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SYDNEY METRO EASTERN TUNNELLING PACKAGE

Detailed Noise and Vibration Impact Statement - The Bays

21 December 2023

John Holland CPB Contractors Ghella Joint Venture

TM372-02-1-01F01 SMW-ETP_DNVIS-TBY (revC)

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Contents

List of tables

List of figures

1 Introduction

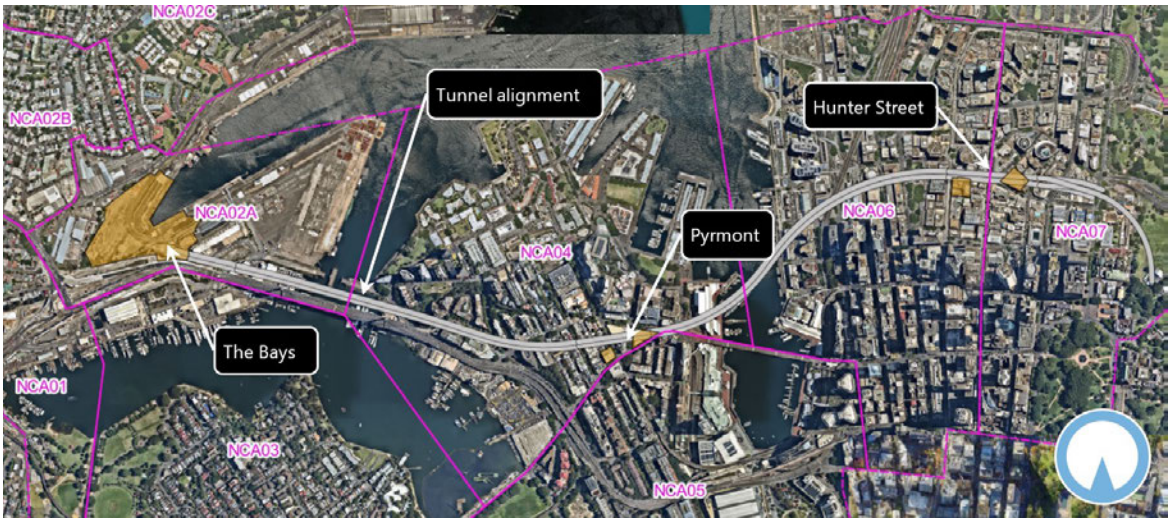
1.1 Purpose and application

This Detailed Noise and Vibration Impact Statement (DNVIS) has been prepared on behalf of John Holland CPB Ghella Joint Venture (JCG) in accordance with the Sydney Metro Construction Noise and Vibration Standard (CNVS)[1] for the construction of the Sydney Metro West – Eastern Tunnelling Package (ETP) Works. This DNVIS has been prepared to satisfy Planning Approval (SSI 19238057) Condition D29.

1.2 Overview

Sydney Metro West ETP is Stage 2 of the Sydney Metro West 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 Project includes all major civil construction work including station excavation (at Pyrmont and Hunter Street Station (Sydney CBD) construction sites) and tunnelling between The Bays and Sydney CBD. An overview of the construction work locations for Sydney Metro West ETP is presented in Figure 1.1.

Figure 1.1: Overview of Sydney Metro West ETP construction work between The Bays and Sydney CBD



The aim of this assessment is to minimise the impact of construction noise and vibration on sensitive receivers and demonstrate compliance with relevant Conditions of Approval, the CSSI Stage 2 Environmental Impact Statement (EIS)[4], the Revised Environmental Mitigation Measures (REMMs) included in the Submissions Report [6] and the Construction Noise and Vibration Management Plan (CNVMP) (SMWSTETP-JCG-SWD-SW000-EN-PLN-002019).

1.3 Detailed Noise and Vibration Impact Statement

This DNVIS provides a quantitative noise and vibration assessment of activities and/ or locations where construction work will occur. It clarifies details provided in the EIS Noise and Vibration technical Paper [4], updated to include the more detailed information available at the detailed design and construction planning stage of the Project. This DNVIS is structured to meet the requirements of Condition of Approval D29 and the CNVS, including specific mitigation measures to be implemented for the duration of the assessed works, identified through consultation with affected sensitive land user(s).

This DNVIS provides a noise and vibration assessment of the ETP works at The Bays worksite that are required to be completed within and outside of standard construction hours. Note that this DNVIS excludes the tunnelling works associated with mainline tunnels. Tunnelling works are assessed in a separate DNVIS (ref: TM372-02-1-04F01 SMW-ETP_DNVIS-TUN).

The works covered by this DNVIS will be undertaken in accordance with the CEMP (incorporating the CNVMP), following its approval.

1.4 Quality assurance

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Construction works and hours

2.1 Construction works addressed in this DNVIS

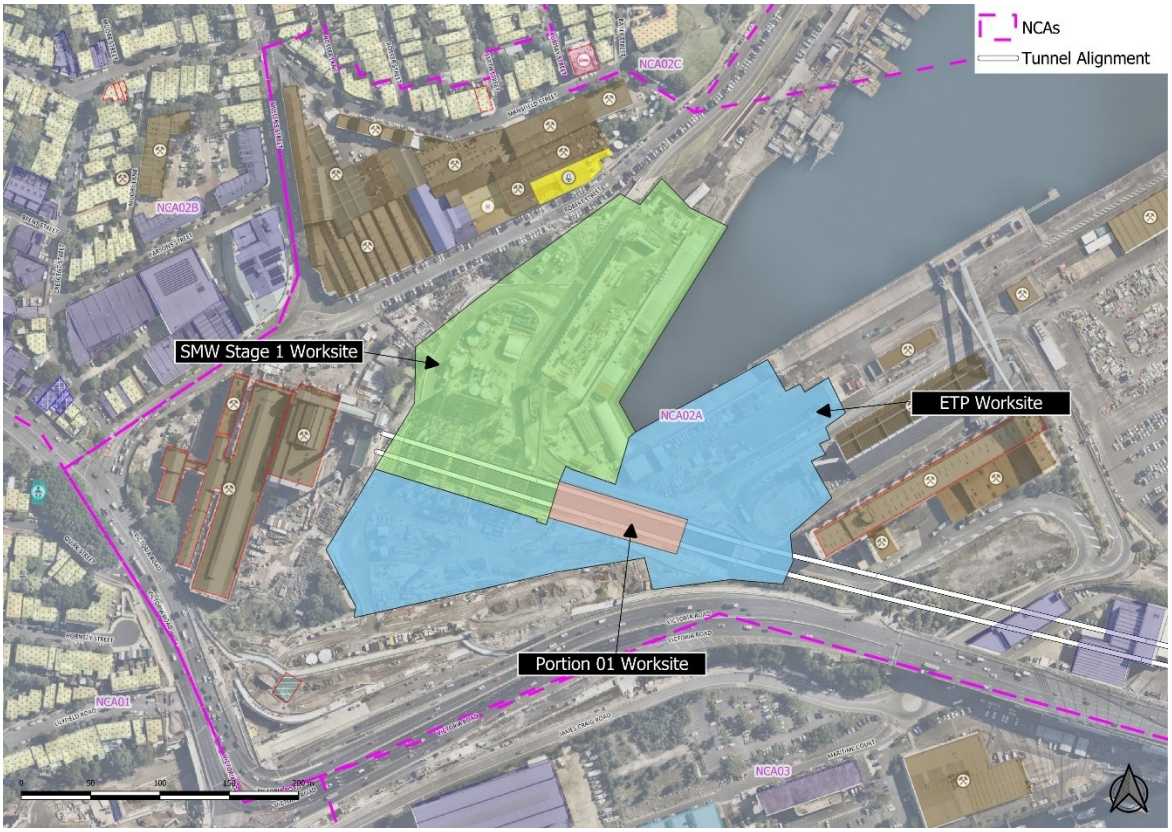
2.1.1 Location of worksite

The Bays worksite has already been established as part of the Sydney Metro West Stage 1 (SSI-10038). The site is located to the east of the former White Bay Power Station and north of Anzac Bridge. The worksite will occupy the eastern end of the station box constructed by CTP, with the bulk of the ETP worksite located to the south of the station box, and part of the site located to the northeast of the Stage 1 worksite.

When TBM tunnelling is complete, Portion 01 of the station box will be handed over to the station build contractor. Access to the ETP portals will be from the eastern most section of the station box only, to support the remainder of cross passage excavation and tunnel backend works.

The construction worksite location is shown in Figure 2.1 below. The CTP worksite will operate concurrently with the ETP worksite.

Figure 2.1: The Bays worksite



2.1.2 Construction works

The Bays ETP works will be delivered through the sub-stages outlined below. Grey text indicates works not included in this issue of the DNVIS. These works will be incorporated in future updates of the DNVIS when more detail regarding the stage of works is known.

- Stage 1
  - Site Establishment: establish construction facilities; acoustic shed and slurry treatment plant (STP) construction;
  - Tunnel excavation and support.
- Stage 2
  - TBM delivery and assembly;
  - TBM support
- Stage 3 (post Portion 1 handover)
  - Acoustic segment shed and plant demobilisation (on surface in Portion 01);
  - Tunnelling & Support: ongoing works in tunnels (XPs etc), tunnel lining and support;
  - Tunnelling back end works and support: cross passages and inverts.
- Stage 4
  - Demobilisation.

The works are proposed to be undertaken during standard construction hours. Some works will also be completed outside standard construction hours, where this is necessary and the out of hours works (OOHW) are justified (see Section 2.2.1). The works are summarised in Table 2.1.

Table 2.1: Summary of construction works under this DNVIS

Activity/ work area	Aspect	Construction hours	Timing of activity
STAGE 1: Site Establishment	Acoustic Shed and STP Erection	Standard hours + OOHW (D/E)	Jun-23 to Mar-24
	Establish construction facilities	Standard hours + OOHW (D/E)	Jun-23 to Mar-24
STAGE 1: Tunnel excavation and support	Tunnel excavation, support, and spoil handling/ earthwork	Standard hours + OOHW (D/E/N)	Oct-23 to Mar-24
STAGE 2: TBM Delivery/ Assembly	TBM delivery (on surface)	Standard hours + OOHW (D/E/N)	Mar-24 to Mar-24
	TBM assembly (in station box)	Standard hours + OOHW (D/E/N)	Mar-24 to Jun-24
STAGE 2: TBM Support	Tunnelling & Support	Standard hours + OOHW (D/E/N)	Jun-24 to Jan-25
STAGE 3: Tunnel Support (Post Portion 01 Handover)	Acoustic segment shed and plant demobilisation (on surface)	Standard hours + OOHW (D/E)	Oct-24 to Jul-25
	Tunnelling & Support (cross passages)	Standard hours + OOHW (D/E/N)	Oct-24 to Jul-25

Activity/ work area	Aspect	Construction hours	Timing of activity
	Tunnelling back end works and support	Standard hours + OOHW (D/E/N)	Sep-24 to Dec-25
Demobilisation	(not assessed in this issue of DNVIS	Standard hours + OOHW (D/E)	Aug-25

Notes: 'OOHW' means Out of Hours works, or work outside the standard construction hours (see Section 2.2)

'OOHW(D)' is the OOH 'Day' period; 8am to 6pm Sunday

'OOHW(E)' is the 'Evening' period, 6pm to 10pm Monday to Sunday

'OOHW(N) is the OOH 'Night' period, 10pm to 7am Sunday/Monday to Thursday/ Friday; 10pm to 8am Friday/Saturday and Saturday/ Sunday

Grey text indicates works not included in this issue of the DNVIS

A detailed summary of the construction activities assessed in this report is presented in Section 5.1 and in Table C.1 of APPENDIX C.

2.1.3 Construction traffic

When construction related traffic moves on the public road network, a different noise assessment methodology is appropriate as vehicle movements would be regarded as additional road traffic on public roads rather than as part of the construction site's activities.

Roads forming the primary haul routes to and from The Bays tunnel launch and support site would include City West Link, A4-City West Link Road, James Craig Road, Port Access Road, Sommerville Road and Solomons Way. Primary site access would be right-in, left-out via Solomons Way.

The proposed truck routes are shown in Figure 2.2

Figure 2.2:The Bays worksite heavy vehicle route

Source: Sydney Metro West Environmental Impact Statement - Major civil construction between The Bays and Sydney CBD [4]

These roads are arterial and sub-arterial roads with typically moderate to high traffic volume, including heavy vehicles. The worksite will generate additional traffic movements in the form of:

- Light vehicle movements generated by construction personnel travelling to and from work
- Heavy vehicle movements generated by:
  - Delivery vehicles bringing raw materials, plant, and equipment to the site (typically standard hours, except for oversized deliveries)
  - Spoil trucks removing spoil from the site (typically standard hours, with out-of-hours spoil handling during tunnelling support)
  - Concrete trucks bringing concrete to the site (typically standard hours, with out-of-hours spoil handling during tunnelling support)

Construction traffic noise, related to the public road network, is addressed in Section 8.

2.2 Construction Hours

Construction hours for the Project are outlined in Conditions of Approval D21, D22 and D23. Table 2.2 below consolidates the information provided in these Conditions regarding construction working hours for the Project.

Table 2.2: Working hours for construction worksite

CoA	Construction Activity[9]	Monday to Friday	Saturday	Sunday / Public holiday
D21	Standard construction	07:00 to 1800	08:00 to 18:00	No work[1]
D22	Highly noise intensive works[2]	08:00 to 18:00 (plus respite[2])	08:00 to 13:00 (plus respite[2])	No work[1]
D23(a)	Safety and emergency work	18:00 to 07:00	18:00 to 08:00	08:00 to 0:700
D23(b)	Low noise impact work[3]	18:00 to 07:00	18:00 to 08:00	08:00 to 07:00
D23(c)	Works approved under an EPL or Out-of-Hours Work Protocol or through negotiated agreement with directly affected residents and sensitive land user(s)	18:00 to 07:00	18:00 to 08:00	08:00 to 07:00
D23(d)	Prescribed activity: ▪ Tunnelling (and associated activities of rockbolting, shotcreting and mucking out, but excluding cut and cover tunnelling and surface works)[4] ▪ Delivery of material to directly support tunnelling activities ▪ Haulage of spoil ▪ Work within an acoustic shed or enclosure[5].	24 hours	24 hours	24 hours

Notes:

1. No work unless permitted and approved.
2. Minimum respite from highly noise intensive works of not less than one (1) hour between each continuous block of works not exceeding three (3) hours.
3. Construction that causes $L_{Aeq(15\ minute)}$ noise levels no more than 5dB(A) above the Rating Background Level (RBL) at any residence; and/or no more than the 'noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s). Construction that causes continuous/impulsive/intermittent vibration values at the most affected residence, no more than the preferred values for human exposure to vibration, specified in Table 2.2 and Table 2.4 of the AVTG.

4. Tunnelling does not include station box excavation and the requirements of Condition D26 apply.
5. 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.

2.2.1 Justification for OOHW

Stage 1 site establishment and sub tunnel excavation, including construction facilities, acoustic shed and STP construction will mostly be completed during standard construction hours, with some OOHW where low impact requirements are met, as per Condition D23(b). Similarly, Stage 2 TBM delivery would be undertaken during standard hours, with OOHW where low impact requirements are met.

Activities during Stage 2 TBM Support and Stage 3 tunnel support works that fit the defined prescribed activities under condition D29(d) are permitted 24 hours a day. Stage 2 and 3 works that do fit the defined prescribed activities under condition D29(d) would be undertaken during standard hours, with OOHW where low impact requirements are met.

Out-of-hours work under CoA D29(c) would be undertaken through the Sydney Metro West Out of Hours Works Protocol [3] (OOHW Protocol) prepared for the project or under the Environment Protection Licence (EPL) number 21784 for works subject to an EPL.

All reasonable and feasible mitigation and management measures will be implemented to reduce noise from the works to within NMLs.

2.2.2 Assessment periods

The standard hours and out of hours work (OOHW) periods for construction works are depicted in Table 2.3. The OOHW periods are further defined as OOHW Period 1 and 2, based on the CNVS [1].

Construction traffic is assessed over a fifteen-hour day period, between 7am and 10pm (typically standard hours plus OOHW Period 1) and a nine-hour night period, between 10pm and 7am (typically OOHW Period 2). This is consistent with the NSW Road Noise Policy [10] and the CNVS [1].

Table 2.3: Assessment periods

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									Standard construction Hours										OOHW Period 1					
Saturday																								
Sunday or Public Holiday	OOHW Period 2								OOHW Period 1										OOHW Period 2					

3 Existing environment

3.1 Land use survey

To assess and manage construction noise and vibration impact, a Land Use Survey has been undertaken to satisfy Condition D20. The Land Use Survey identifies existing land use and development along the Project alignment, including a mix of residential, commercial, and industrial uses; along with other noise and vibration-sensitive businesses, such as hotels, medical or dental surgeries and childcare facilities. At The Bays there are residential receivers to the north of the worksite and to the west, across Victoria Road.

Heritage receivers have been identified in EIS [4] and in the land use survey.

The Land Use Survey is maintained in a Geographic Information System (GIS) established for the Project and was used in the preparation of this DNVIS. The land use at the time of issue of this DNVIS is identified on an aerial photograph in Figure 3.1 (and in APPENDIX B). The land use revision date is shown in the top left corner of the drawing.

3.2 Noise Catchment Areas

Further to the Land Use Survey, residential areas have been divided into Noise Catchment Areas (NCAs) based on those established in the Environmental Impact Statement (EIS) [4] for the project. NCAs group individual sensitive receivers by common traits, such as existing noise environment and location in relation to the ETP works. NCAs relevant to The Bays worksite are identified in Figure 3.1.

3.3 Baseline noise monitoring

As part of the EIS process, baseline noise monitoring was conducted at The Bays in 2019 and 2021. Further review of the NCAs identified for The Bays 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 (WFU) project (Renzo Tonin & Associates 2020) [7].

The ambient noise monitoring locations were selected with reference to the procedures outlined in the Noise Policy for Industry (NPfI, EPA 2017)[9]. Noise monitoring was used to determine appropriate RBLs and ambient noise levels (L_{Aeq}) for each NCA. Noise monitoring was used to establish the Rating Background Level (RBL). The RBL represents the average minimum background sound level for each measurement period, averaged over the measurement days. The RBLs and average ambient noise levels for the day, evening and night assessment periods are summarised in Table 3.1 and in Table B.1 in APPENDIX B.

Table 3.1: Summary of baseline noise monitoring data from EIS

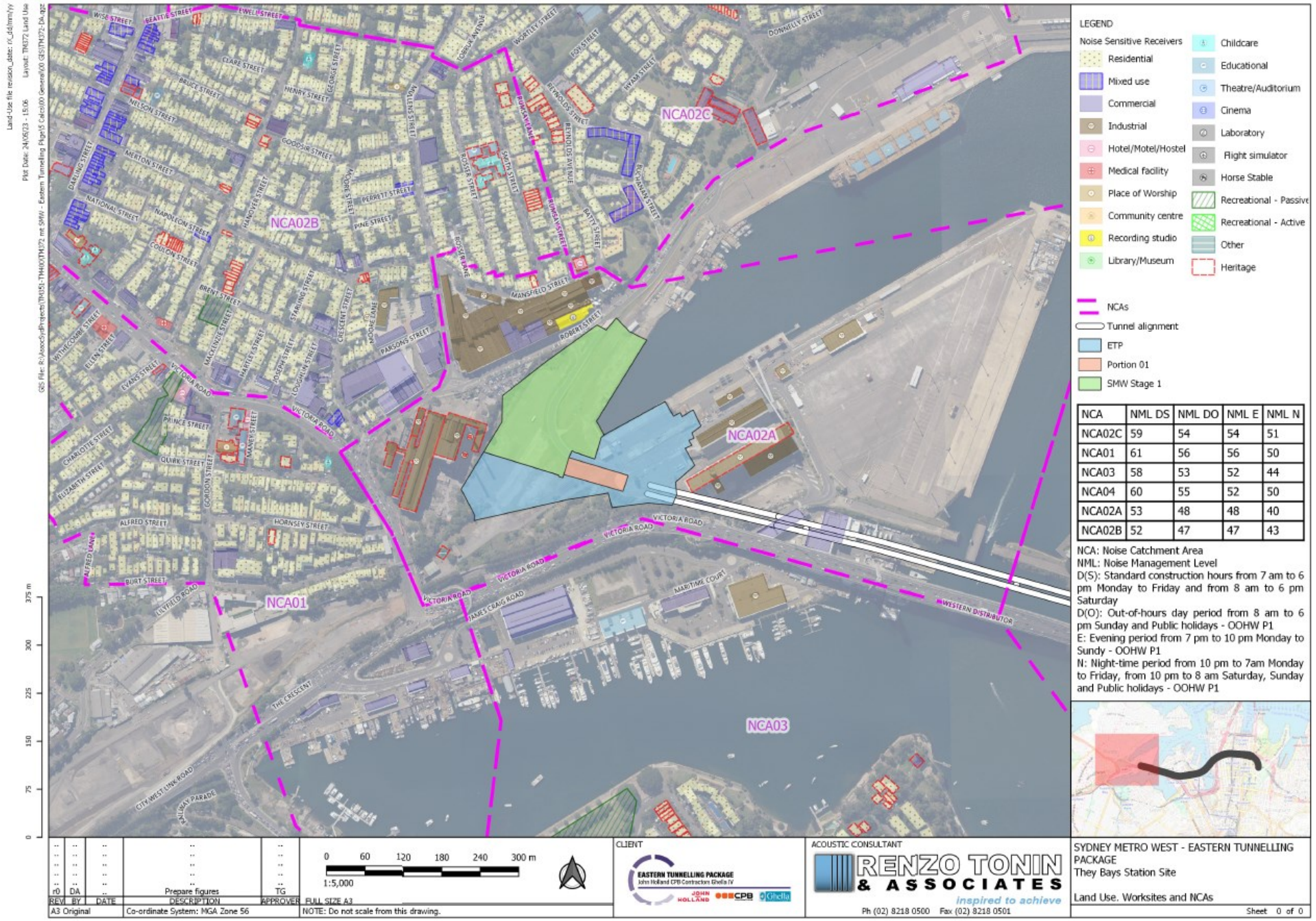
Construction work area	Monitor ID	Rating Background Noise (RBL)[1]			Ambient Noise Level ($L_{Aeq(15min)}$)[1]			Representative NCA
		Day[2]	Eve[2]	Ngt[2]	Day[2]	Eve[2]	Ngt[2]	
The Bays	B.02	51	51	45	57	57	54	NCA01
	B.01	43	43	35	56	54	47	NCA02A
	B40[3]	42	44	38	54	53	48	NCA02B
	B.35[3]	49	49	46	54	51	49	NCA02C
	B.03	48	47	39	59	58	51	NCA03

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

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

3. Noise monitoring data from Renzo Tonin & Associates 2020 [7]

Figure 3.1: Noise Catchment Areas appliable to The Bays worksite



NCA	NML DS	NML DO	NML E	NML N
NCA02C	59	54	54	51
NCA01	61	56	56	50
NCA03	58	53	52	44
NCA04	60	55	52	50
NCA02A	53	48	48	40
NCA02B	52	47	47	43

4 Construction noise and vibration objectives

Construction noise and vibration objectives are detailed in the CNVS Section 2 and the CNVMP. A summary of the objectives as applicable to The Bays worksite is provided in Table 4.1.

Table 4.1: Summary of construction noise and vibration objectives

Impact	Relevant guideline	Construction noise/ vibration objective
Airborne noise	NSW Interim Construction Noise Guideline (ICNG) [7] CNVS [1]	Construction noise management levels (NMLs) for residential receivers are based on long-term noise logging conducted on behalf of Sydney Metro to quantify ambient noise levels for the EIS [3]. During standard construction hours, a highly affected noise objective of $L_{Aeq(15min)}$ 75dB(A) applies at all residential receivers. The NMLs for 'other' sensitive receivers are from the ICNG, as reported in Section 2.2 of the CNVS. Receivers are considered 'noise affected' where construction noise levels are greater than the noise management levels identified in Table B.1 of APPENDIX B. Where construction activities are tonal or impulsive in nature and are described in the ICNG as being particularly annoying, a +5dB(A) correction must be added to the activity noise. construction related activities that could exceed the NMLs shall be identified and managed in accordance with the noise and mitigation and management measures set out in Section 9.
Sleep disturbance	Noise Policy for Industry (EPA 2017) [9] CNVS [1]	Initial screening level • L_{AFmax} ≤ 52 dB(A) or RBL + 15 dB (whichever is greater); and/ or • $L_{Aeq,15min}$ ≤ 40 dB(A) or RBL + 5 dB (whichever is greater). Where noise events are found to exceed the initial screening level, further analysis will be made to identify: • the likely number of events that might occur during the night assessment period, and • Whether events exceed an 'awakening reaction' level of 55 dB(A) L_{AFmax} (internal) that equates to NML of 65 dB(A) externally (assuming open windows).
Ground-borne noise	NSW Interim Construction Noise Guideline (ICNG) [7] CNVS [1]	Receivers are considered 'ground-borne noise affected' where construction noise levels are greater than the noise management levels identified in Table B.2 of APPENDIX B.
Construction traffic	ICNG refers to the NSW Road Noise Policy (RNP) [10] CNVS [1]	Construction traffic impact initial screening test: • Traffic noise levels increase ≤ 2 dB(A) because of construction traffic Where traffic noise levels increase by more than 2 dB(A): • Freeway/arterial/sub-arterial road - 60 dB $L_{Aeq(15hour)}$ day and 55 dB $L_{Aeq(9hour)}$ night • Existing local road - 5 dB $L_{Aeq(1hour)}$ day and 50 dB $L_{Aeq(1hour)}$ night

Impact	Relevant guideline	Construction noise/ vibration objective
Vibration – disturbance to building occupants	NSW 'Environmental Noise Management Assessing Vibration: A Technical Guideline' (AVTG) [11] CNVS [1]	To assess the potential for vibration impact on human comfort, an initial screening test will be done based on peak velocity units, as this metric is also used for the cosmetic damage vibration assessment. The initial screening test values are: • Critical areas - 0.28 mm/s (day or night) • Residential buildings - 0.56 mm/s (15h day); 0.40 mm/s (9h night) • Offices, schools, educational institutions, and places of worship - 1.10 mm/s (day or night) • Workshops - 2.20 mm/s (day or night). 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 as detailed in Section 2.3.1 of the CNVS and Section 2.4 of the AVTG.
Vibration – structural damage to buildings	British Standard BS 7385-2:1993 'Evaluation and measurement for vibration in buildings'[15] German Standard DIN 4150-3: 2016-12, Structural vibration - Effects of vibration on structures [16] CNVS [1]	A conservative vibration damage screening level (peak component particle velocity) per receiver type is detailed in Section 2.4 of the CNVS and outlined below: • Reinforced or framed structures: 25.0 mm/s • Unreinforced or light framed structures: 7.5 mm/s. Heritage buildings and structures found to be structurally unsound (following inspection) would adopt a more conservative vibration damage screening level (peak component particle velocity): • Heritage structures (structurally unsound): 2.5 mm/s (initial screening level). Where the predicted and/or measured vibration is greater than shown above, a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure will be completed to determine the applicable vibration limit.

5 Construction airborne noise impacts

5.1 Noise prediction methodology

Assessment of airborne noise impacts from the construction works were determined by predicting noise levels using a Cadna-A computer noise model developed for this project. The Cadna-A noise model incorporates ground elevation contours, building heights, the built environment, and atmospheric conditions to predict the contribution of each noise source at identified sensitive receiver locations and allows for the prediction of the total noise from a worksite for the various construction stages.

Key details regarding the construction work locations, the likely plant and equipment, and hours of operation were informed by the Design and Construction Teams.

A summary of the noise model input parameters is detailed in Table 5.1.

Table 5.1: Summary of noise modelling parameters

Parameters	Inputs
Calculation method	ISO 9613-2:1996 implementing quality standard ISO 17534-1:2015
Location of noise sources	0.5m to 2m above the ground depending on the equipment or plant in use
Height of receivers	1.5m above ground level to represent 1.5m above ground floor level Additional 3m height for every additional floor assessed (i.e. 4.5m above ground for first floor, 7.5m for second floor etc.)
Ground topography	1m digital ground contours
Sound power levels of plant and equipment	Detailed in Table C.1 in APPENDIX C. Activity timing, number of plant and hours of operation also in Table C1.
Ground absorption	0.5
Noise barriers and screening	Existing noise barriers and buildings providing shielding to receivers have been included in the noise model.
Acoustic sheds/ enclosures	Acoustic sheds and enclosures have been included in the noise model.
Noise source corrections	Noise source penalty corrections have been applied in accordance with Section 4.5 of the NSW Interim Construction Noise Guideline (INCG).

The noise predictions in this report represent a realistic worst-case scenario when construction occurs at a works location close to residences and other sensitive receivers. At each receiver, noise levels will vary during the construction period based on:

- the position of equipment within the worksite and distance to the receiver;
- the construction activities being undertaken;
- the noise levels of plant items and equipment
- existing noise barriers/ construction hoarding/ acoustic sheds or enclosures.

Predicted noise levels presented in APPENDIX D are the maximum noise levels for each building. Actual noise levels will often be less than the predicted levels presented in this report.

5.2 Predicted noise levels

Noise impacts during construction works have been predicted and compared to the noise management levels (NMLs). A receiver is considered construction noise affected when the predicted construction noise level is above the NML.

Table 5.3 and Table 5.4 present a summary of the number of residential receivers and 'other sensitive receivers (respectively) likely to be noise affected by the proposed activities. The tables are colour coded to indicate how much the predicted noise level is above the NML and the corresponding perceived noise impact, based on the CNVS, as noted in Table 5.2.

Table 5.2: Key to the predicted construction noise results tables

Assessment	Time of day	Key			
$L_{Aeq(15min)}$	Standard hours[1] or Outside standard hours	0-10 dB(A) above NML (green)	11-20 dB(A) above NML (yellow)	21-30 dB(A) above NML (orange)	>30 dB(A) above NML (purple)
Sleep disturbance	Night only	$L_{Aeq,15min}$ above 40 dB(A) or RBL plus 5 dB, whichever is the greater (yellow)		L_{Amax} above 52 dB(A) or RBL plus 15 dB, whichever is the greater (purple)	

Notes: 1. Highly noise affected (HNA) which is greater than 75dB(A) during standard construction hours is shown with **Bold** text and applies to residential receiver buildings only.

Table 5.3 summarises the number of construction noise affected residential receivers (i.e. receivers where predicted L_{Aeq} noise levels construction works are above the NML) and the likely perceived noise impact.

Table 5.4 presents the number of construction noise affected other sensitive receivers. Detailed predicted L_{Aeq} noise levels for all receivers in each NCA are presented in Table D.1 of APPENDIX D.

The impacts presented below and in Table D.1 are the maximum predicted noise levels for each activity based on the plant and equipment operating in the closest location relative to the receiver, for The Bays worksite. The cumulative impact from both construction sites operating concurrently is unlikely to add more than 2 dB(A) to the overall airborne construction noise level. To allow for changes to the construction program, cumulative impacts from the worksite can be reviewed in the Appendix D spreadsheet on a case-by-case basis, based on the activities likely to be occurring concurrently.

Table 5.3: Number of receiver buildings over the airborne noise management level (all NCAs) – residential receivers

Worksite	Construction activity	Assessment reference[1]	Highly noise affected[2, 3]	Day (standard hours)[2]				Day (outside standard hours)[2]				Evening[2]				Night[2]				Sleep disturbance[2]	
			L_{Aeq}	L_{Aeq}				L_{Aeq}				L_{Aeq}				L_{Aeq}				L_{Aeq}	L_{Amax}
			> 75 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	> 40 or RBL+5 dB(A)	> 52 or RBL+15 dB(A)
The Bays	STAGE 1: Site Establishment/ Tunnel excavation, support and spoil handling	S1	0	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	STAGE 2: TBM Delivery/ Assembly	S2-TBM(A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	STAGE 2: TBM Support	S2-TBM(S)	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	33	0
	STAGE 3: Tunnel Support (Post Portion 01 Handover)	S3	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0	68	0

Note: Construction noise level cells are shaded based upon the predicted worst case NML exceedance in accordance with the key presented in Table 5.2

1. For detail, refer to Table C1 in APPENDIX C

2. Highly noise affected applies to residential receivers, as per the ICNG.

Table 5.4: Number of other sensitive receivers over the airborne noise management levels (all NCAs)

Worksite	Construction activity	Assessment reference	Commercial[1]				Childcare[1]				Educational[1]				Recreational[1]				Places of worship[1]				Hotel/Motel/ Hostel[1]				Other[1]			
			1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)
The Bays	STAGE 1: Site Establishment/ Tunnel excavation, support and spoil handling	S1	1	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	STAGE 2: TBM Delivery/ Assembly	S2-TBM(A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	STAGE 2: TBM Support	S2-TBM(S)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	STAGE 3: Tunnel Support (Post Portion 01 Handover)	S3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Note: Highly noise affected does not apply to OSRs, as per the ICNG.

1. Commercial, recreational, and other sensitive receivers have been assessed against the respective NMLs (see Table B1 in APPENDIX B), and exceedances have been presented in the count table. 'Other' includes industrial receivers, television or recording studios. For more detail on specific impacts to receivers refer to Appendix D (Table D.1)

2. Impacts only applicable when facility is in use.

5.2.1 Standard construction hours

The results summarised in Table 5.3 and Table 5.4 show that no residential and other sensitive receivers are expected to be construction noise affected by all the works at The Bays during standard construction hours except during the Stage 1 works (i.e. Site establishment and tunnel excavation support). No residential receivers will be highly noise affected (i.e exposed to construction noise above $L_{Aeq(15min)}$ 75 dB(A)).

The predicted noise levels indicate that one (1) film recording studio (56-58 Robert Street, Rozelle) may be construction noise affected during standard construction hours for all stages of work. Consultation with the film recording studio has been undertaken as part of the SMW Stage 1 works and no enquiries or complaints have been made to date. Construction noise may be more than 10dB(A) above the NML during the during the noisier Stage 1 works, such as rockhammering on the surface during the establishment of construction facilities. This rockhammering is likely to be short term and would be managed with respite periods and through consultation with noise affected sensitive receivers to minimise impacts (see Section 9.1 and 9.2). Construction noise is predicted to be within 10dB(A) of the NML during the tunnel support works during Stage 2 and Stage 3.

Mitigation and management measures to reduce construction noise levels towards the standard construction hours NML are summarised in Section 9. Consultation requirements are summarised in Section 9.1 and 9.2.

5.2.2 Out of hours work

The results summarised in Table 5.3 and Table 5.4 show that there will be no construction noise affected residential receivers where works are undertaken outside standard construction hours in the day and evening period. There may be construction noise affected residential receivers where works are undertaken during the night period. During Stage 2 TBM assembly works, out-of-hours works will only occur where the works meet low impact requirements, as outlined in Section 2.2.1. Works and activities will be managed to ensure construction noise levels are below the NMLs.

During Stage 2 TBM support works and Stage 3 Tunnelling and Support works are permitted 24 hours a day, as outlined in Section 2.2.1. All reasonable and feasible mitigation measures have been implemented into the design of the site, including (but not limited to) the installation of a spoil shed to mitigate spoil handling, and enclosed slurry treatment plant, and a segment shed to reduce noise from out-of-hours segment and concrete deliveries to support the tunnelling works. Other mitigation and management measures are detailed in Table C1 and Table C2 in APPENDIX C. Predicted noise levels are marginally above NML (i.e. within 2 dB(A) of NML) at 19 receivers in NCA01, 02A, 02B and 03. There are 14 receivers in NCA01 where predicted noise levels are within 3 to 6 dB(A) of the NML. It is noted that this predicted noise level represents the typical worst case scenario, with tunnelling at peak operation. It is likely that noise from the site will be lower, especially during the night period.

Predictions are based on a worst-case scenario that everything noted in Table C1 is occurring at the same time, which may not occur on site. Actual noise levels are likely to be lower than the predicted noise levels. The Stage 2 TBM support works and Stage 3 Tunnelling and Support works would be subject to verification monitoring to confirm all reasonable and feasible mitigation measures have been implemented and that actual noise levels are consistent with or below predictions.

Mitigation and management measures to reduce construction noise levels towards the out-of-hours hours NML are summarised in Section 9.

5.2.3 Sleep disturbance

The results summarised in Table 5.3 show that there are residential receivers expected to experience construction noise levels above the $L_{Aeq(15min)}$ sleep disturbance criteria by the works undertaken at The Bays during the night period based on a worst-case scenario that everything noted in Table C1 is occurring at the same time. No residential receivers are predicted to experience L_{AFmax} noise events greater than the awakening criterion.

Mitigation and management measures to reduce construction noise levels towards the sleep disturbance are summarised in Section 9.

5.2.4 Cumulative noise impacts (other projects)

Other significant infrastructure projects located near the ETP worksite have been considered in this assessment using the noise and vibration impacts statements publicly available including for Sydney Metro West Central Tunnelling Package (CTP) [20], WestConnex Rozelle Interchange (RIC) [22] and Western Harbour Tunnel Southern Tunnelling Package (WHTS) [21]. Potential cumulative impacts were estimated based on predicted noise levels presented in the reports.

Table C3 in APPENDIX C presents the indicative construction timeline for the Project, and includes the timeline for works associated with CTP, RIC and WHTS. CTP TBM Operation works overlap with the ETP works until August 2024. The predicted noise levels in the DNVIS prepared for CTP The Bays are includes TBM assembly, TBM operation and support, and site decommissioning. TBM operation and decommissioning are the only activities that overlap with ETP. The CTP site is located to the northern side of the SMW site and at worst, noise from the ETP works at night may add 1-2 dB to the noise from CTP works at receivers north of The Bays in NCA02B and NCA02C; and 1-3 dB to the noise from CTP works at receivers west of The Bays in NCA01This marginal increase is unlikely to be noticeable at the receiver.

Predicted noise levels for WHTS are below NML at all receivers during the day, evening, and night periods. The WHTS worksite is located on the western side of Victoria Road, more than 500 metres from the ETP worksite. The WHTS works are unlikely to add to noise generated by the ETP works.

The RIC project will be completed in November 2023. The works being undertaken are finishing works, which include landscaping, pedestrian bridges, and portal works. The works will mostly be during

standard construction hours, except where works need to be completed under Road Occupancy Licence (ROL). The forecast night works are limited, and typically only for 2 to 3 nights until June 2023. OOHW undertaken at The Bays during this period would need to meet the low noise impact requirements of condition D23(b). At worst, noise from the ETP works may add 1-2 dB to the noise from RIC works at night, which is unlikely to be noticeable at the receiver. For other assessment periods the impact is negligible.

6 Ground-borne noise impacts

The works undertaken at The Bays will be surface works to support tunnel excavation. Due to the nature of surface works, airborne noise is expected to be much higher than ground-borne noise levels at the nearest sensitive receivers. In addition, the nearest sensitive receivers to the worksite are more than 150 metres from the works area. On this basis, the potential impact of ground-borne noise from the construction activities is expected to be negligible. Therefore, the risk of annoyance due to ground-borne noise is considered low and has not been addressed further in this DNVIS.

Ground-borne noise impacts associated with TBM tunnelling and cross passage excavation are addressed in the tunnelling DNVIS (ref: TM372-02-1-04F01 SMW-ETP_DNVIS-TUN).

7 Construction vibration impacts

7.1 Vibration assessment methodology

7.1.1 Vibration intensive activities

From the plant and equipment listed in APPENDIX C, the site establishment activities with dominant vibration generating plant and equipment include:

Table 7.1: The Bays vibration intensive activities and plant items

Activity/ work area	Aspect	Vibration intensive plant
STAGE 1: - Site establishment - Tunnel excavation	Acoustic Shed and STP Erection	Nil
	Establish construction facilities	Excavator 30T (Hammer); Wacker Packer
	Tunnels excavation & support	Excavator 25t (Hammer); Excavator 8t (Hammer); Bolting rig Robodrill 525
STAGE 2:	TBM delivery/ assembly	Nil
	TBM Support	Nil
STAGE 3: Post Portion 01 handover	Acoustic segment shed and plant demobilisation (on surface)	Nil
	Tunnelling & Support	Nil
	Tunnel backend works	Nil
Demobilisation	...	

Potential vibration generated to receivers is dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration, and the receiver structure. The recommended minimum working distances for vibration intensive plant in Table 7.2 are taken from a database of vibration levels measured at various sites or obtained from other sources (e.g. BS5228-2:2009). They are not specific to the Project works as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

Potential impacts are identified by determining the buildings/ structures likely to be within the recommended minimum working distances, taking into consideration the vibration intensive plant in use, location of works and distance to nearest affected receiver buildings/ structures.

7.1.2 Minimum working distances for vibration intensive plant

Site specific minimum working distances for vibration significant plant items must be measured on site where plant and equipment is likely to operate close to or within the recommended minimum working distances for cosmetic damage (Table 7.2).

Table 7.2: Recommended minimum working distances (m) for managing vibration impact based on screening criteria

Vibration sensitive receiver	Minimum working distances for vibration intensive plant, m				
	Drill Rig (percussive)	Excavator 8T (Hammer)	Excavator 25T (Hammer)	Excavator 30T (Hammer)	Wacker Packer
Structural damage to buildings					
Reinforced or frame structures (Line 1)[1]	5	5	5	5	5
Unreinforced or light framed structures[1, 2]	5	5	5	5	5
Structurally unsound heritage structures[1, 2]	5	10	15	15	5
Disturbance to building occupants					
Critical areas[4,7]	20	30	40	40	25
Residences – Day	10	20	25	25	15
Residences – Night	-	-	-	-	-
Offices[6,7]	5	15	20	20	10
Workshops[7]	5	10	15	15	5

Notes: 1. Initial screening test criteria reduced by 50% due to potential dynamic magnification in accordance with BS7385.

2. In accordance with CNVMP, a building condition survey should determine whether a heritage structure is structurally unsound.

3. Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method. Jackhammers/ plate compactors are likely to have minimum working distances smaller than 5 m.

4. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.

5. Daytime is 7 am to 10 pm; Night-time is 10 pm to 7am.

6. Examples include offices, schools, educational institutions, and place of worship.

7. Applicable when in use.

7.2 Vibration assessment

The numbers of buildings which are close to or within the minimum working distances for vibration impact are shown in Table 7.3. More detailed results are presented in APPENDIX F. The figure in APPENDIX F identify the minimum working distances for the worst-case vibration intensive plant (excavator 30T (hammer)) with aerial photographs that also show the work areas and land uses.

Table 7.3: Number of buildings within minimum working distances for vibration impact

	Number of buildings within minimum working distances				
	Drill Rig (percussive)	Excavator 8T (Hammer)	Excavator 25T (Hammer)	Excavator 30T (Hammer)	Wacker Packer
Structural damage to buildings					
Reinforced or frame structures (Line 1)[1]	0	0	0	0	0
Unreinforced or light framed structures[1, 2]	0	0	0	0	0
Structurally unsound heritage structures[1, 2]	0	(1)	(1)	(1)	0

	Number of buildings within minimum working distances				
	Drill Rig (percussive)	Excavator 8T (Hammer)	Excavator 25T (Hammer)	Excavator 30T (Hammer)	Wacker Packer
Disturbance to building occupants					
Critical areas[2,7]	0	0	0	0	0
Residences – Day	0	0	0	0	0
Residences – Night	0	0	0	0	0
Offices[4,7]	0	0	0	0	0
Workshops[7]	0	0	0	0	0

Notes: 1. Site inspection should determine structural conditions of all potentially vibration affected buildings

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.

3. Daytime is 7 am to 10 pm; Night-time is 10 pm to 7am.

4. Examples include offices, schools, educational institutions, and place of worship.

5. Applicable when in use.

7.2.1 Structural damage

During vibration intensive works at The Bays worksite, there are no non-heritage structures identified at risk of cosmetic damage for all vibration intensive plant.

Where plant is required to operate within minimum working distances, works will be paused and the construction methodology will be revised to ensure the vibration intensive plant only operates outside the minimum working distance. Alternatively, vibration monitoring is recommended to determine site specific minimum working distances to verify that vibration levels achieve compliance with the structural damage objectives as outlined in Section 4.

Where plant is required to operate within minimum working distances, vibration monitoring is recommended to determine site specific minimum working distances and/or verify that vibration levels achieve compliance with the structural damage objectives, as outlined in Section 9.6.3.

If the monitoring above identifies that vibration is likely to exceed the structural damage objectives, a different construction method with lower source vibration levels should be considered.

7.2.2 Heritage structures at The Bays

The nearest heritage structures to the work area are the following:

- White Bay Power Station, 165 Victoria Road, Rozelle (Heritage Listing No 01015) – located 7 metres from the site boundary adjacent to a storage and laydown area and approximately 15 metres from the site access road.
- Glebe Island Silos, Lot 10, Sommerville, Rozelle (Heritage Listing No 4560016) – located 15 metres from the site parking.

Of these heritage structures, the former (White Bay Power Station) is identified within the recommended minimum working distance for the conservative screening limit for cosmetic damage for 'structurally unsound' structures, as noted in Table 7.3. As the storage and laydown area adjacent to the site boundary has been constructed, it is unlikely that the vibration intensive activities and plant items identified in Table 7.1 will need to operate within the minimum working distances identified in Table 7.2. Works near the heritage structures would be managed to ensure the vibration intensive activities (see Table 7.1) will only occur outside the minimum working distances. The risk of vibration impact from ETP works is considered low. Note that this area is currently being used for the SMW Stage 1 Central Tunnelling Package works.

Where a building condition report on this building finds it to be 'structurally unsound', vibration monitoring and review of construction methodology would be undertaken as outlined in Section 7.2.1.

7.2.3 Human annoyance

The assessing vibration guideline [9] notes that inside dwellings, adverse comments often arise when occupants can perceive (feel) vibration, particularly when the vibration arises from a source located outside their home (or outside their control) and assume that the vibration has the potential to damage their building or contents.

However, it is noted that vibration levels required to cause minor cosmetic damage are typically 10 x higher than levels that will cause disturbance to building occupants. 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 worksite, it is possible that the nearest receivers will be able to feel vibration levels when vibration-generating equipment is being utilised. Properties where vibration levels may be above the vibration disturbance goals in Table 4.1 and there is a probability of adverse comment are shown in Table 7.3. It is important to note that human comfort levels are much lower than vibration levels likely to result in property damage and people therefore may be disturbed by vibration with no potential to result in property damage. More detailed results are presented in APPENDIX E.

As can be noted from the table above, there are no properties that may be exposed to vibration above the screening limit for human annoyance. The above assessment is based on vibration-generating equipment being operating constantly at the closest location to nearby receivers. When vibration-generating equipment operates further from the closest point, the predicted vibration levels will reduce along with the probability of adverse comment.

Attended vibration measurements are proposed to be carried out in accordance with the CNVMP Appendix A and in response to vibration complaints. If measurement results indicate events above the vibration objectives for human annoyance, vibration control and management measures will be provided to reduce vibration impact (see Section 9).

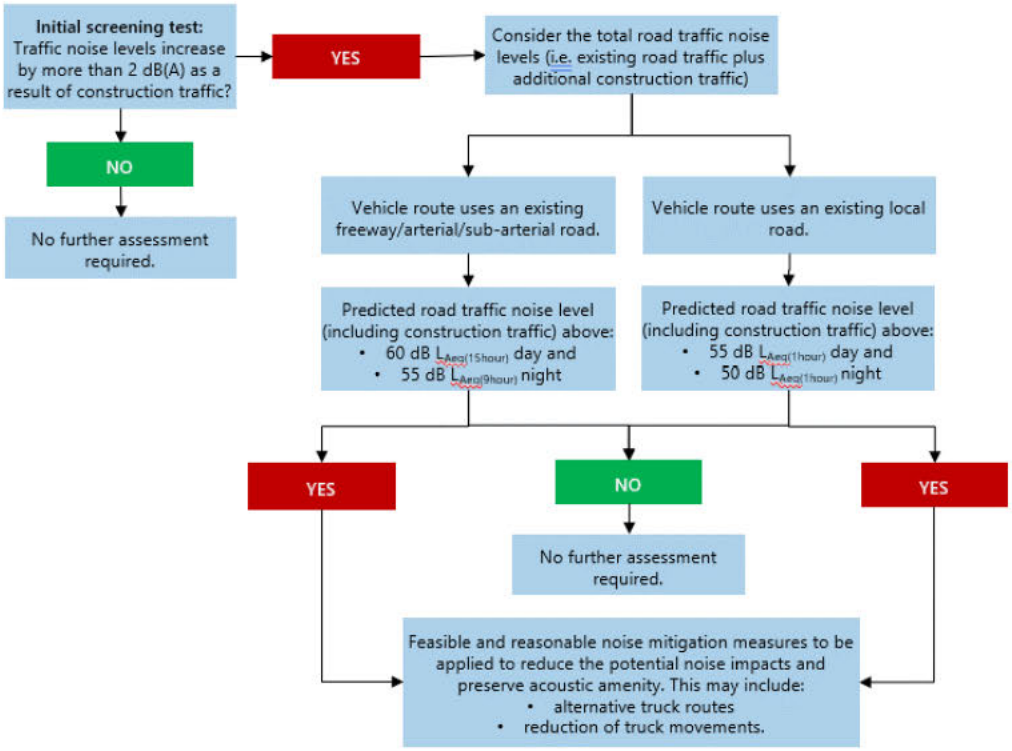
After applying all feasible and reasonable vibration mitigation measures, if vibration monitoring still identifies that measured vibration levels are above the relevant vibration criteria for human annoyance, appropriate additional management measures should be considered (see Section 9).

8 Construction traffic noise assessment

8.1 Traffic noise assessment methodology

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers which are adjacent to construction haulage routes. The construction road traffic noise assessment procedure is outlined in Figure 8.1.

Figure 8.1: Construction Road Traffic Noise assessment procedure



The potential impact of construction road traffic noise to nearby residential receivers has been estimated using the United Kingdom Department of Environment's 'Calculation of Road Traffic Noise' (1988) method. The method uses the average 1-hour traffic volume for the 'assessment period' (i.e. day or night) to predict the $L_{10,\ 1hour}$ noise levels. A correction of -3dB(A) is applied to obtain the $L_{eq,\ 1\ hour}$ noise levels which equate to the L_{Aeq} noise levels for the 'assessment period'.

Details of projected heavy vehicle movements associated with the construction works were provided by JCG (See Table C.1 in APPENDIX C) and are summarised in Table 8.1below.

Table 8.1: Construction generated traffic (refer to Table C.1)

Worksite	Activity/ Work Area	Day (7am to 10pm)		Night (10pm to 7am)	
		Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles
The Bays	STAGE 1: Site establishment and tunnel excavation	110	240	-	60
	STAGE 2: TBM delivery/ assembly	95	240	4	60

Worksite	Activity/ Work Area	Day (7am to 10pm)		Night (10pm to 7am)	
		Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles
	STAGE 2: TBM support works	95	240	4	60
	STAGE 3: Post Portion 01 handover Tunnel support works	150	240	-	60

As the proposed heavy vehicle routes have not substantially changed from the traffic routes assessed in the EIS Technical Paper 2: Noise and vibration [4], the assessment is based on the impacts presented in the EIS. Additionally, construction traffic generated during the construction stages assessed in this DNVIS will be during standard construction hours. There may be some heavy vehicles after 10 pm (e.g. concrete deliveries or oversized deliveries).

8.2 Predicted construction traffic noise

The EIS summarises the predicted construction traffic noise levels during day and night periods. The predicted change in traffic noise levels from additional construction vehicles (including heavy vehicles) accessing The Bays worksite was less than 2 dB(A). The heavy vehicle routes are consistent with the proposed routes assessed in the EIS (and Submissions Report).

Construction traffic noise impacts will be managed by limiting heavy vehicle movements to standard construction hours, with limited heavy vehicle movement after 10 pm when OOHW is triggered. On this basis it is anticipated that construction generated traffic impacts will be consistent with the EIS predicted road traffic noise levels, that is less than 2dB(A) increase on all proposed heavy vehicle routes.

9 Mitigation and management measures

9.1 High noise impact activities

9.1.1 Standard respite periods (CoA D22 and EPL)

Highly noise intensive works are defined in the Conditions of approval as 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; and

i) impact piling.

EPL 21784 defines *high noise impact activities and works as jack hammering, rock breaking or hammering, pile driving, vibratory rolling, cutting of pavement, concrete or steel or other work occurring on the surface that generates noise with impulsive, intermittent, tonal, or low frequency characteristics*. Consistent with the NSW Noise Policy for Industry [9] Fact Sheet C, the occurrence of intermittent, tonal, or low frequency characteristics is assessed at the receiver location.

Activities during site establishment, acoustic shed construction and shaft excavation works include the use of the above items. Where verification monitoring finds highly noise intensive works exceed the applicable NML, respite will be provided by limiting activities as follows to satisfy CoA D22 and the EPL Condition L5.2:

- Between the hours of 8:00am to 6:00pm Monday to Friday
- Between the hours of 8:00am to 1:00pm Saturday, and
- In continuous blocks not exceeding three hours each with a minimum respite from those activities or works of not less than one hour.

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.

Conditions D38 and D39 do not apply at The Bays.

9.2 Consultation with affected receivers

CoA D29 and D30 require consultation with noise and/ or vibration affected sensitive land users to assist in determining site-specific mitigation measures.

JCG has commenced consultation and will continue to consult with potentially affected stakeholders including Councils, businesses, and residential receivers. The consultation is focused on specific mitigation and management measures applicable to the works at The Bays worksite. These measures include managing noise impact and appropriate respite periods for out-of-hours works; scheduling high noise impact works around sensitive periods where feasible and reasonable; alternative methods of compaction to reduce vibration, substitution of plant and equipment to ones with a lower sound power level, offers of movie or dinner vouchers; alternative accommodation offers.

Details of completed consultation is recorded in the Sydney Metro Stakeholder Management System, Consultation Manager. A detailed outline of the receiver specific consultation undertaken to date and the consultation respite program derived through consultation is provided in APPENDIX G. A summary of the consultation program is provided below:

- Consultation with relevant community members on construction works, including site establishment, demolition, acoustic shed construction, tunnel excavation and TBM tunnelling support works.
- A Project wide community information session to discuss site establishment, utility and TBM support works. These sessions will occur every quarter as the Project continues.
- Residents and businesses within the 50m of the tunnel alignment will receive advise of likelihood of ground-borne noise and vibration impact during tunnel excavation, a property condition survey offer letter, and other information on tunnelling as outlined in Tunnelling DNVIS.
- Consultation with noise affected receivers identified in APPENDIX D to ensure additional management measures are provided (if required, refer to Section 9.4).
- Consultation with potentially noise and/ or vibration affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories, and operating theatres) to satisfy CoA D27 and ensure events resulting in noise levels above the NMLs are not timetabled within sensitive periods or make alternative arrangements where this cannot be avoided.
- Consultation with community that are construction noise and/or vibration affected on a regular basis on respite during out-of-hours work. To satisfy CoA D37, this consultation will include:
    - a progressive schedule for periods no less than three (3) months of likely out-of-hours work;
    - a description of the potential work, location, and duration of the out-of-hours work;

  - the noise characteristics and likely noise levels of the work; and
  - likely mitigation and management measures which aim to achieve the relevant NMLs under CoA D26, including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers (see Section 9.4 and 9.3).

- Consultation with the owners of properties identified as at risk of exceeding the screening criteria for cosmetic damage (should this occur), to satisfy Condition D31:
  - Property condition survey offer letter,
  - Community updates as shaft excavation progresses and the expected vibration impacts,
  - Where requested, specific meetings with stakeholders.

Evidence of the receiver specific consultation program and site-specific mitigation and management measures that have been adopted to date to reduce impacts to receivers is included in APPENDIX G. Consultation will continue and mitigation measures implemented as applicable to the stage of work. APPENDIX G will be updated progressively to reflect consultation completed prior to the next stage of work at The Bays. The ongoing consultation record will be entered into the Sydney Metro Consultation Manager system and included in future updates of this DNVIS.

9.3 Noise and vibration control and management measures

Noise and vibration control and management measures to reduce potential noise impacts will be implemented during the construction works, where reasonable and feasible. In accordance with the ICNG and consistent with the CNVS, feasible noise mitigation measures are those work practices or measures to reduce noise that are capable of being put into practice or of being engineered and are practical to build given project constraints such as safety and maintenance requirements. Reasonable noise mitigation measures are those feasible noise mitigation measures that are considered reasonable in the circumstances, based on a judgement that the overall noise benefits outweigh the overall adverse social economic and environmental effects, including the cost of implementing the measure. To make such a judgement, consideration is to be given to noise level impacts, duration of impacts, noise mitigation benefits, cost effectiveness of noise mitigation and community views.

Table 9.1 outlines the noise and vibration control measures that will be implemented on site during the construction works, where feasible and reasonable.

Table 9.1 Site noise control measures

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
At source control measures							
Site planning and layout	Locate noise-generating activities away from sensitive receivers, where practicable. Plan traffic flow, parking, loading/unloading, and other vehicle movements to keep vehicles away from sensitive receivers where possible and to minimise reversing movements. Use acoustic sheds and other site structures as shielding for fixed plant (e.g. water treatment plant, pumps).	The site has been designed and constructed to include this (see Figure C1).	Yes	- Potential benefit of 5-10 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Fixed noise sources such as the water treatment plant is located away from more sensitive receivers. Traffic flow is one-directional. Once constructed, loading, and unloading of heavy vehicles on site will take place within the acoustic sheds. (see Figure C1)
Noise control kits	Plant that is brought to site for works should meet the sound power limits identified in Table C1 of this assessment. Where plant are above limits then the plant may require installation of 'noise control kits' to comply with the noise limits in this assessment. Such 'noise control kits' comprise: • high performance 'residential-grade' exhaust mufflers, • additional engine cowling / enclosure lined inside with sound absorbent industrial-grade foam, and • air intake and discharge silencers / louvres.	This measure could be feasibly implemented. Subject to availability for each equipment item.	Yes	- Potential benefit of 5-10 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects.	Yes	Yes, subject to noise testing on site	The need to fit 'noise control kits' onto the identified plant, will be confirmed once each plant item is tested prior to its regular use on site, or alternative the plant will be swapped for lower noise plant. (see Table C2)
Limit equipment in use	Only the equipment necessary during each stage of the works will be used.	This measure could be feasibly implemented.	Yes	- Routine measure for project team. - Sufficient noise reduction could be achieved at enough receivers. - Cost effective.	Yes	Yes	Excess equipment will be avoided where it is not needed for the works and where it is reasonable to do without it. (see Table C1 and Table C2 for specific limitations)
Timing of equipment in use	Where practicable, activities and plant will be scheduled/limited as outlined in Table C1 and C2 (APPENDIX C) of this assessment For example, for OOHW - During site establishment (prior to acoustic shed completion) spoil handling (including use of the front end loader) will not occur during the night period (10pm to 7am).	This measure is not feasible for all works as there is limited time for works to be completed under ROL (or similar).	Not for all works	- Sufficient noise reduction could be achieved at enough receivers and cost effective etc, - Note that some of the OOHW are unavoidable due to the high risk to construction personnel or public safety triggering ROL.	Not for all works	Not for all works	Where practicable, the timing of works will be managed to reduce noise levels during more sensitive periods (i.e. after 10pm and before 7am). Noisy plant that does not require OOH operation (e.g. front end loader) will be limited to standard at the surface level, where practicable, providing a 5-15 dB reduction in noise levels.

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
Limit activity duration	Any equipment not in use for extended periods shall be switched off. For example, heavy vehicles will switch engines off when not in use.	This measure could be feasibly implemented.	Yes	- Routine measure for project team. Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Equipment that is not directly needed for works at a given time will be switched off.
Equipment selection	Use quieter and less noise/vibration emitting construction methods where feasible and reasonable, for example use rock saw to separate shaft excavation area from existing ground where practicable, to provide a reduction in GBN and vibration; vibratory rollers can, where practicable, be operated with the vibratory mode switched off to reduce vibration impact.).	This measure could be feasibly implemented. To be determined on a case-by-case basis.	Yes	- Sufficient noise or vibration reduction could be achieved at enough receivers. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Project team shall review plant and equipment on a case-by-case basis and find opportunities to use items with lower noise/vibration impacts. Careful design of the slurry treatment plant and pumps, and the ventilation fans, to reduce potential noise and vibration impacts.
Alternative construction methods to reduce vibration	Alternative, less vibration generating construction methods will be reviewed where vibration significant works found to be within the site-specific minimum working distance of a structure, as determined by site vibration monitoring. For example, the use of coring or alternative methods to reduce vibration transmission instead of rockbreaking to excavate the shaft.	This measure could be feasibly implemented. To be determined on a case-by-case basis.	Yes	- Sufficient vibration reduction could be achieved at identified structure to reduce the risk of structural damage from vibration significant works.	Yes	Yes	The use of alternative methods to reduce vibration transmission will be considered where site specific vibration assessments indicate that minimum working distances for cosmetic damage cannot be met.
Truck movements	Where practicable, avoid the use of park air brakes at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site and avoid vigorous slamming of truck doors.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Drivers will be reminded to drive responsibly on-site, especially when accessing and departing the site. Limits on truck numbers, namely for OOHW period, are identified in Table C1 and Table C2.
Non-tonal reversing alarms	Alternative reverse alarms, such as 'quackers' will be installed on all vehicles & mobile plant regularly used on site and on all vehicles & mobile plant required for OOHW.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Project team will mandate use of non-tonal reversing alarms on equipment, including for the segment shed gantry crane.
Building condition surveys	Undertake building dilapidation surveys on all buildings located within the minimum working distances established for cosmetic damage prior to commencement of activities with the potential to cause property damage (see Section 7.2.1).	This measure could be feasibly implemented.	Yes	Deemed to be cost effective. Outweighs the identified social, economic, and environmental effects.	Yes	No	No buildings are identified to be within the MWD for cosmetic damage.

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
Path mitigation measures							
Acoustic shed	Acoustic sheds with sound insulation/absorption specifications designed by Renzo Tonin & Associates will be utilised on the site for spoil handling and for the gantry crane. The enclosure design for the slurry treatment plant will be reviewed as part of the design development.	The site has been designed and constructed to include this.	Yes	- Potential benefit of at least 20 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Acoustic sheds to be constructed as early as practicable during the construction to mitigate noise during the excavation of the shaft. Note: Shed design details to be provided in next issue of this report.
Noise barriers or temporary noise screens	Erection of noise barriers around the perimeter of the site to shield sensitive receivers from noisy activities. For OOHW outside the site boundary, a temporary screen should be located around work areas as close as possible to the plant to ensure adequate shielding of the plant to receivers.	This measure is generally feasible, provided there is sufficient space to complete the works.	Yes, where there is sufficient space	- Limited noise benefit of <5 dB(A) due to site topography relative to receivers. - Sufficient noise reduction would not be achieved at enough receivers. - Deemed to be not cost effective.	No (except for temporary noise screens, as required)	No, (except for temporary noise screens, as required)	Construction hoarding to the north of the site is already in place for the Central Tunnelling Package. Temporary noise screens will be utilised on OOHW wherever is safe and practicable to do so.
Enclosures	Temporary enclosures containing key stationary noise-generating activities and/or items such as generators. The enclosure may be incorporated into the plant design (e.g. generator housing) or built on site, such as an 'acoustic tent', i.e. a structure hung with temporary noise screens (e.g. Echo-barrier, FlexShield or similar).	This measure could be feasibly implemented. Limitations as per temporary noise screens above.	Yes	- Potential benefit of 10-20 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Could be cost effective, where this is incorporated into the plant design (e.g. generator housing)	Yes, where safe to do so	Yes, as noted	Temporary enclosures will be utilised on OOHW wherever is safe and practicable to do so.

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
At-receiver							
At-property treatments	Design and installation of architectural treatments to sensitive receiver buildings to reduce internal noise levels to key rooms. It is noted that most of the properties identified as more than 2 dB(A) above the NML during Stage 2 and 3 OOHW have received at-property treatment as part of the WestConnex Rozelle Interchange project under the SSI 7485 Planning Approval requirements.	This measure could be feasibly implemented, where not already installed under SSI 7485.	Yes	Sufficient noise reduction could be achieved at enough receivers. OOHW residual impacts are marginal (<2 dB) of the OOH NML) at up to 19 properties and within 6 dB(A) of the Night NML at 14 receivers, ten of which were identified for at-property treatment WestConnex Rozelle Interchange Noise Insulation Program report (ref: RIC-JHC-PRG-00-NV-070-001). Four properties are predicted to be within 3 to 5 dB(A) of the WestConnex Rozelle Interchange Noise Insulation Program. The predictions are based on typical worst-case scenario during peak tunnelling support works. As such, the risk of exceedance occurring is considered low.	No	No	The existing on-site mitigation is considered sufficient to manage noise impacts from this worksite. The predicted OOH noise levels in found that there up to 4 residential receivers where predicted noise levels are within 3-5 dB(A) of the Night NML. At-property treatment within this range would provide limited benefit during the night period. At property treatment deemed not reasonable, subject to verification monitoring to confirm works are within or below predicted noise levels.
Noise management measures							
Site inductions & Toolbox Talks	All employees, contractors and subcontractors will receive a Project induction. The environmental component may be covered in toolboxes and should include (but is not limited to): • location of nearest sensitive receivers • relevant project specific and standard noise and vibration mitigation measures; • permitted hours of work; • OOHW Procedure and Form • construction employee parking areas.	This measure could be feasibly implemented.	Yes	Routine task for project team.	Yes	Yes	Inductions and toolbox talks will continue to be conducted for the project.
Community consultation - disseminating information	Provide information to community of construction activity and potential impacts (see Section 9.2).	This measure could be feasibly implemented.	Yes	Routine task for project team.	Yes	Yes	Updates will be distributed regularly for the duration of the project.
Community consultation - active communication with nearby sensitive receivers	Seek feedback from community to identify more sensitive times of the day, or particularly sensitive days (see Section 9.2). An example is identifying when student exams (such as Higher School Certificate exams, end of semester exams) will take place.	This measure could be feasibly implemented.	Yes	Routine task for project team.	Yes	Yes	Project team shall proactively contact nearby sensitive receivers, particularly those which may have special requirements (e.g. recording studios).

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.	This measure could be feasibly implemented.	Yes	Routine task for project team.	Yes	Yes	Project team shall monitor site behaviour and advise supervisors if issues arise or additional behavioural practices are needed.
Noise/ vibration monitoring and on-site checks	Noise/ vibration monitoring to be conducted at key locations to verify or quantify impacts at sensitive receivers, as outlined in Section 9.6. Check whether feasible and reasonable mitigation and work practices are in place, as outlined in APPENDIX C.	This measure could be feasibly implemented.	Yes	Deemed to be cost effective. Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Noise / vibration monitoring and site checks shall be carried out as detailed in this assessment.
Update DNVIS	Regular updates of the DNVIS to account for changes in noise and vibration management strategies.	This measure could be feasibly implemented.	Yes	Can be reasonably undertaken by project team where required.	Yes	Yes	Updates to the DNVIS will be carried out where required and will be reviewed regularly.
Provision of respite evenings and nights	Where OOHW are required under CoA D23(c), such as works under ROL, respite evenings and nights will be provided in accordance with the CNVS. Where after all reasonable and feasible noise mitigation measures have been implemented there are still receivers noise affected during the OOHW period, works will be programmed to ensure that works and activities do not result in noise levels exceeding NMLs at the same noise sensitive receivers on more than: • 2 consecutive evenings and/or nights at any time; and • 3 evenings and/or nights per week; and • 10 evenings and/or nights per month. Furthermore, high noise impact works will be completed before 12:00 am (midnight) where reasonable and feasible.	This measure could be feasibly implemented and updated to reflect EPL conditions, if required.	Yes	Works would be able to be undertaken at night, with respite achieved at enough receivers on nights where works are not undertaken. Deemed to be cost effective. Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Works will be planned to minimise consecutive nights of works affecting the same sensitive receiver.
Respite coordination	Consult with proponents of other construction works in the vicinity of the worksite and take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers (e.g. aligning respite evenings).	This measure could be feasibly implemented, if required.	Yes	Sufficient noise reduction could be achieved at enough receivers. Deemed to be cost effective. Outweighs the identified social, economic, and environmental effects.	Yes	Yes	Respite coordination shall be conducted with neighbouring projects.
Implement additional management measures	Identify and implement additional management measures outlined in this assessment.	This measure could be feasibly implemented.	Yes	Consistency with CNVS	Yes	Yes	Additional management measures to be identified on a case-by-case basis and with consideration of the standard mitigation and management measures outlined in this report.

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
Encourage good heavy vehicle driver behaviour	The JCG Heavy Vehicle Code of Conduct also includes several measures, including limiting of compression braking, which will ensure that noise impacts of heavy vehicle traffic on surrounding streets are minimised.						

9.4 Additional management measures

Section 5 of the CNVS directs that in instances where, after the application of all reasonable and feasible mitigation and management measures (refer to Section 9.3), the $L_{Aeq(15minute)}$ airborne construction noise and/ or $L_{Aeq(15minute)}$ ground-borne noise levels are still predicted to exceed the relevant NMLs, or if vibration monitoring at representative locations still exceeds relevant vibration objectives for human annoyance, additional management measures can be applied to further limit the risk of annoyance from construction noise and vibration. The CNVS suggests the Project should consider implementing additional management measures such as:

- **Alternative accommodation** (**AA**) options may be provided for residents living close to construction works that are likely to incur unreasonably high impacts over an extended period of time (more than 2 consecutive days). 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 objectives. 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 and management measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.
- **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.
- **Phone calls and emails** (**PC**) detailing relevant information about construction works would be made to identified noise or vibration affected stakeholders within 7 days of proposed work to provide tailored advice and the opportunity for stakeholders to provide comments on the proposed work and specific needs etc.
- **Specific notifications** (**SN**) would be letterbox dropped or hand distributed to identified stakeholders no later than 7 days ahead of construction activities that are likely to exceed the

noise objectives. This form of communication is used to support periodic notifications, or to advertise unscheduled works.

In addition, all potentially impacted receivers will be kept informed of the nature of works to be carried out, the expected noise levels and duration, as well as be given appropriate enquiries and complaints contact details (see Section 9.6.4).

9.4.1 Additional airborne noise management measures

The steps to be carried out to determine the additional airborne noise management measures to be implemented are identified in Figure 9.1.

Figure 9.1: Additional airborne noise management measures

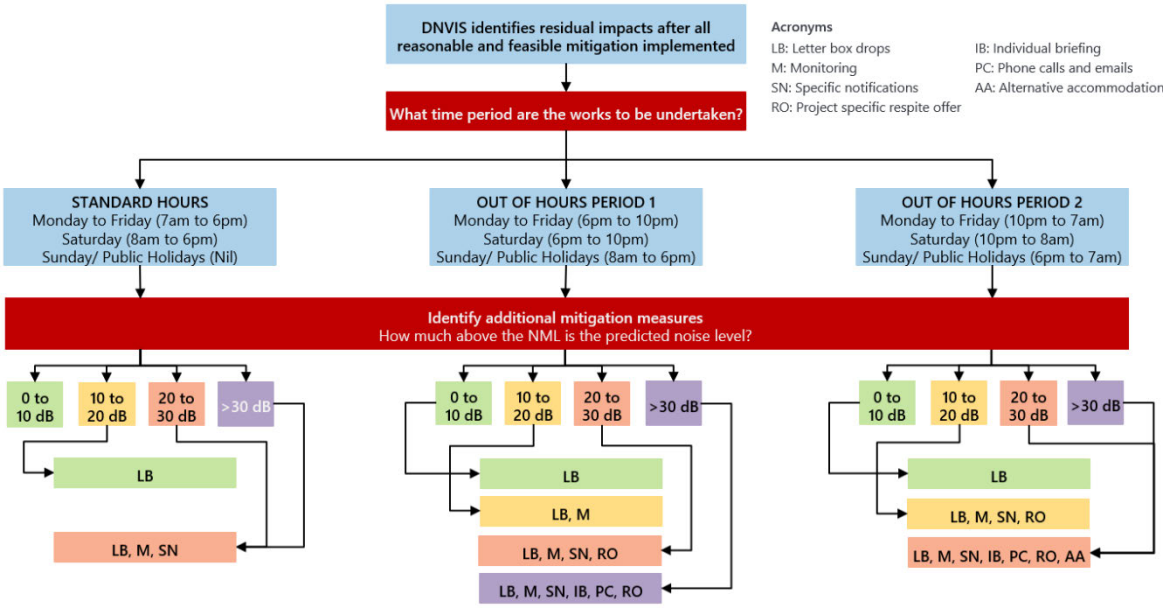


Figure 9.1 presents a summary of the additional management measures applicable for construction activities where, after application of all reasonable and feasible mitigation options, construction noise levels are still above the NMLs.

Prior to the commencement of works, receivers identified in APPENDIX D.3 will be notified to advise that noise from the works may at times be audible. Additional airborne noise management measures will be implemented as per Table D.3. Additional airborne noise management measures

9.4.2 Additional ground-borne noise management measures

The steps to be carried out to determine the additional ground-borne noise management measures to be implemented are identified in Figure 9.2.

Figure 9.2: Additional ground-borne noise management measures

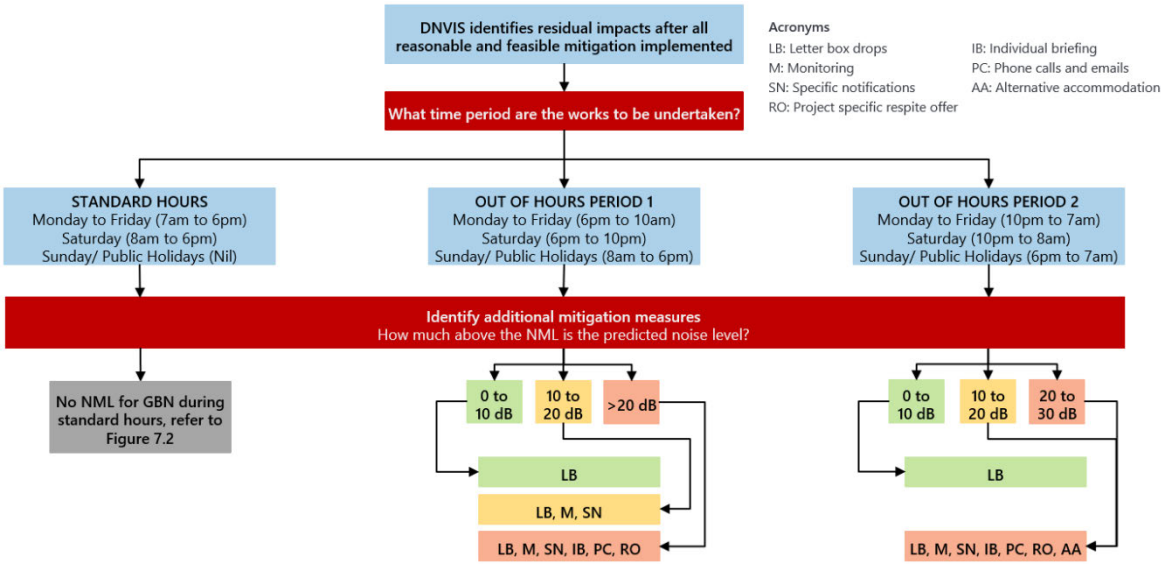


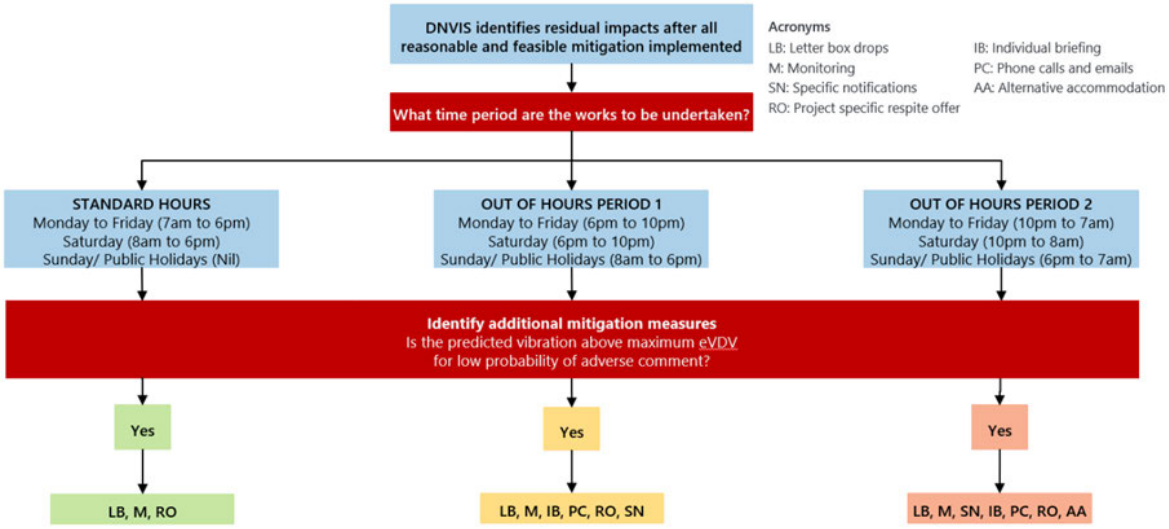
Figure 9.2 presents a summary of the additional ground-borne noise management measures applicable for construction activities where, after application of all reasonable and feasible mitigation options, ground-borne noise levels are still above the NMLs.

Prior to the commencement of works, receivers identified in APPENDIX E will be notified to advise that ground-borne noise from the works may at times be audible.

9.4.3 Additional vibration management measures

If vibration monitoring at representative locations still exceeds relevant vibration objectives for human annoyance, the appropriate additional management measures [1], presented in Figure 9.3, should be provided.

Figure 9.3: Additional vibration management measures



9.5 Managing site specific activities and cumulative noise impacts

9.5.1 Construction noise and vibration management tool (Gatewave)

This DNVIS has established the overall impacts associated with the proposed works. A 3D construction noise and vibration management tool (Gatewave, www.gatewave.com.au) is being developed specifically for the ETP Works to allow specific work areas and activities to be assessed as construction works progress. It also allows cumulative noise impact from other aspects of the Project or, where relevant noise from other construction projects, to be assessed and managed in accordance with relevant conditions of approval.

Gatewave will be used regularly to plan, assess, and manage works progressively.

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 are integrated into the Gatewave tool.

9.5.2 Managing cumulative noise impacts (other projects)

The estimated cumulative impacts from the CTP, RIC and WHTS projects under construction concurrently with the ETP works has been considered in Section 5.2.4. The potential increase in construction noise from concurrent operation of these projects was found to be low to negligible.

Regular consultation and coordination with Place Management NSW is ongoing with the aim of coordinating ETP works with other infrastructure projects being undertaken within 300 metres of the ETP worksite at The Bays to manage cumulative noise and vibration impacts through SMART principles, in accordance with Conditions C6(d), D36 and the EPL.

9.6 Real-time and attended noise monitoring

Under the CNVMP, real time noise monitoring is not required at The Bays.

Noise and vibration monitoring should follow the procedures outlined in the Noise and Vibration Monitoring Program required by condition C14 and the CNVS. Note that monitoring at all properties may be undertaken from the property boundary to limit any inconvenience to property owners. Monitoring should be undertaken at a minimum of two of the most affected locations nominated in Table 9.2.

9.6.1 Airborne noise

Attended noise monitoring is to be undertaken to verify that noise levels resulting from construction works are in accordance with the levels predicted in this report, subject to obtaining the property owner/occupier's consent to access the property (where required). Noise monitoring will be completed

in publicly accessible areas on or near the nominated receivers, typically at ground floor level. Where, following community consultation, specific sensitive receivers are identified for additional monitoring, access to the property will be sought through the Stakeholder and Community Relations team.

Table 9.2: Nominated verification monitoring locations

Type of monitoring	NCA/ Receiver type	Nominated receiver address
Attended	NCA01	5 LILYFIELD ROAD ROZELLE
Attended	NCA02B	21 SMITH STREET ROZELLE
Attended	OSR (STUDIO)	56-58 ROBERT STREET ROZELLE

Note: * To be confirmed subject to suitability of location and agreement from property owner.

APPENDIX D.3 identifies the activities where monitoring should be carried out for each NCA and additional locations, should any of the above monitoring locations be unsuitable.

9.6.2 Ground-borne noise

Not required

9.6.3 Vibration monitoring

Attended vibration monitoring not required as there are no sensitive receivers nearby to the construction works.

9.6.4 Complaints handling

Noise and/ or vibration complaints received and responded to will be managed in accordance with the JCG Community Communication Strategy prepared under Condition D52 and the Overarching Community Communications Strategy.

All noise and vibration related complaints received and responded to will be managed in accordance with the CEMP, the JCG Community Communication Strategy prepared under Condition D52 and the Overarching Community Communications Strategy. Each complaint shall be investigated and where noise and/or vibration levels are established as exceeding the set limits, appropriate amelioration measures shall be put in place to mitigate future occurrences. Management measures may include modification of construction methods such as using smaller equipment and establishment of minimum working distances as mentioned above and/or use of additional temporary screening.

Sydney Metro operate a 24-hour construction complaints line. Enquiries/ complaints may also be received through the project email mailbox (sydneymetrowest@transport.nsw.gov.au) or through the complaints hotline (1800 612 173).

10 Impact classification

The CNVS requires that on completion of a DNVIS, the subjective classification of the noise (and vibration) impact is to be evaluated and documented as:

- Low Impact
- Moderate Impact
- High Impact.

The classifications are to be determined on a case-by-case basis with consideration of the items addressed in the table below and the requirements of SSI 19238057 Condition D23 (b) which defines Low impact.

Table 10.1: Impact classification for the works – The Bays *(Stage 1, Stage 2, and Stage 3)*

No.	Impact item description	Analysis	Classification
1	The location of the works in relation to noise sensitive receivers (NSRs) with consideration of noise attenuation features such as noise barriers including topographical features (earth-mounds), buildings, dividing fences etc (distance of works from sensitive receiver(s)).	Majority of the NSRs close to The Bays worksite are industrial and commercial receivers. There are residential blocks located 150m metres from The Bays worksite to the North and West of the site. The residential receivers are located at a higher ground level than the work site, therefore noise shielding is less effective.	Low to Moderate
2	The type and sensitivity of the NSRs: - Low Impact: e.g. Commercial buildings/ Scattered Residential (low density) - Moderate Impact: e.g. Standard residential (typical density) - High Impact: e.g. Residential home for the elderly/high density unit blocks/ persistent complainers/ residents deemed to have "construction noise fatigue".	One recording studio and one place of worship are located adjacent to The Bays worksite. Closest residential receiver is located 150 metres away	Low to Moderate
3	Land use zoning and planning amenity objectives for the area.	Commercial and industrial use in the immediate vicinity, residential beyond.	Low
4	Construction and architectural design of impacted building, particularly the presence of any existing noise mitigation including that provided under a Noise Abatement Program or required by the ISEPP, Council DCP or other planning instrument.	At The Bays worksite there is a mix of commercial, industrial, and single and multi-storey residential and mixed-use residential receivers with additional façade attenuation. Single occupancy residential or older multi-storey residential are assumed to be standard construction with no extra noise mitigation, except for buildings identified for at-property treatment under the SSI 7485.	Low to moderate
5	Existing ambient levels.	Moderate existing ambient noise levels during daytime ($L_{Aeq(15min)}$ 54-59 dB(A)); evening ($L_{Aeq(15min)}$ 51-58 dB(A)); and night ($L_{Aeq(15min)}$ 48-58 dB(A)) at The Bays.	Low
6	The extent of noise exceedance above Noise Management Level.	Mitigation measures including acoustic sheds and temporary noise barriers will be implemented to reduce noise from the works, where reasonable and feasible. Impacts at The Bays are low to moderate due to the worksite being in an industrial area. Works will be programmed to ensure respite periods for receivers, as required by the CNVS and the Conditions of Approval.	Low to moderate

No.	Impact item description	Analysis	Classification
7	The likelihood for potential sleep disturbance (as described in the NPfI).	Residential receivers near the work zone may experience construction noise levels above the sleep disturbance criteria at the Bays, however OOHW are limited during the stages assessed in this DNVIS. Truck movements to and from site are limited between 10pm and 7am to reduce the potential for sleep disturbance.	Low to Moderate
8	The type of and intensity of noise emitted from works (i.e. tonal or impulsive): - Lower Impact: No high noise and/or vibration intensive activities - Moderate Impact: Short/intermittent high noise and/or vibration intensive activities - High Impact: Prolonged high noise and/or vibration intensive activities.	The proposed works consist of 'typical impact', with high noise and/or vibration intensive activities such as rock sawing or rock hammering. All reasonable and feasible measures will be applied to minimise noise and vibration impacts. Respite periods will be provided for highly noise intensive works as per Section 9.1. For OOHW under Condition D23(c), high noise activities will be completed before midnight, where reasonable and feasible. All works are typically short term, as noted in Table 2.1.	Low to Moderate
9	The duration of any OOHW required.	The 24 hours a day tunnel support works will continue for 16 months.	Moderate
10	The time frames for any OOHW: - Lower Impact: 6.00 pm till 10.00 pm weekdays 1.00 pm till 10.00pm Saturdays 8.00 am till 6.00 pm Sundays or Public Holidays. - Moderate Impact: 10.00 pm to 7.00 am Weekday Nights 10.00 pm to 8.00 am Saturdays. - High Impact: 6.00 pm to 7.00 am Sundays and Public Holidays.	Some assessed works are required to be OOHW due to the requirement for road closures. Where reasonable and feasible works would be limited to 10pm, although road closures in James Craig Road may not commence until after 9pm. High noise works will be completed before midnight, where reasonable and feasible to reduce the likelihood of sleep disturbance.	Moderate
11	As a result of noise classification and/or the noise level exceedances at sensitive receivers provided by the DNVIS report, appropriate reasonable and feasible noise mitigation is to be adopted and implemented. For sites where works are predicted to significantly exceed noise goals and impact on receivers for a significant period of time, additional reasonable and feasible noise mitigation measures such as those outlined in Section 5 of the CNVS would be considered if practical to reduce the noise levels and impact on sensitive receivers.	Mitigation measures outlined in Section 9 will be implemented to manage and reduce impacts from the works.	Low

Review of the overall noise impact of The Bays (Stage 1, Stage 2, and Stage 3) works is considered **low to moderate**. Some of the works outside standard construction hours were found to, at times, exceed the NMLs. This impact will be managed through the mitigation and management measures outlined in Section 9, including suitable community notification regarding potential impacts from the works. Mitigation measures will be implemented to reduce noise levels with the aim of achieving the NMLs and limit the overall noise impact to **low**. Where this is not feasible or reasonable, residual impacts will be managed as outlined in Section 9.4.

Properties at risk of vibration impact have been identified through the conservative screening process set out in the CNVS [1]. Vibration significant works will be managed in accordance with Section 9. The overall vibration impact of The Bays (Stage 1 demolition and Stage 2 excavation) is considered **low**.

11 Conclusion

In conclusion, construction works associated with The Bays *(Stage 1 demolition, Stage 2 excavation and Stage 3 post handover tunnel support)* have been described in this DNVIS to identify potential environmental risks associated with construction noise and vibration. Construction noise and vibration objectives have been established consistent with the conditions of approval for the Project and the EIS.

Construction airborne noise

During Stage 1 works (i.e. Site establishment and tunnel excavation and support) the predicted noise levels indicate the nearby sensitive receivers will be construction noise affected during standard construction hours. No residential receivers are predicted to be highly noise affected receivers during all works at The Bays worksite. During Stage 2 and 3 (i.e. TBM assembly/support and Post handover tunnel support) the predicted noise levels indicate that no residential will be construction noise affected during standard construction hours. Nearby sensitive receivers including a film recording studio and place of worship will be construction noise affected during standard hours for all stages of the works.

During Stage 1 (i.e. Site establishment and tunnel excavation and support) and Stage 2 TBM assembly works out-of-hours works will only occur where low impact requirements can be achieved. The predicted levels indicate that there will be no nearby residential receivers construction noise affected by these out-of-hours works at The Bays and the low impact requirements can be achieved during Stage 1 works. During Stage 2 TBM support work and Stage 3 (i.e. Post handover tunnel support) out-of-hours works will occur 24 hours a day as prescribed tunnel support works. The predicted levels indicated that nearby residential receivers will be construction noise affected during these out-of-hours works at The Bays only during the night period.

Noise mitigation and management measures, including noise monitoring requirements, have been presented in Section 9 to aid in providing additional noise reduction benefits where noise levels are above the NMLs.

Construction ground-borne noise

Ground borne noise impacts have been assessed as negligible.

Construction vibration

No building/structures have been identified as within the recommended minimum working distance for cosmetic damage during the works. No residential receivers have been identified as within the minimum working distance for human comfort during the works.

Vibration mitigation and management measures have been presented in Section 9 to reduce the risk of damage to buildings near the worksite and to manage annoyance from construction vibration.

Construction traffic

The predicted noise impacts are assessed as low and generally within the minimum requirements in the CNVS.

Impact classification

The overall noise and vibration impact of The Bays works is considered **low**.

Careful management of noise and vibration generating activities will reduce the impact of the works.

References

[1] Sydney Metro Construction Noise and Vibration Standard Version 4.3 (SM-20-00098866) – 4 November 2020

[2] Transport for NSW Construction Noise and Vibration Strategy (ref: ST-157/4.1) April 2019

[3] Sydney Metro West Out-of-hours Work Protocol (in progress)

[4] Sydney Metro 2021 Sydney Metro West Environmental Impact Statement - Major civil construction between The Bays and Sydney CBD November 2021

[5] SLR Consulting Australia Pty Ltd 2021 Sydney Metro West - Major civil construction between The Bays and Sydney CBD - Technical Paper 2: Noise and Vibration October 2020

[6] Sydney Metro 2022 Sydney Metro West – Submissions Report - Major civil construction between The Bays and Sydney CBD

[7] Renzo Tonin & Associates 2020 Western Harbour Tunnel and Warringah Freeway Upgrade, Technical working paper: Noise and vibration, Roads and Maritime, January 2020

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

[9] Environment Protection Authority 2017 NSW Noise Policy for Industry (NPfI)

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

[11] Department of Environment Conservation NSW 2006 Assessing Vibration; a technical guideline

[12] Environment Protection Authority 2000 NSW Industrial Noise Policy (INP)

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

[14] Australian Standard AS 2187.2-2006 Explosives - Storage and Use - Use of Explosives

[15] British Standard BS 7385 Part2-1993, Evaluation and measurements for vibration in buildings Part 2

[16] German Standard DIN 4150-3: 2016-12, Structural vibration - Effects of vibration on structures, December 2016

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

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

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

[20] Hutchisson Weller 2022 Acciona Ferrovial Joint Venture Sydney Metro West Central Tunnelling Package The Bays - Detailed noise and vibration impact statement September 2022 - Doc no. 21028-NV-RP-2-4

[21] Renzo Tonin & Associates 2022 Western Harbour Tunnel (WHT) - Stage 3A Construction Noise and Vibration Impact Statement: Western Harbour Tunnel Cut & Cover Tunnel Support – Document no TM589-01F01 WHT Stage 3A - WHT C&C Tunnel Support CNVIS(r2)

[22] Renzo Tonin & Associates 2022 Rozelle Interchange M4-M5 Link Rozelle Interchange Construction Noise and Vibration Impact Statement: Rozelle Rail Yard - Civil Works September 2019 – Document no TH914-03-01-02-02-01 F1 CNVIS RRY (r1)

[23] NSW Government 2023 Rozelle Interchange Interactive Construction Portal, accessed 21 April 2023 https://caportal.com.au/tfnsw/wcxri/

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

ABN	Airborne Noise
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	Assessing Vibration – a technical guideline (DEC 2006)
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 (Sydney Metro 2021)
CoA	Condition of Approval (SSI 19238057)
Condition	Condition of Approval (SSI 19238057)
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The 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.
DEC	Department of Environment and Conservation (now EPA)

DECC	Department of Environment and Climate Change (now EPA)
DECCW	Department of Environment, Climate Change and Water (now EPA)
DNVIS	Detailed Noise and Vibration Impact Statement
DP&E	NSW Department of Planning and Environment
ECRTN	Environmental Criteria for Road Traffic Noise (EPA 1999)
EIS	Environmental Impacts Statement
EPA	NSW Environment Protection Authority
ETP	Sydney Metro West – Eastern Tunnelling Package
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.
GBN	Ground-borne noise
GNML	Ground-borne Noise Management Level
GIS	Geographic Information System
ICNG	Interim Construction Noise Guideline (DECC, 2009)
INP	NSW Industrial Noise Policy (EPA, 2000)
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.
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.
JCG	John Holland CPB Contractors Ghella Joint Venture
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
MWD	Minimum Working Distance
NCA	Noise Catchment Area
NML	Noise management level
NPfI	Noise Policy for Industry
NSR	Noise Sensitive Receiver
OEH	Office of Environment and Heritage
OOHW	Out-of-Hours Works – work completed outside of standard construction hours

OSR	Other Sensitive Receiver
PPV	Peak Particle Velocity
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all the days measured. There is therefore an RBL value for each period (day, evening and night)
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
REMM	Revised Environmental Mitigation Measure
RNP	NSW Road Noise Policy (DECCW 2011)
ROL	Road Occupancy Licence
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance, and designed to measure sound pressure levels.
Sound pressure level (SPL)	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level (SWP)	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
SSI	State Significant Infrastructure
Standard construction hours	Hours during which construction work is permitted by the conditions of approval and the EPL.
STP	Slurry Treatment Plant, processes the slurry that assists TBM tunnelling and excavation
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Sensitive receivers and noise management levels

B.1 NCAs and sensitive receiver identification

Land Use file: revision_date: rX_dd_mm_yy

Plot Date: 24/05/23 - 15:00 Layout: TM372 Land Use

GIS File: R:\AssocSyd\Projects\TM351-TM400\TM372 mt SMW - Eastern Tunnelling Phase\5 Cad\s00 General\00 GIS\TM372-DA.qgz

LEGEND

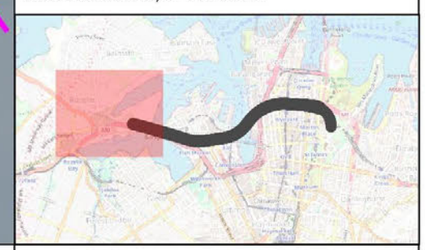
Noise Sensitive Receivers

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

- NCAs
- Tunnel alignment
- ETP
- Portion 01
- SMW Stage 1

NCA	NML DS	NML DO	NML E	NML N
NCA02C	59	54	54	51
NCA01	61	56	56	50
NCA03	58	53	52	44
NCA04	60	55	52	50
NCA02A	53	48	48	40
NCA02B	52	47	47	43

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 - OOHW P1
E: Evening period from 7 pm to 10 pm Monday to Sundy - OOHW P1
N: Night-time period from 10 pm to 7am Monday to Friday, from 10 pm to 8 am Saturday, Sunday and Public holidays - OOHW P1



REV	BY	DATE	DESCRIPTION	APPROVER
r0	DA	..	Prepare figures	TG

0 60 120 180 240 300 m
1:5,000

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

CLIENT
EASTERN TUNNELLING PACKAGE
John Holland CPB Contractors Ghella JV

ACOUSTIC CONSULTANT
RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501

SYDNEY METRO WEST - EASTERN TUNNELLING PACKAGE
They Bays Station Site

Land Use. Worksites and NCAs

Sheet 0 of 0

B.2 NCAs and noise management levels

Table B1: Noise Sensitive Receivers and Construction Noise Management Levels (airborne noise) **THE BAYS**

NCA	Receiver Type	Reference RBL	Existing Noise Levels, dB(A)						Airborne NMLs based on ICNG (external)					Sleep Dist. L_{Amax}		Comments
			RBL Day	RBL Evening	RBL Night	LAeq_D	LAeq_E	LAeq_N	NMLD(S)	NMLD(O)	NMLE	NMLN	NMLMS	$L_{Aeq(15min)}$	L_{AFmax}	
Residential receivers																Nearest worksite
NCA01	Predominantly Residential	B.02	51	51	45	57	57	54	61	56	56	**50**	53	50	60	The Bays.
NCA02A	Predominantly Residential	B.01	43	43	35	56	54	47	53	48	48	**40**	44	40	52	The Bays.
NCA02B	Predominantly Residential	B.40	42	44	38	54	53	48	52	47	47	**43**	45	43	53	The Bays.
NCA02C	Predominantly Residential	B.35	49	49	46	54	51	49	59	54	54	**51**	53	51	61	The Bays.
NCA03	Predominantly Residential	B.03	48	47	39	59	58	51	58	53	52	44	49	44	54	The Bays.
ICNG 'Other sensitive' receivers (NML applicable when in use)																
Classrooms at schools and other educational institutions									55	55	55	55	55	-	-	Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Hospital wards and operating theatres									65	65	65	65	65	-	-	Source: ICNG, assuming a conservative façade loss of 20 dB(A)
Places of worship									55	55	55	55	55	-	-	Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Passive recreation areas (e.g. area used for reading, meditation)									60	60	60	60	60	-	-	Source: ICNG
Active recreation areas (e.g. sports fields)									65	65	65	65	65	-	-	Source: ICNG
Commercial premises (including offices and retail outlets)									70	70	70	70	70	-	-	Source: ICNG
Industrial premises									75	75	75	75	75	-	-	Source: ICNG
Non-ICNG 'Other sensitive' receivers (GBNML applicable when in use)																
Hotel - daytime and evening									70	70	70	70	70	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss
Hotel - night-time									60	60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss
Café/ Bar/ Restaurant									60	60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 10 dB(A) facade loss
Childcare centre (indoor sleeping areas)									55	55	55	55	55	-	-	Source: CNVS Section 2.2.1, assuming a conservative façade loss of 10 dB(A)
Childcare centre (play areas)									65	65	65	65	65	-	-	Source: CNVS Section 2.2.1
Public Building									60	60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 10 dB(A) facade loss
Studio building (music recording studio)									45	45	45	45	45	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss
Studio building (film or television studio)									50	50	50	50	50	-	-	Source: AS2107 'maximum', assuming 20 dB(A) facade loss
Theatre/ Auditorium									50	50	50	50	50	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss

Notes:
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 - OOHW P1
E: evening period from 6 pm to 10 pm Monday to Sunday - OOHW P1
N: night-time period from 10 pm to 7 am Monday to Friday, from 10 pm am to 8 am Saturday, Sunday and Public holidays - OOHW P2
MS: Morning shoulder from 05:00 to 07:00 Monday to Friday, and from 06:00 to 08:00 Saturday, Sunday and Public holidays - OOHW P2

Table B2: Noise Sensitive Receivers and Construction Noise Management Levels (groundborne noise) **THE BAYS**

NCA	Receiver Type	Groundborne NMLs based on ICNG (internal) NMLDS	NMLDO	NMLE	NMLN	MS			Comments
Residential receivers									
All	All residential receivers	(50)*	(50)*	40	35				Source: ICNG
		**Human comfort vibration limit applies during the day. 50 dB(A) used as screening guideline.*							
ICNG 'Other sensitive' receivers (NML applicable when in use)									
Classrooms at schools and other educational institutions		45	45	45	45	45	-	-	Source: ICNG
Hospital wards and operating theatres		45	45	45	45	45	-	-	Source: ICNG
Places of worship		45	45	45	45	45	-	-	Source: ICNG
Commercial premises (including offices and retail outlets)		50	50	50	50	50	-	-	Source: ICNG, assuming a conservative façade loss of 20 dB(A)
Industrial premises		55	55	55	55	55	-	-	Source: ICNG, assuming a conservative façade loss of 20 dB(A)
Non-ICNG 'Other sensitive' receivers (GBNML applicable when in use)									
Hotel - daytime and evening (non-sleeping areas)		50	50	50	50	50	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'
Hotel - night-time (sleeping areas)		40	40	40	40	40	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'
Café/ Bar/ Restaurant		50	50	50	50	50	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'
Childcare centre (indoor sleeping areas)		45	45	45	45	45	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'
Childcare centre (play areas)		55	55	55	55	55	-	-	Source: CNVS Section 2.2.1, assuming a conservative façade loss of 10 dB(A)
Public Building		50	50	50	50	50	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'
Studio building (music recording studio)		25	25	25	25	25	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'
Studio building (film or television studio)		30	30	30	30	30	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'
Theatre/ Auditorium		30	30	30	30	30	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum'

Notes: 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 - OOHW P1
E: evening period from 6 pm to 10 pm Monday to Sunday - OOHW P1
N: night period from 22:00 to 07:00 Monday to Friday, and from 22:00 to 08:00 Saturday, Sunday and Public holidays - OOHW P2
MS: Morning shoulder from 05:00 to 07:00 Monday to Friday, and from 06:00 to 08:00 Saturday, Sunday and Public holidays - OOHW P2

APPENDIX C Construction timetable/ activities/ management

C.1 Construction timetable/activities/equipment

Table C1-1: Construction 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	-	-	May-23	Jan-26	106	-	111	-	-	
Compound		Light vehicle	180 in/ out	60 in/ out	60 in/ out			89	-	100	-	-	
Compound		Wheel wash unit	1	1	1			99	-	101	-	-	
Compound		Water treatment plant pump	2	2	2			99	-	101	-	-	Same as TBM WTP
Compound		Compressor	2	-	-			102	-	103	-	-	
Compound		Workshop Hand Tools	1	-	-			105	-	118	-	-	
Compound		Franna Crane	1	-	-			98	-	102	-	-	
Compound		Gantry Crane	2	2	2			106	-	110	-	-	
Compound		Water cart/ Street Sweeper	1	-	-			107	-	111	-	-	
STAGE 1: Site establishment	Support plant (applicable to all aspects)	Mobile Crane 280T	1	-	-	Jun-23	Mar-24	104	-	108	-	-	
		Franna Crane	2	-	-			98	-	102	-	-	
		Delivery Trucks	4 p.h.	-	-			106	-	111	-	-	
		Lighting tower	4	4	-			99	-	102	-	-	May be required after 4pm due to works being undertaken in Winter
		Truck & Dog (spoil haulage)	4 p.h.	-	-			106	-	111	-	-	
	Acoustic Shed and STP Erection	Compressor	2	-	-			102	-	103	-	-	
	- Segment shed & spoil shed	Rattle Gun	2	-	-	Jun-23	Dec-23	90	-	105	-	-	Spoil & Segment June to Dec 2023
	- Slurry Treatment Plant (STP)	Hand tools (power)	2	-	-	Jan-24	Mar-24	108	-	118	-	-	STP Jan to Mar 2024
		Hand tools (non-power)	2	-	-			105	-	118	-	-	
	Establish construction facilities	Excavator 30T w bucket	4	-	-	Jun-23	Mar-24	103	-	108	-	-	General sit establishment activities across the worksite
	- Hardstanding, carparks (FRP works)	Excavator 30T w hammer	3	-	-			118	5	126	HN	X	
	- Install demountable site sheds	Vacuum Truck	1	-	-			107	-	111	-	-	
	- Minor earthworks to level compounds	Wacker packer	2	-	-			108	-	110	-	X	
	- Installation of utilities (e.g. power, water, sewerage, communications)	Franna Crane	2	-	-			98	-	102	-	-	
		Small Truck <20 tonne	4 p.h.	4 p.h	-			106	-	111	-	-	
	- Workshops	Concrete agitator	4 p.h	4 p.h	-			108	-	111	-	-	
	- Lighting, security	Concrete Pump	2	2	-			103	-	107	-	-	
		Concrete vibrator	6	6	-			97	-	100	-	-	
		Compressor	2	2	-			102	-	103	-	-	
		EWP	2	-	-			95	-	98	-	-	
		Hand tools (power)	2	-	-			108	-	118	-	-	
		Compaction roller	1					112	5	120	HN	X	bottom of station box(TBM platform)
		Water cart/ Street Sweeper	1					107	-	111	-	-	bottom of station box(TBM platform)
		Hand tools (manual hammer)	2	-	-			116	-	118	-	-	
		Rattle Gun	3	3				90	-	105	-	-	
		Generator	2	-	-			94	-	95	-	-	
		Hand tools (power)	2	-	-			108	-	118	-	-	
STAGE 1: HSE OOH	Spoil Handling/Management (Spoil shed complete)	FE Loader (CAT980)	1	1	1	Dec-23	Jun-25	110	-	115	-	-	(or excavator with bucket) tidying stockpile in spoil loading area prior to shed completion.
		Truck & Dog (spoil haulage)	8 p.h.	8 p.h.	8 p.h.			106	-	111	-	-	Unload spoil behind spoil bund wall
		Tailgate bang after tipping spoil	8 p.h.	8 p.h.	8 p.h.			102	-	128	-	-	Spoil loading area prior to shed completion. Manage tail gate closure during night tipping.
STAGE 1: Tunnel Excavation and Support	Tunnel excavation & support	Excavator 25t w hammer	2	2	-	Oct-23	Jan-24	118	5	126	HN	X	Bottom of station box/ in stub tunnel
		Excavator 25t w bucket	1	1	1	Jan-24	Mar-24	103	-	108	-	-	Bottom of station box/ in stub tunnel
		Shotcrete rig (Potenza)	1	1	1			104	-	107	-	-	Bottom of station box/ in stub tunnel
		Skid steer	1	1	1			109	-	113	-	-	Bottom of station box/ in stub tunnel

Table C1-1: Construction 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}			
STAGE 2: TBM Delivery/ Assembly	TBM delivery (on surface)	Delivery trucks	4 p.h.	4 p.h.	4 p.h.	Mar-24	Mar-24	106	-	111	-	-	Oversized deliveries would be at night
		Mobile Crane 250T	4 lifts/hr	4 lifts/hr	4 lifts/hr			104	-	108	-	-	Top of station box
		Tower Crane (diesel)	4 lifts/hr	4 lifts/hr	4 lifts/hr			114	-	119	-	-	Top of station box, near crawler crane location
		Franna Crane 25T	2	2	2			98	-	102	-	-	1 x top of station box; 1 x bottom of station box
	TBM assembly (in station box)	Hammering Steel	2 locations	-	-	Mar-24	Jun-24	116	-	118	-	-	Station box
		Air/ hydraulic hand tools	2	2	2			108	-	118	-	-	Station box
		Hydraulic Power Pack	1	1	1			94	-	95	-	-	Station box
		Welding Machines 400 amp	4	4	4			96	-	107	-	-	Station box
		Welding Machines 400 amp	1	-	-			96	-	107	-	-	Station box
		Site Forklift	1	1	1			99	-	103	-	-	Surface
		SPMT in cavern	1	1	1			116	-	120	-	-	Cavern
STAGE 2: TBM Support	Tunnelling & Support	Grout plant	1	*1*	*1*	Jun-24	Jan-25	*105*	-	*108*	-	-	*Acoustic treatment TBC*
	TBM support	Ventilation fan with silencer	2	*2*	*2*			*98*	-	*102*	-	-	*Acoustic treatment TBC*
		TBM Cooling water pump	1	1	1			106	-	109	-	-	*Partial or full enclosure TBC*
		Water treatment plant pump	4	4	4			99	-	101	-	-	*Partial or full enclosure TBC*
		Gantry crane (electric)	2	2	2			106	-	110	-	-	Visible alarm after 8pm
		Compressed air plant	5	5	5			70	-	-	-	-	on surface
		Bentonite mixing area	1	1	1			97	-	100	-	-	on surface
		EWP	2	2	2			95	-	98	-	-	on surface/station box
		Delivery truck	2 p.h.	2 p.h.	2 p.h.		9 months	106	-	111	-	-	consumables: grout, chemical, grease, disc cutters
		Slurry return pipe	2	2	2			99	-	101	-	-	on surface
	Slurry Treatment Plant	DESANDER	2	2	2			107	-	107	-	-	Part of STP
		Filterpress 17t/h	2	2	2			107	-	107	-	-	Part of STP
		SD 2400 Primary shaker	2	2	2			107	-	107	-	-	Part of STP
		P1.1 pump	2	2	2			106	-	109	-	-	outside acoustic shed
		Belt conveyor	2	2	2			83/m	-	103	-	-	outside acoustic shed
		Fresh bentonite plant	1	1	1			104	-	106	-	-	Outside acoustic shed. Acoustic treatment TBC
	Spoil Handling (in shed)	FE Loader	2	2	2			110	-	115	-	-	In the spoil loadout area
		Excavator 25t w bucket	1	1	1			103	-	108	-	-	
		Spoil loading conveyor / stacker	1	1	1			83/m	-	103	-	-	
		Forklift	1	1	1			99	-	103	-	-	Loading/moving materials outside acoustic shed
		Truck & Dog (spoil haulage)	4-6 p.h.	4 p.h.	4 p.h.			106	-	111	-	-	Inside shed
	Tunnel Lining (segments)	Truck Movement (MSVs) Combustion Engine CATERI	2 p.h.	2 p.h.	2 p.h.		9 months	106	-	111	-	-	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	-	-	120	-	-	Broadband horn - e.g. BBS-tek. Within Station Box/ Cross Over Cavern
STAGE 3: Tunnel Support Post Portion 01 Handover (TBM tunnelling complete)	Acoustic segment shed and plant demobilisation (on surface)	Tower crane (diesel)	1	1	-	Oct-24	Jul-25	114	-	119	-	-	Designed to meet Table C5. Visible alarm after 8pm. Same crane as for backend works.
		Forklift	1	1	-			99	-	103	-	-	
		Hand tools (non-power)	Various	Various	-			105	-	118	-	-	
		Rattle Gun	2	2	-			90	-	105	-	-	
		Hand tools (power)	2	2	-			108	-	118	-	-	
		Hand tools (non-power)	2	2	-			105	-	118	-	-	
		EWP	2	2	-			95	-	98	-	-	
		Franna Crane 25T	2	2	-			98	-	102	-	-	
		Delivery trucks	2 p.h.	2 p.h.	-			106	-	111	-	-	
		Forklift	1	1	-			99	-	103	-	-	
	Tunnelling & Support - Ongoing works in tunnels (XPs etc) - Tunnel lining	Tower Crane (diesel)	1	1	1			114	-	119	-	-	Designed to meet Table C5. Visible alarm after 8pm. Same crane as for backend works.
		Ventilation fan with silencer	4	4	4			98	-	102	-	-	Same fans from TBM tunnelling support
		Water treatment plant pump	1	1	1			99	-	101	-	-	Same WTP from TBM tunnelling support
		Concrete Pump	1	1	1			103	-	107	-	-	In station box
		Concrete road agitator	4ph	4ph	4ph			108	-	111	-	-	On surface
		Concrete site agitator (10m3 transmix)	4ph	4ph	4ph			108	-	111	-	-	In station box
		Concrete truck	1	1	1			108	-	111	-	-	Into drop pipe within acoustic enclosure (Table C4)
		Forklift	2	2	2			99	-	103	-	-	1 on surface/ 1 in station box
		Hand tools (non-power)	Various non-power hand tools					105	-	118	-	-	
		Truck Movement (MSVs) Combustion Engine CATERI	7-9 p.h.	7-9 p.h.	-			106	-	111	-	-	
	Spoil Handling (in shed)	FE Loader	1	1	1			110	-	115	-	-	In the spoil shed
		Excavator 25t w bucket	1	1	-			103	-	108	-	-	On the surface
		Excavator 25t w bucket	1	1	1			103	-	108	-	-	In the station box
		Forklift	1	1	1			99	-	103	-	-	Loading moving materials
		Truck & Dog (spoil haulage)	4-6 p.h.	4 p.h.	4 p.h.			106	-	111	-	-	Loaded inside shed

Table C1-1: Construction 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}			
Tunnel backend works cross passages and inverts	Tunnelling back end works and support [OOH TBC subject to noise impacts]	Tower crane (diesel)	2	2	+	Sep-24	Dec-25	114	-	119	-	-	Designed to meet Table C5. Visible alarm after 8pm. Same crane as for TBM post Portion 01.
		Ventilation fan with silencer	4	*4*	*4*			*98*	-	*102*	-	-	Same fans from TBM tunnelling support
		Water treatment plant pump	4	4	4			99	-	101	-	-	Same WTP from TBM tunnelling support
		Skid steer	1	1	1			109	-	113	-	-	Bottom of station box/ in tunnel
		Concrete site agitator	2	2	2			108	-	111	-	-	Bottom of station box and in tunnel
		Concrete road agitator	2 p.h	2 p.h	2 p.h			108	-	111	-	-	Deliver to drop pipe located inside concerte shed at headwall
	Spoil Handling [OOH TBC subject to noise impacts]	FE Loader	2	2	2			110	-	115	-	-	In the spoil loadout area (i.e. inside shed)
		Excavator 25t w bucket	1	1	1			103	-	108	-	-	In the spoil loadout area (i.e. inside shed)
		Truck & Dog (spoil haulage)	4-6 p.h.	4 p.h.	4 p.h.			106	-	111	-	-	Loaded inside shed
		Dump truck (Moxy CAT 725)	1	1	1			109	-	119	-	-	Bottom of station box/ in tunnel
		Dump truck (Moxy CAT 725)	1	1	1			109	-	119	-	-	On surface, moving spoil to acoustic shed
		Forklift	1	1	1			99	-	103	-	-	Loading/moving materials outside acoustic shed

Figure C1-1: Site Layout and Hoardings

THE BAYS - STAGE

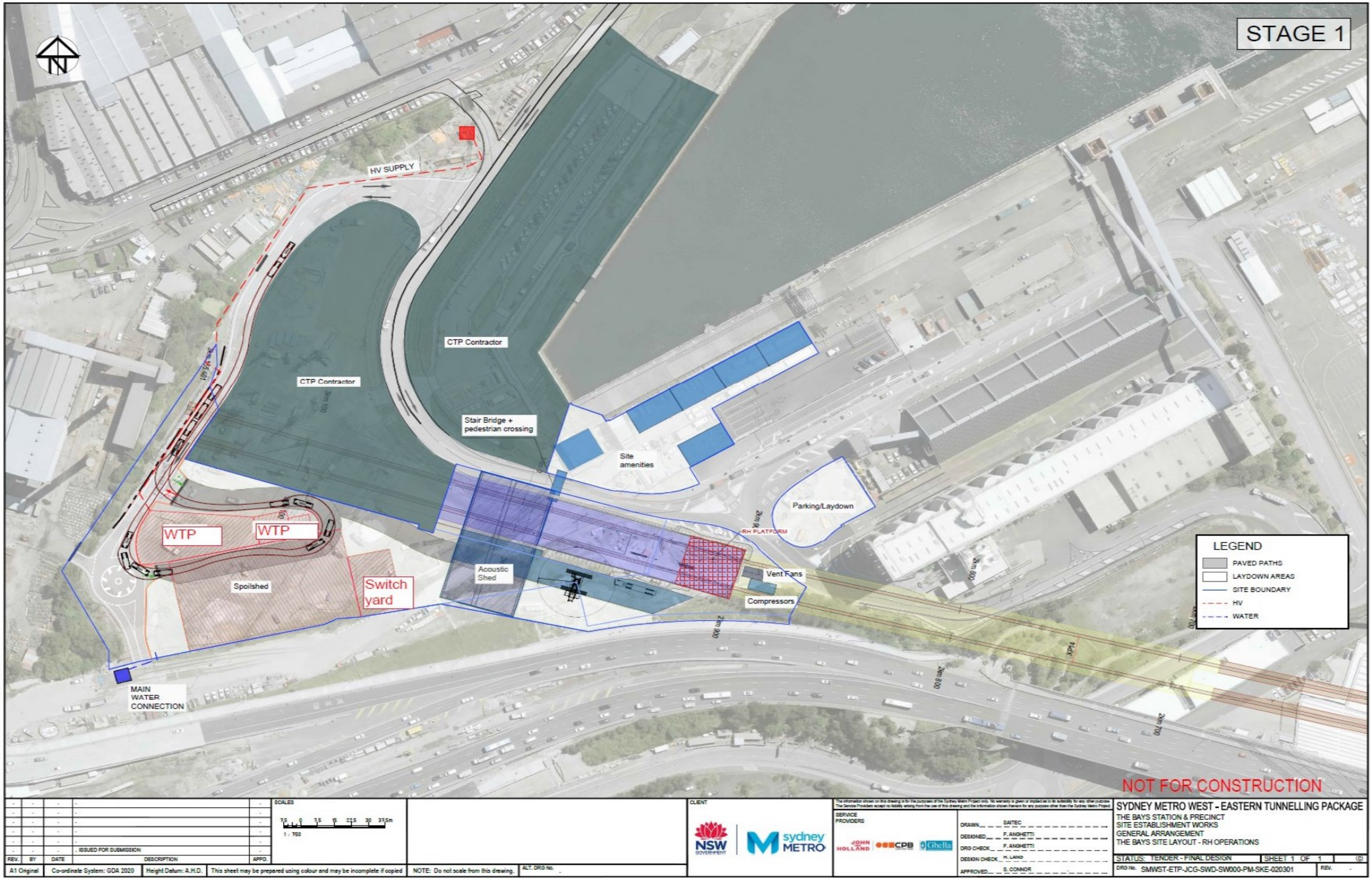


Figure C1-2: Site Layout and Hoardings

THE BAYS - STAGE 2

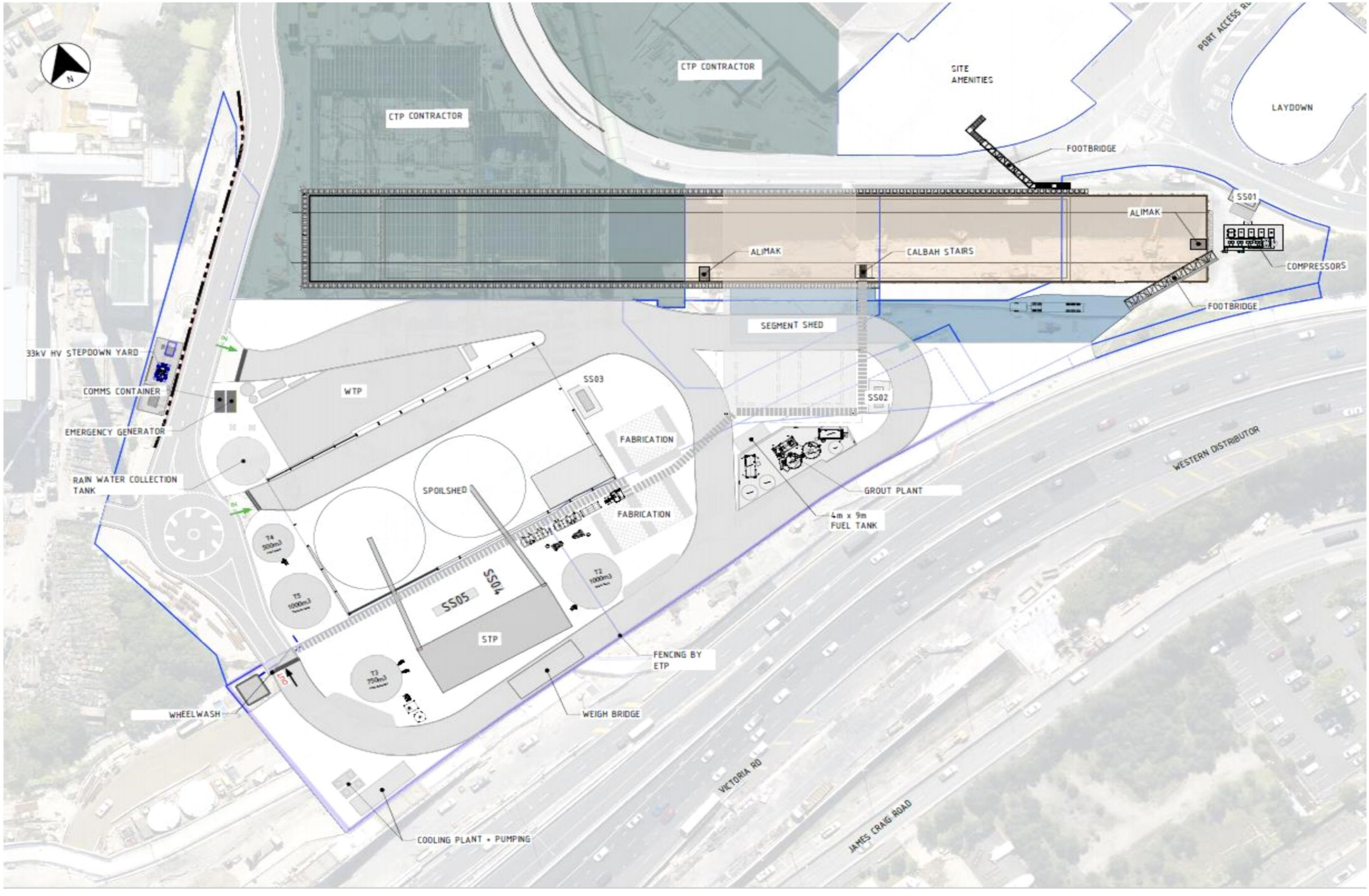


Table C1-2: Construction timetable (indicative)

THE BAYS

Activity/ Work Area	Aspect	2023 May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2024 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2025 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2026 Jan
Compound	Deliveries; Maintenance; Office areas; Storage areas; Car parking																																	
STAGE 1:	Support plant																																	
Site Establishment	Acoustic shed erection																																	
	Establish construction facilities																																	
	STP erection																																	
Tunnel excavation & support	Tunnel excavation & support																																	
STAGE 2:	TBM delivery (on surface)																																	
TBM Delivery/Assembly	TBM assembly (in station box)																																	
TBM Support	Tunnelling & support																																	
	Slurry treatment plant																																	
	Spoil handling (in shed)																																	
	Tunnel lining (segments)																																	
STAGE 3: Post Portion 01 Handover	Acoustic segment shed and plant demobilisation (on surface)																																	
Tunnel Support	Tunnelling & support																																	
	Tunnel lining (segments)																																	
Tunnel backend works	Tunnelling back end works and support																																	
	Spoil handling																																	
CONCURRENT WORKS - OTHER PROJECTS																																		
SYDNEY METRO WEST: CENTRAL TUNNELLING PACKAGE *(Source: SM CTP The Bays DNVIS; ref: Doc no. 21028-NV-RP-2-4)*																																		
3. TBM Works	3C Operation (Tunnelling, support, spoil handling, tunnel lining, XPs)																																	
4. Demobilisation	Demobilise from site																																	
WESTERN HARBOUR TUNNEL SOUTHERN TUNNELLING PACKAGE *(Source: WHT_3A CNVIS Western Harbour Tunnel Cut & Cover Tunnel Support; ref: TM589-01F01 WHT Stage 3A - WHT C&C Tunnel Support CNVIS(r2))*																																		
Tunnelling Support	Stage 2 (up to 6 roadheaders operating)																																	
WESTCONNEX ROZELLE INTERCHANGE *(Source: NSW Government 2023 Rozelle Interchange Interactive Construction Portal, accessed 21 April 2023 https://caportal.com.au/tfnsw/wcxri/)*																																		
Victoria Road Works	Finishing works	Works completed in March 2023																																
Rozelle Rail Yard – Civil Works	Finishing works (landscaping)																																	

C.2 Construction mitigation and management measures

Table C2: Construction Noise Management Schedule **THE BAYS**

Area to be Managed			Specific Mitigation/ Management Measure	Details
Airborne Noise				
1	**Site establishment and Stub Tunnels**			
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:	OOHW activities limited as noted below and in Table C1	see Table C1 for details
		NIGHT:	No spoil handling on the surface during the night period. OOHW activities limited as noted below and in Table C1	
1.3	Acoustic enclosures/sheds		Acoustic shed s under construction during site establishment.	
1.4	Truck restrictions during the OOHW period	D(O)/EVE/NGT:	OOHW truck movements limited as noted below and in Table C1	
			Avoid the use of park air brakes 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 for ground support/ temporary lining)	see Table C1 for details
		NIGHT:	Mobile Crane 280T	
	SPOIL trucks on site	D(O)/EVE	≤ 8 per hour	see Table C1 for details
		NIGHT:	≤ 8 per hour after 10pm. All spoil truck loading and unloading will be completed within the spoil shed.	
1.5	Ventilation Fan		Ventilation fans with silencer + additional attenuation. 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		No impacts are likely to occur	See Table C6
2	**TBM Delivery/ Assembly**			
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:	OOHW activities limited as noted below and in Table C1	see Table C1 for details
		NIGHT:	OOHW activities limited as noted below and in Table C1	
2.3	Truck restrictions during the OOHW period	D(O)/EVE/NGT:	OOHW truck movements limited as noted below and in Table C1	
			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	D(O)/EVE/NGT:	≤ 4 per hour (concrete trucks for ground support/ temporary lining)	see Table C1 for details
2.4	Residual impacts		No impacts are likely to occur	See Table C6

Table C2: Construction Noise Management Schedule **THE BAYS**

Area to be Managed			Specific Mitigation/ Management Measure	Details
3	**TBM Support**			
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:	OOHW activities limited as noted below and in Table C1	see Table C1 for details
		NIGHT:	No spoil handling on the surface during the night period. OOHW activities limited as noted below and in Table C1	
3.3	Acoustic enclosures/sheds			
	Spoil shed	D(O)/EVE/ NGT:	Acoustic shed to allow OOHW spoil handling	see Table C4 for details
		D(O)/EVE/ NGT:	Excavator with bucket loading kibble; kibble loads directly to spoil truck.	see Table C1 for details
	Acoustic shed over station box	D(O)/EVE/ NGT:	Acoustic shed to allow OOHW concrete delivery and loading	see Table C4 for details
		D(O)/EVE/ NGT:	1 Gantry Crane inside acoustic shed.	see Table C1 for details
3.4	Truck restrictions during the OOHW period	D(O)/EVE/NGT:	OOHW truck movements limited as noted below and in Table C1	
			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	D(O)/EVE/NGT:	≤ 4 per hour	see Table C1 for details
	SPOIL trucks on site	D(O)/EVE/NGT:	≤ 4 per hour	see Table C1 for details
3.5	Ventilation Fan (TBC)		Ventilation fans with silencer + additional attenuation. 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
3.7	Residual impacts		Worst affected receivers are predicted to exceed by up 10dB, most impacted receivers will be marginally impacted.	See Table C6
5	**Post Handover Tunnel Support**			
5.1	Work during Standard Construction Hours	DAY:	Standard hours activities	see Table C1 for details
5.2	Work outside Standard Construction Hours	D(O)/EVE:	OOHW activities limited as noted below and in Table C1	see Table C1 for details
		NIGHT:	No spoil handling on the surface during the night period. OOHW activities limited as noted below and in Table C0	
5.3	Acoustic enclosures/sheds			
	Spoil shed	D(O)/EVE/ NGT:	Acoustic shed to allow OOHW spoil handling	see Table C4 for details
		D(O)/EVE/ NGT:	Excavator with bucket loading kibble; kibble loads directly to spoil truck.	see Table C1 for details
5.4	Truck restrictions during the OOHW period	D(O)/EVE/NGT:	OOHW truck movements limited as noted below and in Table C1	
			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	see Table C1 for details
	SPOIL trucks on site	D(O)/EVE/NGT:	≤ 4 per hour	see Table C1 for details
5.5	Ventilation Fan (TBC)		Ventilation fans with silencer + additional attenuation. Intake to be orientated away from receivers. To achieve maximum sound power level as per Table C5	see Table C5 for performance requirements
5.6	Water treatment plant		Additional enclosure subject to compliance testing	see Table C5 for performance requirements
5.7	Residual impacts		Worst affected receivers are predicted to exceed by up 10dB, most impacted receivers will be marginally impacted.	See Table C6

Table C4: Noise Shed / Enclosure Design Specifications **THE BAYS**

Area to be Mitigated	Construction component	Reference ID	Indicative element construction
Segment shed	Walls	F002	1x 0.48mm BMT corrugated steel
	Roof	F002	1x 0.48mm BMT corrugated steel
	Acoustic lining	-	Acoustic lining with roofing blanket on inner skin facing inside shed: - upper section of walls (above 4 m) acoustic insulation with perforated foil (perforation facing inside of the shed) - underside of roof acoustic insulation with perforated foil (perforation facing inside of the shed)
	Doors	-	Oversized roller door (larger than wall opening) and rubber seals side and bottom Access doors to be selected to not acoustically comprimise the overall building element it sits within. Rapid roller doors on the western side of the shed
	Openings (ventilation/ access)	-	Any necessary ventilation openings should face away from neighbours and also fitted with acoustic louvres / attenuators or doors to achieve requirements.
Spoil shed	Walls	F004	Double Skin Steel, External side: 1 x 0.48 mm BMT corrugated sheet steel + 50 mm insulation (24 kg/m3) + 200mm air gap Inside: 1 x 0.42 mm BMT corrugated sheet steel.
	Roof	F004	Double Skin Steel, External side: 1 x 0.48 mm BMT corrugated sheet steel + 50 mm insulation (24 kg/m3) + 200mm air gap Inside: 1 x 0.42 mm BMT corrugated sheet steel.
	Insulation inside double skin walls/roofs		Foil side of the acoustic insulation to be interfaced with the steel layer so that glasswool is exposed to the cavity (not against the steel)
	Acoustic lining	-	Acoustic lining with roofing blanket on inner skin facing inside shed of: - upper section of walls (above 4 m) with perforated foil (perforation facing inside of the shed) - Underside of roof with non-perforated foil
	Doors	-	Oversized roller door (larger than wall opening) and rubber seals side and bottom Access doors to be selected to not acoustically comprimise the overall building element it sits within. Rapid roller doors on the western side of the shed
	Openings (ventilation/ access)	-	Any necessary ventilation openings should face away from neighbours and also fitted with acoustic louvres / attenuators or doors to achieve requirements.
Slurry Treatment Plant	Schauenburg Separation Plant	-	See Table C5

Notes:

1. The final level of noise reduction required from an acoustic shed / enclosure is dependent on a number of factors, however one important factor is whether or not there are noisy plant on site which cannot be acoustically treated and operate outside the acoustic shed / enclosure. Depending on the number and noise emissions of such plant, it may be necessary to apply greater acoustic treatment to the acoustic shed / enclosure in order to keep its noise contributions down so that the total noise emissions from site meet the set environmental noise limits at neighbouring receptors.

LEGEND * estimated by calculations and/or reference to other similar wall type data. The client is advised not to commit to materials which have not been tested in an approved laboratory or for which an opinion only is available. Testing materials is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested materials, estimates or opinions.

GENERAL

- The underside of the roof and (where possible) internal walls should be lined with acoustic insulation to reduce the build-up of sound inside the shed
- The specified performances must be achieved by the product selected.
- The sealing of all gaps is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
- Check design of all junction details with acoustic consultant prior to construction.
- Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
- The information provided in this table is subject to modification and review without notice.
- The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.
- Only the buildings elements noted in Table C4 and Table C4a have been assessed. It is assumed that all other items will not impact the acoustic properties, or can be sufficiently acoustically treated.

Table C4a: Specification for acoustic elements of noise sheds/ acoustic enclosures

THE BAYS

Reference	Sound transmission loss per octave spectrum dB							Indicative shed element construction
ID	63	125	250	500	1000	2000	4000	
F002	7	9	13	18	22	19	20	1x 0.48mm BMT corrugated steel
F004	8	10	24	38	47	44	46	Double Skin Steel, External side: 1 x 0.48 mm BMT corrugated sheet steel + 50 mm insulation (24 kg/m3) + 200mm air gap Inside: 1 x 0.42 mm BMT corrugated sheet steel.

LEGEND * estimated by calculations and/or reference to other similar wall type data. The client is advised not to commit to materials which have not been tested in an approved laboratory or for which an opinion only is available. Testing materials is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested materials, estimates or opinions.

Table C4b: Fan & Silencer Design Specifications

THE BAYS

Fan location	Model	Fan details			Fan Duty Point			Sound Power Level - Octave Band dB								Overall		Notes
		No. fans	Diameter	Power	Air flow	Total pressure	Fan speed	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	
FANS		-	mm	kW	m^3/s	Pa	rpm											
1-TBM Ventilation fans [located on surface, east side of station box - see Figure C4b]	ZITRON TBM Fan ZVN 1-14-110/4 (+ 2400mm long silencer no pod)	2	1400	110	34.2	2123	1500	94	105	104	93	86	88	93	93	**108**	**100**	

Figure C4b: Ventilation fan location

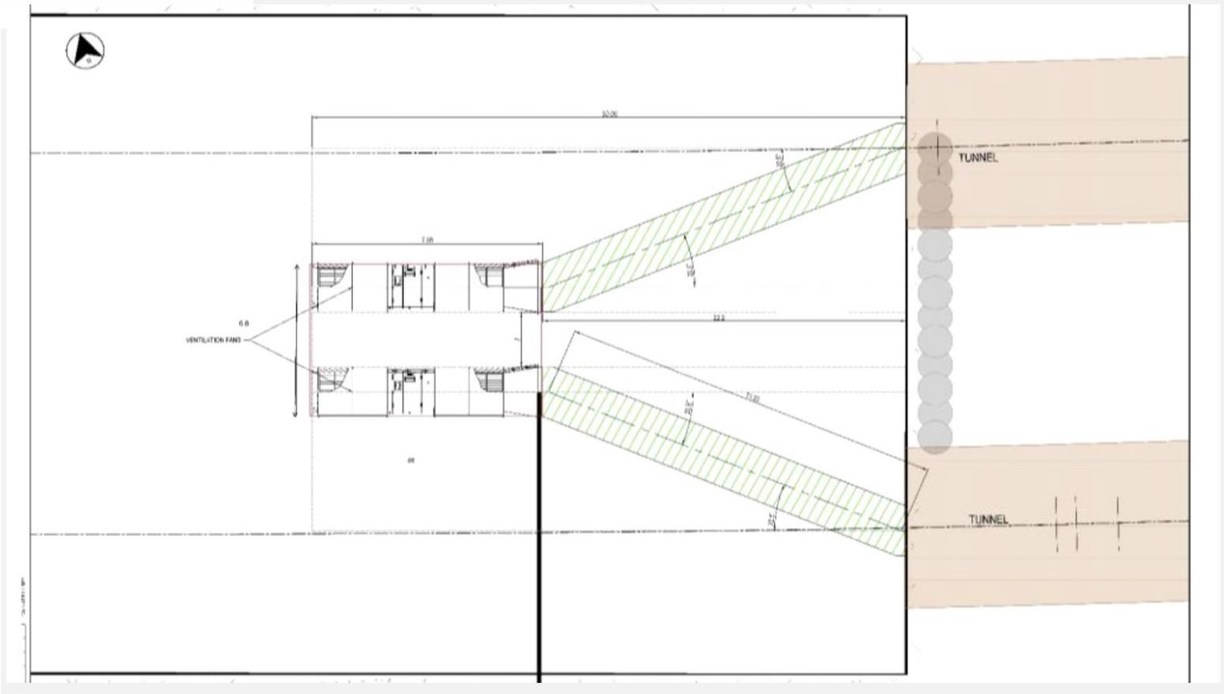


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Table C5: Plant noise level schedule **THE BAYS**

Building/ Area to be Mitigated	Item	Acoustic Requirement	Lw dB(A)
Plant item (Tunnel support)	Water treatment plant (total plant noise)	Additional partial or full enclosure subject to compliance testing	85
Slurry Treatment Plant	Schauenburg Separation Plant	Separation plant within a prefabricated acoustic enclosure, as per manufacturers design	107
Slurry Treatment Plant	P1.1 pump	Noise attenuation subject to comliance testing	104
Plant item	TBM water cooling pump	Noise attenuation subject to comliance testing	104
Plant item	Rigid Truck (spoil haulage)	Plant sound power level (on site measurments conducted on 17 April 2020)	102
Plant item	Concrete / shotcrete truck	Plant sound power level (on site measurments conducted on 17 April 2020)	105
Plant item	Tower crane	Plant sound power level to be achieved.	104

Notes:

LEGEND * estimated by calculations and/or reference to other similar plant type data. The client is advised not to commit to fans which have not been tested in an approved laboratory. Testing plant is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested materials, estimates or opinions. The advice provided here is in respect of acoustics only.

GENERAL

- Sound power level of plant assumed based on sound power level of similar plant type, incorporating attenuation (acoustic attenuator/ muffler/ duct lining as required)
- The specified performances must be achieved by the product selected.
- Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
- The information provided in this table is subject to modification and review without notice.
- The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

APPENDIX D Construction airborne noise impacts

D.1 Predicted noise levels

The detailed predicted levels have been provided to JCG in a spreadsheet table to more adequately mitigate and manage potential noise impacts.

D.2 Number of receivers above NMLs

The number of exceedances has been provided to JCG in a spreadsheet table.

D.3 Additional management measures

The additional management measures have been provided to JCG in a spreadsheet table to more adequately mitigate and manage potential noise impacts.

D.4 Predicted ABN levels greater than $L_{eq(15\ minute)}$ 60 dB(A) at receivers (CoA D38)

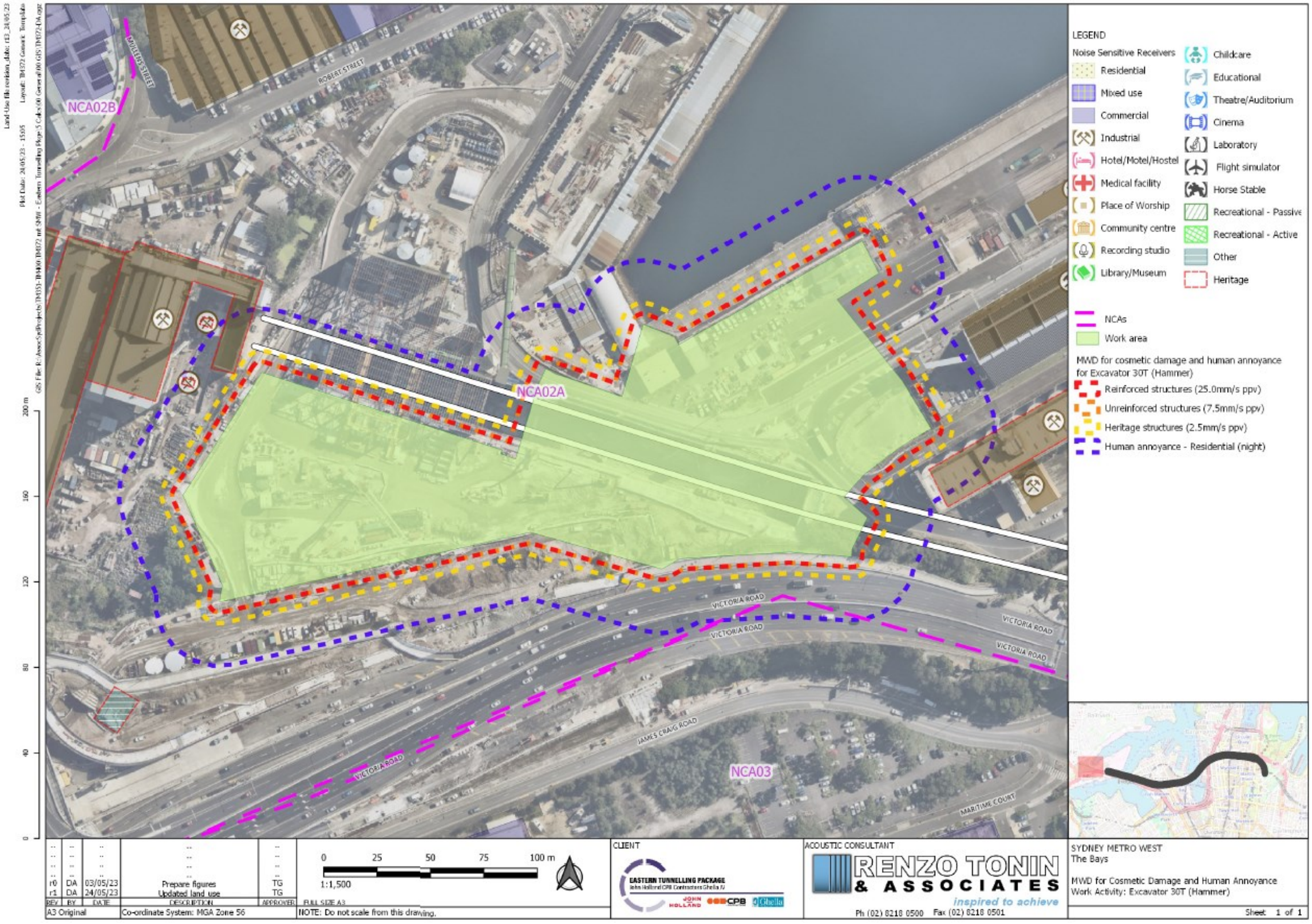
Receivers likely to experience airborne noise levels greater than $L_{eq(15\ minute)}$ 60 dB(A) have been provided to JCG in a spreadsheet table to more adequately mitigate and manage potential noise impacts.

APPENDIX E Construction ground-borne noise impacts

Ground-borne noise impacts have been assessed as negligible.

APPENDIX F Construction vibration impacts

F.1 The Bays worksite - minimum working distance for vibration impact


NCA02B
NCA02A
NCA03
MILLERS STREET
ROBERT STREET
VICTORIA ROAD
JAMES CRAIG ROAD
MARITIME COURT
LEGEND
Noise Sensitive Receivers
Residential
Mixed use
Commercial
Industrial
Hotel/Motel/Hostel
Medical facility
Place of Worship
Community centre
Recording studio
Library/Museum
Childcare
Educational
Theatre/Auditorium
Cinema
Laboratory
Flight simulator
Horse Stable
Recreational - Passive
Recreational - Active
Other
Heritage
NCAs
Work area
MWD for cosmetic damage and human annoyance for Excavator 30T (Hammer)
Reinforced structures (25.0mm/s ppv)
Unreinforced structures (7.5mm/s ppv)
Heritage structures (2.5mm/s ppv)
Human annoyance - Residential (night)
0 25 50 75 100 m
1:1,500
FULL SIZE A3
r0 DA 03/05/23 Prepare figures TG
r1 DA 24/05/23 Updated land use TG
A3 Original
Co-ordinate System: MGA Zone 56
NOTE: Do not scale from this drawing.
CLIENT
EASTERN TUNNELLING PACKAGE
John Holland CPB Contractors Ghella JV
ACOUSTIC CONSULTANT
RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501
SYDNEY METRO WEST
The Bays
MWD for Cosmetic Damage and Human Annoyance
Work Activity: Excavator 30T (Hammer)
Sheet 1 of 1

APPENDIX G Community consultation and construction noise respite program

G.1 Evidence of receiver specific consultation

Provided as a spreadsheet table to allow to JCG to update with ongoing community consultation.

ACOUSTICS ADVISOR ENDORSEMENT
SYDNEY METRO WEST (SSI 19238057)

Review of	**Eastern Tunnelling Package:** Detailed Noise and Vibration Impact Statement (DNVIS) – The Bays	**Reviewed document reference:**	TM372-02-1-01F01 SMW-ETP_DNVIS-TBY (revC) Revision 3 dated 21 December 2023
Prepared by:	[redacted], Acoustics Advisor		
Date of issue:	7 March 2024		

As approved Acoustics Advisor for the Sydney Metro West project, I reviewed Revision 2 of the Detailed Noise and Vibration Impact Statement (DNVIS) for The Bays and had no comments. Revision 3 has been updated to address comments by others and I am satisfied that it is suitable for implementation.

I endorse Revision 3 of this DNVIS.

[redacted]

[redacted], Metro West Acoustics Advisor