

9 May 2024

TM372-02-1-02F05 SMW-ETP_ADD-DNVIS-PYR_OOH partial shed_S1(r3)

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Sydney Metro West Eastern Tunnelling Package - Addendum Detailed Noise and Vibration Impact Statement - Pymont Station - low noise impact OOHW prior to shed completion

1 Introduction

A Detailed Noise and Vibration Impact Statement (DNVIS) has been prepared for the Sydney Metro West – Eastern Tunnelling Package (ETP) **Pymont Station** surface worksites Renzo Tonin & Associates 2023 Sydney Metro West Eastern Tunnelling Package - Detailed Noise and Vibration Impact Statement – Hunter Street Station – 24 May 2023. The DNVIS was prepared on behalf of John Holland CPB Contractors Ghella Joint Venture (JCG) to meet the requirements of Planning Approval (SSI 19238057) Condition D29 and the Sydney Metro Construction Noise and Vibration Standard (CNVS) Sydney Metro Construction Noise and Vibration Standard Version 4.3 (SM-20-00098866) – 4 November 2020 for the construction of the ETP Works.

This Addendum has been prepared consistent with the DNVIS to assess short duration works (approx. 4 weeks) outside the scope of works assessed in the Pymont Station DNVIS.

2 Construction works and hours

2.1 Construction works addressed in this Addendum DNVIS

The works assessed in this Addendum includes low impact roadheader assembly works (Stage 1) and shaft support works (Stage 1A) prior to the full completion of the acoustic shed. The acoustic shed at the Pymont East worksite will be partly constructed, including the platforms over the temporary shaft. Part of the shed walls may also be complete depending on the timing of the works.

To minimise impacts from the OOHW, construction activity would be largely limited to the bottom of the shaft underneath the platform, with no surface works. Voids between the steel platforms will be closed off using plywood, spoil material or noise blankets, where practicable.

Table 2.1 presents the list of plant proposed to be used for these works and their assumed sound power levels. Vibration intensive plant are also identified. There are no truck movements proposed for Stage 1 and 1A.

2.1.1 Construction traffic noise

Based on the proposed activities presented in Table 2.1, there are no truck movements proposed for Stage 1 and 1A. No further assessment is required.

2.1.2 Ground-borne noise and vibration

There are no vibration intensive activities required for these works. No further assessment is required.

Figure 2.1: Pyrmont East – OOH tunnelling support (partial shed) Stage 1 (roadheader assembly and low impact shaft support works)

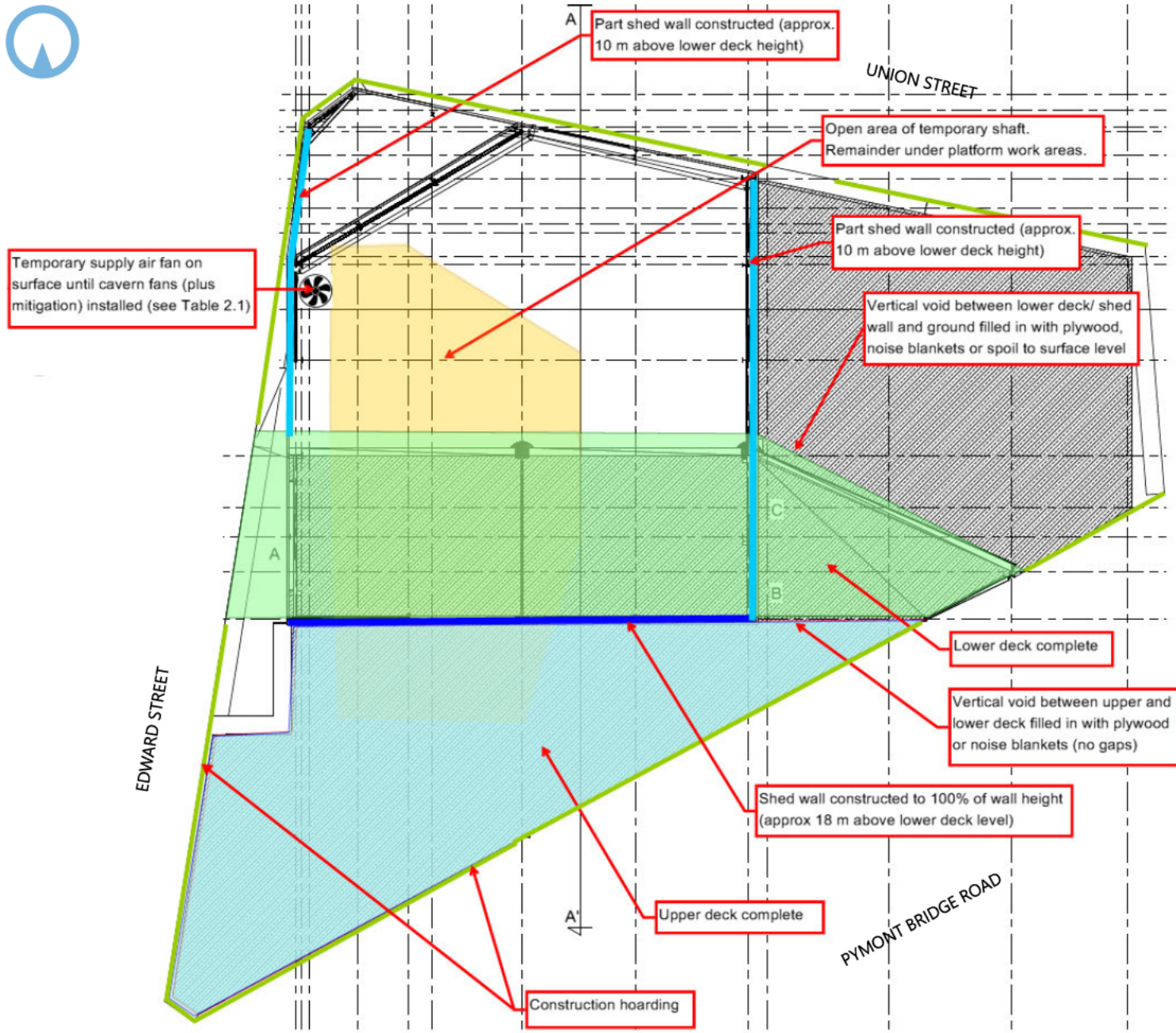


Table 2.1 Construction activities and equipment sound power levels used in noise modelling

Activity description/ Work area	Aspect (Activity/ Aspect ID)	Plant/ Equipment	Evening ¹ 6pm – 10pm	Night ¹ 10pm – 7am	Sound Power Level (Lw re: 1pW), dB(A)		High noise plant	Vibration intensive plant
					L _{Aeq} (15min)	L _{Amax}		
Compound (located on surface)	Deliveries; Maintenance; Office areas; Storage areas; Car parking	Water Treatment Plant (as per DNVIS) * ⁵	1	1	85	90	-	-
Stage 1: Low impact assembly of Roadheader dayshift and nightshift - assuming minimal gantry crane use, some hand tools inside the shaft, limited activity on the surface.								
Partial shed Stage 1: Assembly of Roadheader (located bottom of shaft)	- Delivery to surface compound, - Tram to the Gantry crane - Lower into the shaft - Roadheader assembly at bottom of shaft using the gantry crane, excavator and hand tools. Assessment ref: S1 (no mitigation); S1M (mitigation as per Figure 2.1)	Gantry Crane * ⁵	1	1	106	110	-	-
		Temporary ventilation fan - shaft/cavern * ⁵	1	1	93	96	-	-
		Road Header 1,000V Electric (tramping only)	1	1	104	108	-	-
		Excavator 25t w bucket (not concurrent with roadheader)	1	1	103	108	-	-
		Workshop Hand Tools (intermittent use, not hammering)	1	1	105	118	-	-
Stage 1A: Low impact Shaft Support work								
Partial shed Stage 1A: Shaft support works (located bottom of shaft)	- Install/grout/test bolts, - Stockpile material - Place mesh (if required), - Electrical lighting install, - Dewater pump adjustments - Ventilation install using gantry crane Assessment ref: S1AM	Temporary ventilation fan - shaft/cavern * ⁵	1	1	93	96	-	-
		Grout pump	1	1	103	106	-	-
		Hilti TE 60 drill (in use ≤5 min per 15 minute period)	1	1	107 (102)	116	-	-
		Elevated work platform	1	1	104	108	-	-
		Excavator 25t w bucket (not concurrent with EWP)	1	1	103	108	-	-
		Workshop Hand Tools (intermittent use, not hammering)	1	1	105	118	-	-

Notes: *⁵ refers to plant/ equipment located on the surface. All other plant is located at the bottom of the shaft.

2.2 Construction Hours

Construction hours are as reported in the DNVIS Section 2.2. The Stage 1 and Stage 1A works assessed in this Addendum will be undertaken outside standard construction hours as Low Noise Impact Work, in accordance with Planning Approval Condition D23(b) and under the Environment Protection License (EPL) number 21784 Condition L5.3.

2.2.1 Justification for OOHW

It is proposed to commence Stage 1 and 1A low noise impact out of hours work in the temporary shaft prior to the completion of the acoustic shed at Pyrmont East to complete the shaft and building roadheader for tunnelling works.

The Stage 1 and 1A works and activities may be undertaken outside standard construction hours if the works and activities do not cause, when assessed at the boundary of the most affected Noise Sensitive Receiver:

- a) $L_{Aeq(15 \text{ minute})}$ noise levels greater than 5dB above the day, evening or night rating background level (RBL) at any residence in accordance with the ICNG; and
- b) no more than the "Noise affected" NMLs specified in Table 3 of the ICNG at other sensitive land users(s); and
- c) $L_{A1(1 \text{ minute})}$ or L_{Amax} noise levels greater than 15 dB above the night RBL for night works;
- d) preferred continuous or impulsive vibration values greater than those for human exposure to vibration, set out for residences in Table 2.2 in Assess Vibration: a technical guideline (DEC, 2006);
- e) preferred intermittent vibration values greater than those for human exposure to vibration, set out for residences in Table 2.4 in Assessing Vibration: a technical guideline (DEC, 2006).

The Stage 1 and 1A OOHW will allow the shed construction to continue during the day with minimal disruption, and will reduce the overall construction program compared to if works were limited to standard construction hours until the acoustic shed is completed. It would allow tunnelling to commence sooner, which will reduce program risk regarding the cavern completion prior to TBM transit through Pyrmont. The proposed OOHW will reduce program risk because:

- Due to the geotechnical conditions at Pyrmont East, ground support requirements such as the supply of shotcrete and equipment interaction requires flexibility to allow the installation of ground support at the completion of each work shift. Undertaking the proposed works would allow these works to be completed following the bulk excavation activities.
- Rock bolts are required to be installed and grouted as soon as practicable and within 24 hours of drilling the holes as there is lateral load on the excavated wall and drill holes can collapse if left open for too long.

- During rock excavation and support, excavation support material (anchors, anchor bars, meshmesh, and other support tendons) will be installed as soon as practicable following excavation. An exclusion zone is required to be maintained around the excavated face until the ground support has been installed and checked by a geotechnical representative.

The following sections of this Addendum report present an assessment of impacts and the mitigation and management measures to be implemented to show how the Stage 1 and 1A works can satisfy the Low Noise Impact Works requirements.

3 Construction noise objectives

The DNVIS Section 3 describes the Land Use Survey and Noise Catchment Areas used to identify sensitive receivers potentially impacted by the Project and establish receiver groups for the purpose of assessment and management of impact.

Construction airborne noise objectives are detailed in the CNVS Section 2. A summary of the objectives as applicable to the Pyrmont Station works is provided in Table 4.1 of the DNVIS. Construction noise objectives specific to these works are presented in Table B1 in Sensitive receivers and noise management levels.

Low Noise Impact Works objectives are presented in Table B1 for outside standard construction hours, including the Evening (NMLE) and Night (NMLN) period.

4 Construction airborne noise impacts

The airborne noise prediction methodology is consistent with the DNVIS (Section 5.1).

4.1 Predicted noise levels

Airborne 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 4.2 presents a summary of the number of residential receivers and 'other sensitive receivers' (in use) likely to be noise affected by the additional activity associated with the OOH works. 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 4.1.

Table 4.1: Key to the predicted construction airborne noise results tables

Assessment	Time of day	Key			
L _{Aeq} (15min)	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 4.2 summarises the number of construction air-borne 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. Predicted noise levels are presented in Appendix Predicted noise levels.

Table 4.2: Number of receiver buildings over the airborne noise management level (all NCAs)

Construction activity	Scenario ID/ mitigation	Evening ¹				Night ¹				Hotel/Motel/ Hostel ²				Sleep disturbance ¹	
		L _{Aeq}				L _{Aeq}				L _{Aeq}				L _{Amax}	L _{Amax}
		1 – 2 dB(A)	3 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	1 – 2 dB(A)	3 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	1 – 2 dB(A)	3 – 10 dB(A)	11 – 20 dB(A)	> 30 dB(A)	> 52 or RBL+15 dB	> 65 dB(A)
Stage 1: Low impact roadheader assembly	S1 (no mitigation)	1	4	0	0	0	5	0	0	0	0	0	0	^	^
	S1_M (mitigation as per Figure 2.1)	0	0	0	0	4	0	0	0	0	0	0	0	4	0
Stage 1A: Low impact shaft support work	SA1 (no mitigation)	1	4	0	0	0	5	0	0	0	0	0	0	^	^
	SA1_M (mitigation as per Figure 2.1)	0	0	0	0	2	0	0	0	0	0	0	0	4	0

Note: 1. Applies to residential receivers
 2. Other sensitive receiver likely to be in use at the time of works. Impacts to all 'other sensitive receivers included in Appendix C.
 3. ^ indicates not modelled for this scenario.

4.1.1 Standard construction hours

Low Noise Impact Work requirements do not apply during standard construction hours.

4.1.2 Out of hours work

Stage 1 and 1A – low noise impact works

The results summarised in Table 4.2 show that the activities required during the OOH will exceed the NMLs during the evening and night period by up to 10 dB(A) during **Stage 1** and **1A**, prior to implementation of mitigation measures described in Section 2.1. Installation of mitigation measures, including the closing off of the vertical voids between the work platforms, and the partial construction of the acoustic shed walls are predicted to reduce noise levels during **Stage 1** and **1A** to within the evening and night NMLs at the worst affected receivers, with the exception of up to four receivers where predicted noise levels are within 2 dB(A) of the NML:

- 65-67 EDWARD STREET PYRMONT
- 1-5 HARWOOD STREET, PYRMONT
- 1-9 PYRMONT BRIDGE ROAD, PYRMONT
- 17-21 PYRMONT BRIDGE ROAD, PYRMONT.

Predicted noise levels are considered to be conservative, based on a realistic, worst case scenario of what is likely to be operating concurrently during the OOHW period. Assumptions regarding plant and equipment likely to be operating during Stage 1 and Stage 1A are noted in Table 2.1.

Measurements would be conducted on site prior to the commencement of the proposed OOHW, to confirm that measured construction noise levels are below the NMLs (refer to Section 4.2.3 for detail).

Mitigation and management measures summarised in Section 9 of the DNVIS will continue to be implemented during the Low Noise Impact Works.

4.1.3 Sleep disturbance

The results summarised in Table 4.2 show that there are residential receiver buildings where predicted L_{Amax} noise levels are above the $L_{Aeq(15min)}$ sleep disturbance screening level. Predicted instantaneous noise levels at up to 3 residential receiver buildings are above the initial L_{Amax} sleep disturbance screening level. No residential buildings are likely to be exposed to events above 65 dB(A) (external).

Due to the nature of the activities to be undertaken, it is difficult to quantify how many events above the screening level are likely to occur. Instantaneous noise events will be dependent on materials handling, site activity on the surface and worker behaviour on site.

Predicted impacts are conservative, based on a realistic, worst case scenario of what is likely to be operating during the night period. Verification noise monitoring (refer to Section 4.2.3) would be conducted prior to the commencement of the proposed night works to identify any actions that might trigger L_{Amax} events above the screening level. Mitigation and management measures (outlined in Table 4.3) would be identified and implemented to ensure L_{Amax} noise levels during the night period are below $RBL + 15$ dB(A) to meet low noise impact requirements.

4.2 Mitigation and management measures

4.2.1 Specific mitigation measures

In addition to the mitigation and management measures outlined in Section 9 of the DNVIS, the following specific mitigation measures will be implemented as applicable during the proposed OOH works, taking into consideration industry best practice methods in accordance with Condition D28 of the Planning Approval.

Table 4.3: Specific mitigation measures

Control measure	Description of the control measure	Feasible/ reasonable test	Adopted?
Limit activities during OOH period as noted in Table 2.1	OOH works would be limited to the plant and activities nominated in Table 2.1, to manage noise emission from site to below the low noise impact requirements.	This measure could be feasibly and reasonably implemented.	Yes
Use of existing construction hoarding surrounding site.	Works will be contained within the construction footprint, behind existing construction hoarding and within the acoustic shed components that have been constructed at the time of the works.	This measure could be feasibly and reasonably be implemented.	Yes
Close off vertical voids between work platforms	Installation of plywood, noise blankets or spoil material to close off and seal the vertical voids between upper and lower work platform, and between lower work platform and ground level.	Estimated 5 dB noise reduction. Covering of vertical void between platforms and between platform and ground surface level reasonable and feasible.	Yes
Partial construction of acoustic shed walls	Prior to commencement of: <ul style="list-style-type: none"> Stage 1 OOH works, walls of acoustic shed should be installed as shown on Figure 2.1 Where shed is incomplete, works would be further limited to ensure noise levels are below NML at receivers (confirmed by verification monitoring). 	Estimated 5-10 dB noise reduction. Shed will be completed to extent noted for each stage, or better	Yes
Access gates closed during OOHW on worksite.	The access gate at Edward Street, Union Street and Pyrmont Bridge Road would be closed during OOHW on site.	This measure could be feasibly and reasonably be implemented.	Yes
Switch off plant not in use.	Any plant not in use for an extended period (e.g. delivery trucks) would be switched off and not left idling on site.	This measure could be feasibly and reasonably be implemented.	Yes
Toolbox talks	Toolbox Talks will be provided to all personnel involved in the OOH works (as per the DNVIS), specifically targeted to ensure the noise impacts from unloading and installation of the steel components of the acoustic shed and platforms. Toolbox talks should encourage employees to limit the occurrence of high instantaneous noise sources that may trigger sleep disturbance by following good behavioural practices, including: <ul style="list-style-type: none"> No swearing or unnecessary shouting or loud stereos/radios on site. Use of slings instead of chains when manoeuvring shed components using the gantry crane. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air. 	This measure could be feasibly and reasonably be implemented.	Yes

4.2.2 Additional noise mitigation measures

The steps to be carried out to determine the additional airborne noise management measures to be implemented are identified in Section 9.4.1 of the DNVIS. Prior to the commencement of works, receivers identified in APPENDIX C.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 C.3.

4.2.3

4.2.3 Attended airborne noise monitoring

Consistent with Section 9.6.1 of the DNVIS, attended noise monitoring is to be undertaken to verify that noise levels resulting from Stage 1 and 1A low noise impact works are below the NML.

Attended noise monitoring will be completed at the nominated receiver locations, subject to gaining access to properties. Where access to properties is denied, monitoring will be undertaken in publicly accessible areas on or near the nominated receivers. The nominated monitoring locations are:

Table 4.4: Nominated verification monitoring locations

Type of monitoring	NCA/ Receiver type	Nominated receiver address
Unattended	PYR-E1 FIXED RTM	69 EDWARD STREET PYRMONT, NSW (balcony)
Unattended	PYR-E2 FIXED RTM	1-5 HARWOOD STREET, PYRMONT, NSW (rooftop balcony)
Unattended	PYR-W FIXED RTM	28 PATERNOSTER ROW, PYRMONT, NSW (rear courtyard)
Attended	NCA05	1-5 HARWOOD STREET, PYRMONT, NSW
Attended	OSR (HOTEL)	104 PYRMONT STREET, PYRMONT, NSW (THE SEBEL HOTEL)

For Stage 1 and 1A works, to ensure low noise impact requirements are met, the following verification process will be followed.

1. Site noise level checks

Prior to the commencement of OOHW, noise monitoring would be undertaken on site to confirm plant sound power levels are consistent with (or below) the assumptions in Table 2.1. Where noise levels are above the levels in Table 2.1, mitigation and/ or management measures would be implemented to reduce noise levels accordingly.

2. Initial noise checks at intermediate and receiver monitoring locations

Prior to the commencement of OOHW, noise monitoring would be undertaken during standard hours during a period where ambient noise levels are lower (e.g. Saturday). Noise levels will be compared to the predicted noise levels and the noise management levels for the evening period (and night period, if practicable). Low noise impact works can extend into the OOHW period where measured noise levels are below the NML for the relevant period.

3. Establish intermediate monitoring locations on or near site works for verification monitoring

If ambient noise from non-project related sources cannot be excluded from the measurements, this will complicate the ability to verify low noise impact works. Intermediate locations will then be established on or near site to allow monitoring of construction noise with minimal influence from other noise sources. The intermediate locations will be selected during the site noise level checks to ensure that they are representative of construction noise propagating towards the nearest residential receivers. Noise levels will be predicted to the transient locations for comparison with measured noise levels.

4. Ongoing noise checks at receiver (or intermediate, if required) monitoring locations during evening and night period

Ongoing noise checks would be carried out during Stage 1 and 1A works to confirm noise levels are below the NML during the evening and night period.

5 Impact classification

The impact classification from Section 10 of the DNVIS has been reviewed taking into consideration the outcomes of this Addendum assessment report. The impact classification for these works is **low**, consistent with (less than) the classification in the DNVIS. It is noted that the OOH works will allow the uninhibited installation of the acoustic shed, and potentially expedite the completion of tunnelling excavation which will reduce the overall impacts from the excavation works at Pyrmont East.

Whilst predicted noise levels from the OOH were found to marginally exceed the NMLs at three locations, the impacts will be managed through the mitigation and management measures outlined in Section 9 of the DNVIS and Section Mitigation and management measures of this Addendum report, including suitable community notification regarding the works and noise monitoring to verify low impact requirements are met.

6 Conclusion

In conclusion, works associated the Pyrmont Station east worksite partial shed OOH tunnelling works have been described in this Addendum DNVIS to identify potential environmental risks associated with construction noise and vibration. Construction noise and vibration objectives have been established in the DNVIS, consistent with the conditions of approval for the Project and the EIS.

Construction airborne noise

The predicted airborne noise levels were found to exceed the NMLs during the evening and night period. Airborne noise impacts will be managed through the mitigation and management measures outlined in Section 9 of the DNVIS and Section 4.2 of this Addendum report, including implementing community notification regarding potential impacts from the works.

Construction ground-borne noise and vibration

There are no vibration significant plant or equipment proposed to be used during the OOH works. Ground-borne noise and vibration impacts are unchanged from the impacts presented in the DNVIS.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
08.04.2024	Initial issue (non-reviewed)	-	0			
15.04.2024	Update following client comments	-	1			
02.05.2024	Respond to AA comments	-	2			
09.05.2024	Remove stage 2 works	-	3			

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The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

References

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

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.

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.
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).
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.
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.
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.
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.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L _{eq} 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	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
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

400 m
300
200
100
0



LEGEND

Noise Sensitive Receiver

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

Tunnel Alignment
 Project Worksites
 Project NCAs

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

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 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



REV	BY	DATE	DESCRIPTION	APPROVER
r2	SS	25/01/24	Landuse Update	TG
r1	SS	18/10/23	Heritage update	TG
r0	DA	03/04/23	Prepare figures	TG

Co-ordinate System: MGA Zone 56

0 50 100 150 m

1:3,000 At A3

FULL SIZE A3, REDUCED TO A4

NOTE: Do not scale from this drawing.

CLIENT

SYDNEY METRO WEST

JOHN HOLLAND CPB Ghella

ACOUSTIC CONSULTANT

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inspired to achieve

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B.2 NCAs and noise management levels

PYRMONT STATION

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

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	$L_{Aeq}(5min)$	L_{Aifmax}
Residential receivers														Nearest worksite		
NCA04	Predominantly Residential	B.04	50	47	45	56	50	47	60	55	52	50	53	50	60	Pyrmont
NCA05	Predominantly Residential	B.05	52	49	46	61	59	56	62	57	54	51	54	51	61	Pyrmont
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) façade loss
Hotel - night-time									60	60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) façade loss
Café/ Bar/ Restaurant									60	60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 10 dB(A) façade 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) façade loss
Studio building (music recording studio)									45	45	45	45	45	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) façade loss
Studio building (film or television studio)									50	50	50	50	50	-	-	Source: AS2107 'maximum', assuming 20 dB(A) façade loss
Theatre/ Auditorium									50	50	50	50	50	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) façade 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

APPENDIX C Construction airborne noise impacts

C.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.

C.2 Number of exceedances per NCA

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

C.3 Additional noise mitigation and receiver notifications

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

ACOUSTICS ADVISOR ENDORSEMENT SYDNEY METRO WEST (SSI 19238057)

Review of	Eastern Tunnelling Package: Detailed Noise and Vibration Impact Statement (DNVIS) – Addendum - Pymont Station – low noise impact OOH prior to shed completion	Reviewed document reference:	TM372-02-1-02F05 SMW-ETP_ADD-DNVIS-PYR_OOH partial shed(r3)
Prepared by:	[REDACTED], Acoustics Advisor		Revision 3 dated 9 May 2024
Date of issue:	10 May 2024		

Context

As approved Acoustics Advisor for the Sydney Metro West project, I endorsed Rev 4 of the Detailed Noise and Vibration Impact Statement (DNVIS) for Pymont Station Works on 14 March 2024. I then endorsed an addendum to the DNVIS on 20 March 2024 covering the OOH use of the tower crane for unloading components of the deck and acoustic shed at the Pymont East site. This addendum to the Pymont Station DNVIS covers low noise impact OOH works prior to shed completion at Pymont East.

Notes

I provided comments on Rev 1 of this addendum, and I am satisfied that my comments have been addressed. The DNVIS includes a detailed methodology for attended monitoring to verify that noise levels from the works meet Condition D23(b).

Endorsement

I endorse Revision 3 of the DNVIS addendum for implementation of the proposed works as low noise impact work under Condition D23(b).

[REDACTED]

[REDACTED], Metro West Acoustics Advisor