-specific Construction Traffic Management Plan (CTMP). This assessment will

REVIEW COMMENTS SHEET

N ^o	DATE	REVIEW DOC. NO	DOCUMENT REF	DEED REF	COMMENTS / RESPONSE	COMMENT CATEGORY	CLOSED OUT
85	30/01/2023	SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	Table 10	N/A	It is noted in Table 10 that there many out-of-hours (OOH) work periods are scheduled for The Bays precinct. Although (fortunately) most works will be underground, the main worksite will be covered by acoustic sheds and dwellings and other sensitive uses are not in very close proximity, noise from these works will add to existing night-time ambient noise, e.g. noise from cruise ship terminal. Cumulative noise impacts therefore need to be considered, particularly for OOH works.COMMENTED BY - KENDALL BANFIELD - INNER WEST COUNCIL	Potential Non-Compliance	N
		SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	Table 10	N/A	Cumulative impacts have been considered during the preparation of the Noise and Vibration Management Plan and will continue to be assessed and managed during the ETP Works. Relevant references in the Noise and Vibration Management Sub-plan include: -Section 1.4.3 (Cumulative and consecutive noise impact) notes that ongoing stakeholder consultation will be undertaken during the ETP Works to coordinate activities and manage cumulative noise and vibration impacts. -Section 7.3 (Gateway noise and vibration management tool) details the 3D construction noise and vibration management tool (Gateway) that has been developed for the Project to enable work areas and activities to be planned, assessed and managed. Data relating to cumulative noise impacts from other aspects of the Project or, where relevant, noise from other construction projects, will be entered into Gateway to ensure an accurate assessment is undertaken.	Potential Non-Compliance	N
86	30/01/2023	SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	N/A	The 'additional mitigation measures' are noted. Council would like to see a generous approach to offering residents relief from noise impacts if needed, such as alternative accommodation.COMMENTED BY - KENDALL BANFIELD - INNER WEST COUNCIL	Observation	N
		SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	N/A	Noted. Refer to Figures 6 to 8 which detail the additional mitigation measures for standard hours and OOH (including alternative accommodation) as recommended in the Sydney Metro Construction Noise and Vibration Standard. Additional details on alternative accommodation will also be provided in the DNVIS (discussed in Section 7.2). DNVISs must be submitted to the independent Acoustic Consultant and the Environmental Representative which provides assurance that the alternative accommodation control measure will be implemented as required.	Observation	N
87	30/01/2023	SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	Figure 3	N/A	It is noted that Figure 3 shows there are many potential residential receivers in Balmain & Rozelle area.COMMENTED BY - KENDALL BANFIELD - INNER WEST COUNCIL	Observation	N
		SMWSTETP-JCG-1NL-NL000-EN-PLN-000001	Figure 3	N/A	Noted. As detailed in Section 7.2, the potential impact of the ETP Works on residential and other noise and vibration sensitive receivers will be assessed in a DNVIS for each worksite. The DNVIS will be prepared by an appropriately qualified and experienced acoustic consultant and will determine the management and mitigation measures that are required to be implemented.	Observation	N

Appendix C Place Management NSW Consultation Evidence

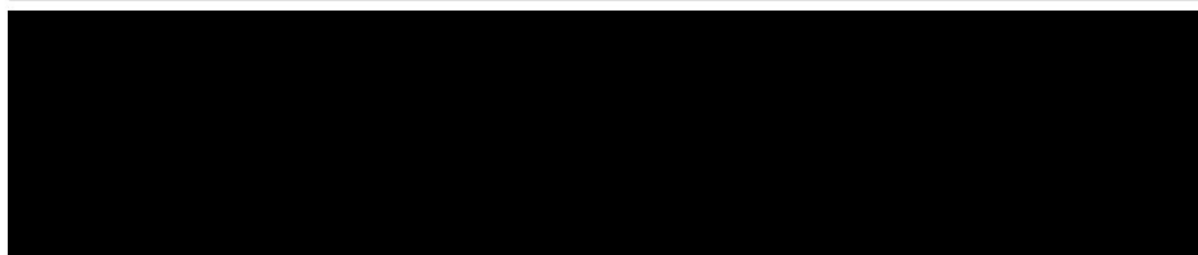
Table 7: Consultation Log

In/Out	Date	Medium	Details of Contact
Out	7 December 2022, 4:00pm	Phone call	Katarina Simunic, Acting Director Leasing and Commercial (PMNSW) was called by Sydney Metro and briefed on document review cycle and timings
Out	13 December 2022, 6:03pm	Email	Sydney Metro emailed the Subject Document to Antonio Goncalves, Senior Manager Leasing and Place Management (PMNSW). Offer of briefing provided.
In	20 January 2023, 8:47am	Email	Michelle King, Leasing & Place Management Officer (PMNSW) issued PMNSW comments to Sydney Metro

Table 8: Issues Raised by Stakeholder

No	Issues Raised	How Addressed	Subject document ref
Noise and Vibration Management Sub-plan			
5	It is recommended that Renzo Tonin review and cross reference the Central Tunnelling package (AFJV), NVMPs to ensure appropriate baselines have been used and to ensure any monitoring and mitigation methods that are already in place can be used by both JVs. This is to both avoid duplication and to continue the currently applied methodologies and mitigation measures, along with being consistent with data collection and analysis. Eg: fixed noise monitors – are they proposed to be in the same location for continuous data collection – should more be included?	Renzo Tonin and Associates have reviewed the AFJV NVMP, noise and vibration monitoring program and DNVIS for The Bays to ensure consistency between the two projects. It is noted that fixed monitoring for the Central Tunnelling Package (CTP) has been established to best manage impacts from the CTP works. Similarly, for ETP works, the monitoring locations will be selected to ensure meaningful monitoring of ETP works is undertaken for the purpose of verifying and managing impacts.	Noise and Vibration Management Sub-plan
6	It is noted that the tunnelling and “associated works” such as spoil transport can continue 24/7. Whilst it is understood that the impacts of this from a road traffic assessment will be undertaken, please also include additional noises such as dumping spoil into the trucks this type of noise is intermittent, and should be assessed in combination with general road noise and vibration impacts. There appears to be an acoustic shed constructed as part of the Central tunnelling package by AFJV although this is not referenced in this report as a mitigation measure for Bays.	The Detailed Noise and Vibration Impact Statement (DNVIS) that will be prepared for The Bays worksite will include all noise and vibration sources (including spoil transfer haulage) to predict and assess impacts. The DNVIS will also include relevant mitigation measures that have been implemented as part of the Central Tunnelling Package (i.e. acoustic shed and noise barriers). Refer to Section 7.2 of the NVMP for additional details on DNVISs.	Noise and Vibration Management Sub-plan
7	Complaints – PMNSW should be advised of any complaints in relation to noise and vibration from any stakeholder (community, Council or otherwise) within 24 hours of receiving the complaint, including how the complaint has been addressed and mitigation measures for future similar works that resulted in the complaint.	Sydney Metro advised JCG that this comment was addressed by Sydney Metro in TeamBinder.	N/A

No	Issues Raised	How Addressed	Subject document ref
8	Whilst there is no formal condition requiring SMW to consult with PMNSW some of the other EMP sub-plans, PMNSW would appreciate Metro providing all CEMP sub-plans as they are developed to PMNSW, as land owner, so that PMNSW can be across all issues and informed enough to be able to provide land owners consent when required.	Sydney Metro advised JCG that this comment was addressed by Sydney Metro in TeamBinder.	N/A
9	Confirmation as to who the appointed he Environmental Representative for the Eastern tunnelling package to be provided to PMNSW.	Sydney Metro advised JCG that this comment was addressed by Sydney Metro in TeamBinder.	N/A
Noise and Vibration Monitoring Program			
10	White Bay Power Station (WBPS) is a significant (and sensitive) heritage building at the Bays precinct and is not referenced in the report. Vibration monitors have already been installed by AFJV for the Central Tunnelling package on the Power Station itself. While the Eastern tunnelling works will commence approximately 150m from the WBPS, monitors should remain in place for continuity and consistency during initial eastern tunnelling. Consultation with the PMNSW Heritage Wayne Johnson should be consulted prior to any decisions being made about the Power Station.	Reflecting the ETP Works tunnel alignment and surface works scope, the EIS determined the Project would not impact the White Bay Power Station. As such, there are no specific controls or monitoring requirements included in either the Heritage Management Sub-plan or the Noise and Vibration Management Sub-plan (CNVMP). Construction vibration criteria for heritage items are established in Section 6.6.3 of the Noise and Vibration Management Sub-plan. Vibration screening criteria assessment approach is described in Section 6.6.6 of the Sub-plan, which sets out a conservative screening level to identify the risk of vibration impact on a heritage item. Detailed Noise and Vibration Impact Statements (DNVISs, see Section 7.2 of the Sub-plan) will identify the likelihood that construction generated vibration will impact on neighbouring buildings/ structures, including the White Bay Power Station. Where the DNVIS identifies a risk of vibration impacts, it will further outline the mitigation and management measures along with a monitoring program to ensure impacts are minimised. As noted above, based on the scope of the ETP works it is very unlikely that vibration impact on the White Bay Power Station will be triggered. Consultation with Place Management NSW will occur in the event of any changes in the ETP Works scope that are assessed as having a potential impact on the White Bay Power Station.	Section 6.6.2 (Structural damage to buildings) Section 6.6.6 (Vibration screening criteria assessment approach) Section 7.2 (Detailed Noise and Vibration Impact Statements)



Subject: Sydney Metro West - Eastern Tunnelling Package - Environmental Management Plans (Placemaking NSW)

Hi Antonio,

Sydney Metro is providing Placemaking NSW environmental management plans for review as part of the consultation process for the preparation of these plans.

These plans are required under planning approvals for the Eastern Tunnelling Package (ETP) Package that was recently awarded to John Holland CPB Ghella Joint Venture (JCG) for works that form part of Sydney Metro West – Stage 2 (major civil construction between The Bays to Sydney CBD) planning approval located [here](#).

The review period is from **13 December 2022 to 27 January 2023**, please advise in the coming days if you require a meeting during this time to go through the plans.

In addition to this email I have sent these documents to your colleague Michelle King (michelle.king@property.nsw.gov.au) via our document management system TeamBinder to assist in circulating to relevant reviewers within your team.

If you have any questions please feel free to reach out. Thank you,


Manager Environment
Environment, Sustainability & Planning
Sydney Metro

M: 

sydneymetro.info

Level 43, 680 George Street, Sydney NSW 2000
PO Box K659, Haymarket NSW 1240



Transport for NSW



20 January 2023

Mr [REDACTED]
Director, Project Environment, Sustainability & Planning
Metro West
Level 43
680 George Street
SYDNEY NSW 2000

Dear [REDACTED]

Re: Comments – Sydney Metro SSI 19238057 – Eastern Tunnelling Package
Reference Number: #11765

Thank you for the opportunity to meet with you on Monday 19 December 2022 and provide feedback on the Sydney Metro SSI 19238057 – Eastern Tunnelling Package – John Holland CPB Ghella Joint Venture – Construction Heritage Management Sub-plan; Noise and Vibration Management Sub-plan; Noise and Vibration Monitoring Program

Place Management NSW (PMNSW) has reviewed the documentation and provides the following comments:

- It is recommended that Renzo Tonin review and cross reference the Central Tunnelling package (AFJV), NVMPs to ensure appropriate baselines have been used and to ensure any monitoring and mitigation methods that are already in place can be used by both JVs. This is to both avoid duplication and to continue the currently applied methodologies and mitigation measures, along with being consistent with data collection and analysis. Eg: fixed noise monitors – are they proposed to be in the same location for continuous data collection – should more be included?
- White Bay Power Station (WBPS) is a significant (and sensitive) heritage building at the Bays precinct and is not referenced in the report. Vibration monitors have already been installed by AFJV for the Central Tunnelling package on the Power Station itself.
- While the Eastern tunnelling works will commence approximately 150m from the WBPS, monitors should remain in place for continuity and consistency during initial eastern tunnelling. Consultation with the PMNSW Heritage Wayne Johnson should be consulted prior to any decisions being made about the Power Station.
- It is noted that the tunnelling and “associated works” such as spoil transport can continue 24/7. Whilst it is understood that the impacts of this from a road traffic assessment will be undertaken, please also include additional noises

OFFICIAL

Place Management NSW
Placemaking NSW
Cites and Active Transport
Level 2, 66 Harrington Street, Sydney NSW 2000
PO Box N408, Grosvenor Place NSW 1220

Tel: 02 9240 8500

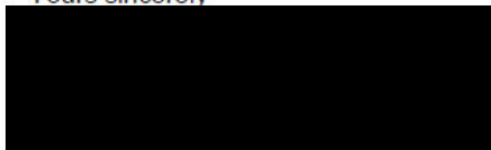
Placemaking NSW is the registered business name of Place Management NSW

such as dumping spoil into the trucks this type of noise is intermittent, , and should be assessed in combination with general road noise and vibration impacts. There appears to be an acoustic shed constructed as part of the Central tunnelling package by AFJV although this is not referenced in this report as a mitigation measure for Bays.

- Complaints – PMNSW should be advised of any complaints in relation to noise and vibration from any stakeholder (community, Council or otherwise) within 24 hours of receiving the complaint, including how the complaint has been addressed and mitigation measures for future similar works that resulted in the complaint.
- Whilst there is no formal condition requiring SMW to consult with PMNSW some of the other EMP sub-plans, PMNSW would appreciate Metro providing all CEMP sub-plans as they are developed to PMNSW, as land owner, so that PMNSW can be across all issues and informed enough to be able to provide land owners consent when required
- Confirmation as to who the appointed Environmental Representative for the Eastern tunnelling package to be provided to PMNSW

If you require any further information or wish to discuss the contents of this letter, please contact the undersigned on 0436 802 874.

Yours sincerely



A/Director, Leasing & Commercial

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Placemaking NSW
Cites and Active Transport
Level 2, 66 Harrington Street, Sydney NSW 2000
PO Box N408, Grosvenor Place NSW 1220

Tel: 02 9240 8500

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Appendix D EPA Consultation Evidence

Table 9: Consultation Log

In/Out	Date	Medium	Details of Contact
Out	8 December 2022	Email	Subject Documents provided to stakeholder
Out	20 January 2023	Email	Follow-up correspondence to the EPA requesting comments on the Subject Documents or confirmation of no comments.
In	31 January 2023	Telephone	EPA confirmed that they will not be providing comments on the Subject Documents
Out	31 January 2023	Email	JCG summarised the outcomes of the telephone conversation with the EPA on 31 January 2023 where the EPA confirmed that they will not be providing comments on the Subject Documents.

RE: ETP: monitoring program consultation



Tue 31/01/2023 9:43 AM



Subject: ETP: monitoring program consultation

Dear [Redacted]

Sydney Metro have engaged the John Holland CPB Ghella Joint Venture (JCG) to design and construct the Sydney Metro West – Eastern Tunnelling Package (ETP Works). The purpose of this correspondence is to provide an overview of the ETP Works and to submit the following monitoring programs to your agency for consultation:

- Noise and Vibration Monitoring Program (Appendix A of the Noise and Vibration Management Sub-plan)
- Surface Water Quality Monitoring Program (Appendix A of the Soil and Water Management Sub-plan)

It is noted that the Noise and Vibration Management Sub-plan and the Soil and Water Management Sub-plan are provided to the EPA for completeness; consultation with the EPA is not required on these Sub-plans. In recognition of the Christmas holiday period, an extended consultation period has been nominated to allow sufficient time for review the document(s). It is requested that comments (or confirmation of no comments) are provided by **27 January 2023**. In addition, if you would like to discuss the sub-plan details, please advise and we can arrange a specific meeting with our technical specialists.

Link to the Noise and Vibration Sub-Plan and Monitoring Program

<https://wettransfer.com/downloads/58b9815b51bf017fe23cfd0c09da991220221208042439/3c3e3871a2c851b4c7e3f7ac5676f3b720221208042503/201f0c>

Please give me a call if you have any queries on the consultation process or would like to request a meeting to discuss the ETP Works.

Regards,



RE: ETP: monitoring program consultation

[Reply](#)[Reply All](#)[Forward](#)

Tue 31/01/2023 9:43 AM

From: [Redacted]

Sent: Friday, 20 January 2023 3:50 PM

Subject: RE: ETP: monitoring program consultation

Hi Mark

I'm following up on the below email. Could you please confirm if EPA will review and provide comments on the monitoring programs. It is requested that comments (or confirmation of no comments) are provided by **27 January 2023** so that we can complete the documents and submit in accordance with the SSI planning approval.

If you would like to discuss the monitoring programs, please give me a call.

Regards



Environment, Approvals & Sustainability Director

Level 4, 60 Union Street
Pyrmont NSW 2009



RE: ETP: monitoring program consultation

[Reply](#)[Reply All](#)[Forward](#)

Tue 31/01/2023 9:43 AM

Hi [Redacted]

Confirming our conversation this morning regarding consultation on the monitoring programs, where you confirmed EPA will not be providing comments on the **Noise and Vibration Monitoring Program** or the **Surface Water Quality Monitoring Program**.

Regards



Appendix G

Endorsements

**ACOUSTICS ADVISOR ENDORSEMENT
SYDNEY METRO WEST (SSI 19238057)**

Review of	Eastern Tunnelling Package: Noise and Vibration Management Sub-plan and Monitoring Program	Reviewed document reference:	SMWSTETP-JCG-SWD-SW000-EN-PLN-002019
Prepared by:	[REDACTED], Acoustics Advisor		Revision D dated 15 February 2023
Date of issue:	17 February 2023		

As approved Acoustics Advisor for the Sydney Metro West project, I have reviewed and provided comment on Revision B of the Noise and Vibration Management Sub-plan (CNVMP) for the Eastern Tunnelling Package Works.

The CNVMP was prepared by Renzo Tonin Associates on behalf of JCG and includes the Noise and Vibration Monitoring Program.

I am satisfied that Revision D has addressed my comments and endorse it for submission to DPE.

[REDACTED]

[REDACTED], Metro West Acoustics Advisor

17 February 2023

Director Sustainability, Environment & Planning
Metro West
Sydney Metro
PO Box K659
HAYMARKET NSW 1240

REF: 201208(G) NVMP REV D

Dear [REDACTED]

RE: Sydney Metro West Stage 2– Eastern Tunnelling Package: Noise and Vibration Management Sub-Plan (Rev D)

I refer to Sydney Metro's (SM) submission of the following document required by Condition C5 and C16 of the Sydney Metro West – The Bays to Sydney CBD Approval (SSI 1923805) which was approved by the Department of Planning and Environment (DPE) on 24 August 2022:

- Sydney Metro West, Eastern Tunnelling Package Noise and Vibration Management Plan Rev D 15 February 2023 (SMWSTEP-ICG-SWD-SW000-EM-PLN-002012).

It is noted that:

- The Construction Noise and Vibration Management Plan (NVMP Rev D) which includes the Noise and Vibration Monitoring Program, has been prepared by Renzo Tonin & Associates on behalf of John Holland CPB Ghella JV (JCG) to address the requirements of Condition C5(a), C14(a) and C16 of the Infrastructure Approval.
- Previous versions of the document have been reviewed and updated following comments from the ER.
- Sydney Metro has reviewed and commented on previous versions of the document.
- The NVMP, including the Noise and Vibration Monitoring Program, has been reviewed by the Acoustic Advisor.
- In accordance with CoA C5(a), consultation has been undertaken for the NVMP with the Place Management NSW (in respect of The Bays) and Relevant Council(s)
- In accordance with CoA C14(a), consultation has been undertaken for the Noise and Vibration Monitoring Program with the EPA, Place Management NSW (in respect of The Bays) and Relevant Council(s).

Following the above reviews, the document is considered to contain information required by the Conditions of Approval (SSI 1923805) in relation to the Noise and Vibration Management Plan and Monitoring Program.

As the approved Environmental Representative for the Metro West and as required by Conditions A32(d), C7, and C19, on the basis of the above, the Construction Noise and Vibration Management Plan (Revision D) which includes a Noise and Vibration Monitoring Program, is endorsed and considered appropriate for submission to DPE for their consideration for Approval.

Yours sincerely

Environmental Representative – Sydney Metro West – Eastern Tunnelling Package

CC: [REDACTED]

[REDACTED]
Associate Director Environment
Sydney Metro
Level 43, 680 George Street,
Sydney NSW 2000

22/03/2023

Attention: [REDACTED] – Manager Environment

Subject: **Sydney Metro West, Eastern Tunnelling Package**

Construction Environmental Management Sub-Plans

Dear [REDACTED],

I refer to your recent submission of the Construction Environmental Management Plan Sub-Plans for SSI-19238057. I also acknowledge your response to the Department's review comments and requests for additional information.

I note these documents have been:

- prepared in accordance with the consultation requirements of Conditions C1 and C5 of the approval, including consultation with:
 - City of Sydney
 - Inner West Council
 - Place Management NSW
 - Heritage NSW
- reviewed by Sydney Metro and no issues have been raised with the Department;
- endorsed by the Environmental Representative and, where relevant, the Acoustic Advisor; and
- contain the information required by the conditions of approval.

As nominee of the Planning Secretary, I approve the documents tabulated below under the corresponding condition in the table:

Document Name	Document Version	Date	Approval Condition
Spoil Management Sub-Plan	C	20 February 2023	C7
Heritage Management Sub-Plan	C	17 February 2023	C7

Noise and Vibration Sub-Plan	D	15 February 2023	C7
Noise and Vibration Monitoring Program	D	15 February 2023	C18

Please note that no blasting is authorised as no blasting plans have been provided.

You are reminded that if there is any inconsistency between the approved document and the conditions of approval, then the requirements of the conditions of approval prevail.

Please ensure you make the document and this approval letter publicly available on the project website.

If you wish to discuss the matter further, please contact [REDACTED] or [REDACTED]

Yours sincerely

[REDACTED]

Director
Infrastructure Management

As nominee of the Planning Secretary