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SYDNEY METRO - WESTERN SYDNEY AIRPORT - STATION BOXES AND TUNNELLING WORKS - Addendum Detailed Noise and Vibration Impact Statement - Claremont Meadows Ventilation Facility

1 Introduction

This technical memorandum is an addendum to the report *Detailed Noise and Vibration Impact Statement – Claremont Meadows Ventilation Facility*[1] (Claremont Meadows DNVIS) and has been prepared on behalf of CPB Ghella Joint Venture (CPBG) in accordance with the Sydney Metro Construction Noise and Vibration Standard (CNVS) [1] for the construction of the Sydney Metro: Western Sydney Airport – Station Boxes and Tunnelling SBT Works. The DNVIS and this addendum have been prepared to satisfy SSI 10051 Infrastructure Condition of Approval (CoA) E47.

This addendum to the DNVIS assesses noise and vibration impacts from the proposed out-of-hours (OOH) TBM support works.

2 Construction works, hours and objectives

2.1 Construction works addressed in this Addendum DNVIS

2.1.1 Location of works

The works assessed in this addendum include TBM support works within the shaft and on the surface. The works will consist of the following phases:

[1] Sydney Metro – Western Sydney Airport – Station Boxes and Tunnelling Works, Detailed Noise and Vibration Impact Statement – Claremont Meadows Ventilation Facility, reference TM008-02-02F01 SMWSA-SBT_DNVIS-DMF, revision 5, dated 5 September 2023

- Phase 1 – TBM breakthrough, traverse and relaunch
- Phase 2 – Post TBM Relaunch (at least 200m in-bye)
- Phase 3 – Segment storage and lifts

Figure 2-1 following shows the indicative locations of the TBM support works assessed in this Addendum DNVIS.

Figure 2-1: TBM support works – Claremont Meadows Ventilation Facility

2.1.2 Construction works

The TBM support works assessed in this addendum will be undertaken within standard and outside standard construction hours. The extent of the out of hours works have been limited as much as practicable to minimise noise emission from the worksite. The works are summarised in Table 2-1. A detailed summary of the construction activities assessed in this report is presented in Table C1 of APPENDIX C.

Table 2-1: Summary of construction works under this DNVIS

Phase	Activity	Aspect	Construction hours	Indicative timing
Phase 1 – TBM breakthrough, traverse and relaunch	TBM breakthrough	TBM breakthrough	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
	Post TBM breakthrough	Post TBM breakthrough clean up	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
		Breakthrough face stabilisation with shotcrete	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
		Installation of concrete precasts, steel modules and steel supports	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
	TBM traverse	Ring building & bracings	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
		Traverse TBM using thrust cylinders	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
		Grouting underneath invert segment	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
		TBM mechanical maintenance	Standard hours + OOHW (D/E/N)	Jan 2024 – Feb 2024
Phase 2 – Post-TBM relaunch	Post-TBM Relaunch (at least 200m in-bye)	Tunnel activities include cutting & clamping of tunnel belt, stripping of tunnel conveyor structures and services	Standard hours + OOHW (D/E/N)	Feb 2024
		Demolition of blind rings within CMF shaft	Standard hours + OOHW (D/E)	Feb 2024
		Removal of concrete rubbles and steel temporary works	Standard hours + OOHW (D/E/N)	Feb 2024
		Installation of conveyor gallows and service pipe stands	Standard hours + OOHW (D/E/N)	Feb 2024
		Tunnel conveyor belt reconfiguration and belt splicing	Standard hours + OOHW (D/E/N)	Feb 2024
		Tunnel earth ramps installation – granular material capped with concrete	Standard hours + OOHW (D/E/N)	Feb 2024
Phase 3 – Segment storage and lifts	Segment storage and lifts	Segment storage and lifts	Standard hours + OOHW (D/E/N)	Mar 2024 – Oct 2024

Notes: OOHW' means Out of Hours works, or work outside the standard construction hours

'OOHW(D)' is the OOH 'Day' period, 1pm to 6pm Saturday; 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

* Crawler Crane only plant used during the night period and only used for emergency egress outside of standard hours

2.1.3 Construction traffic

Construction traffic noise is based on the proposed activities presented in Table 2-1 and Table C1 in APPENDIX C. The TBM support works will include heavy truck movements during the day and night period. The heavy vehicle movements at night have been limited as much as practical to minimise the construction traffic noise impacts. Construction traffic noise objectives are detailed in Table 4.1 of the DNVIS.

2.2 Construction Hours

Construction hours are as reported in the DNVIS Section 2.2.

The TBM support works will be undertaken during standard construction hours and outside standard construction hours, during the evening period.

2.2.1 Justification for OOHW

The TBM support works are prescribed activities under Condition of Approval E41(d) and are permitted to operate 24 hours to support and as part of tunnelling works. All reasonable and feasible mitigation measures will be implemented to reduce noise emissions from the TBM support works to be below the NMLs.

2.3 Construction noise and vibration 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 noise and vibration objectives are detailed in the CNVS Section 4. A summary of the objectives as applicable to the CMF TBM support works is provided in Table 4.1 of the DNVIS. Construction noise objectives specific to these works are presented in APPENDIX B.

3 Construction noise and vibration assessment

3.1 Airborne noise assessment

The construction activities included in this addendum are summarised in Table 3-1.

Table 3-1: Summary of construction activities

Stage (APPENDIX C)	Work Activity (APPENDIX C)	Scenario reference code (APPENDIX C)[1]
TBM breakthrough	TBM breakthrough	TBMB
Post-TBM breakthrough scenario 1	Post TBM breakthrough clean up	PTBMB-1
Post-TBM breakthrough scenario 2	Breakthrough face stabilisation with shotcrete + Installation of concrete precasts, steel modules and steel supports	PTBMB-2
TBM traverse scenario 1	Installation of concrete precasts, steel modules and steel supports + Ring building and bracings	TBMT-1
TBM traverse scenario 2	Ring building and bracings + Traverse TBM using thrust cylinders	TBMT-2
TBM traverse scenario 3	Grouting underneath invert segment + TBM mechanical maintenance	TBMT-3
Phase 2 – Post-TBM relaunch	Post-TBM Relaunch (at least 200m in-bye)	P2
Phase 3 – Segment storage and lifts	Segment storage and lifts	P3

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

Noise impacts during construction works have been predicted and compared to the noise management level (NMLs). A receiver is considered construction noise affected when the predicted construction noise level is above the NML. Table 3-3 and Table 3-4 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 3-2. Detailed predicted L_{Aeq} noise levels for all receivers in each NCA are presented in Table D.1 of C.2.

Table 3-2: Key to the predicted construction ground-borne 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 3-3 Number of receiver buildings over the noise management level (all NCAs) - residential receivers

Stage	Construction activity	Assessment reference	Highly noise affected[3]	Day (standard hours)					Day (outside standard hours)					Evening					Night					Sleep disturbance		
			L_{Aeq}	L_{Aeq}					L_{Aeq}					L_{Aeq}					L_{Aeq}					L_{Aeq}		L_{Amax}
			> 75 dB(A)	1 – 5 dB(A)	6 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 5 dB(A)	6 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 5 dB(A)	6 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 5 dB(A)	6 – 10 dB(A)	11 – 20 dB(A)	21-30 dB(A)	> 30 dB(A)	1 – 5 dB(A) above criteria	> 5 dB(A) above criteria	> 52 or RBL+15 dB(A)
TBM breakthrough	TBM breakthrough	TBMB	0	0	0	0	0	0	8	0	0	0	0	8	0	0	0	0	16	0	0	0	0	15	0	0
Post-TBM breakthrough scenario 1	Post TBM breakthrough clean up	PTBMB-1	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0	0	4	0	0	0	0	4	0	0
Post-TBM breakthrough scenario 2	Breakthrough face stabilisation with shotcrete + Installation of concrete precasts, steel modules and steel supports	PTBMB-2	0	0	0	0	0	0	15	0	0	0	0	16	0	0	0	0	8	0	0	0	0	7	0	0
TBM traverse scenario 1	Installation of concrete precasts, steel modules and steel supports + Ring building and bracings	TBMT-1	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0	0	8	0	0	0	0	7	0	0
TBM traverse scenario 2	Ring building and bracings + Traverse TBM using thrust cylinders	TBMT-2	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0	0	5	0	0	0	0	4	0	0
TBM traverse scenario 3	Grouting underneath invert segment + TBM mechanical maintenance	TBMT-3	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0	0	10	0	0	0	0	9	0	0
Phase 2 – Post-TBM relaunch	Post-TBM Relaunch (at least 200m in-bye)	P2	0	0	0	0	0	0	4	0	0	0	0	5	0	0	0	0	9	0	0	0	0	8	0	0
Phase 3 – Segment storage and lifts	Segment storage and lifts	P3	0	0	0	0	0	0	15	0	0	0	0	16	0	0	0	0	22	0	0	0	0	20	0	0

Note: 1. No work is proposed outside standard construction hours for this work activity, except for the water treatment plant which operates 24/7.
2. Construction noise level cells are shaded based upon the predicted worst case NML exceedance in accordance with the key presented in Table 3-2.
Highly noise affected applies to residential receivers, as per the ICNG.

Table 3-4 Number of other sensitive receivers over the noise management levels (all NCAs)

Stage	Construction activity	Assessment reference	Commercial				Childcare				Educational				Recreational				Places of worship				Hotel/Motel/ Hostel				Industrial			
			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)
TBM breakthrough	TBM breakthrough	TBMB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post-TBM breakthrough scenario 1	Post TBM breakthrough clean up	PTBMB-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post-TBM breakthrough scenario 2	Breakthrough face stabilisation with shotcrete +Installation of concrete precasts, steel modules and steel supports	PTBMB-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBM traverse scenario 1	Installation of concrete precasts, steel modules and steel supports + Ring building and bracings	TBMT-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBM traverse scenario 2	Ring building and bracings + Traverse TBM using thrust cylinders	TBMT-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBM traverse scenario 3	Grouting underneath invert segment + TBM mechanical maintenance	TBMT-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phase 2 – Post-TBM relaunch	Post-TBM Relaunch (at least 200m in-bye)	P2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phase 3 – Segment storage and lifts	Segment storage and lifts	P3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: 1. Commercial, industrial, recreational and other sensitive receivers have been assessed against the respective NMLs, and exceedances have been presented in the count table.
2. Impacts only applicable when facility is in use.
Highly noise affected does not apply to OSRs, as per the ICNG.

3.1.1 Standard construction hours

The results summarised in Table 3-3 and Table 3-4 show that no nearby residential receivers or other sensitive receivers may be construction noise affected by the TBM support works during standard construction hours. The predicted noise levels from the TBM support works are below the highly noise affected level of $L_{Aeq(15min)}$ 75 dB(A) at all residential receivers. Note that predictions are based on the worst-case scenario during the peak construction period. Actual noise levels are likely to be lower than the predicted noise levels.

3.1.2 Out of hours work

The TBM support works assessed in this addendum would occur outside of standard hours, provided all reasonable and feasible mitigation measures have been implemented to reduce noise levels with the aim of minimising noise impacts. Predicted noise levels include that the mitigation measures in Section 3.4.1 and Section 3.4.2 are implemented, The results summarised in Table 3-3 show that nearby residential receivers are likely to be within 5 dB(A) above the construction noise management level for all scenarios of the out-of-hours TBM support works.

Measures for managing construction noise impacts are described in Section 3.4.

3.1.3 Sleep disturbance

The TBM support works assessed in this addendum are scheduled for 24 hour operation. The maximum noise levels from all proposed works are predicted to be within 5 dB(A) of the $L_{Aeq(15min)}$ sleep disturbance NML ($L_{Aeq,15min}$ above 40 dB(A) or RBL plus 5 dB, whichever is the greater) and below L_{Amax} sleep disturbance (L_{Amax} above 52 dB(A) or RBL plus 15 dB, whichever is the greater). The main contributor to sleep disturbance impacts is identified to be the concrete truck movements on site. During the night-time period, a maximum of 3 concrete trucks per hour is required at peak production.

3.1.4 Cumulative noise impacts

The TBM support works assessed in this addendum are not scheduled to be undertaken concurrently with any works assessed in the Claremont Meadows DNVIS. There will be no cumulative noise impacts from the TBM support works.

3.2 Construction vibration assessment

Vibration intensive plants utilised for the works (see table C.1 in APPENDIX C) are less vibration intensive than the plants assessed in the Claremont Meadows DNVIS and the work area for the vibration intensive works within the shaft remain the same as assessed in the Claremont Meadows DNVIS. No additional vibration assessment needs to be conducted.

3.3 Construction traffic noise assessment

The heavy vehicle routes and construction traffic noise prediction methodology are consistent with what was assessed in the Claremont Meadows DNVIS (Section 7).

Details of projected heavy vehicle movements associated with the construction works are summarised in Table 3-5, which were provided by CPBG (See Table C.1 in APPENDIX C)

Table 3-5: Summary of construction generated traffic based on Table C.1 in APPENDIX C

Activity/ Aspect	Vehicle type	Construction vehicles – Total		Construction traffic movements (in/out) – Total	
		Day (7am-10pm)	Night (10pm-7am)	Day (7am-10pm)	Night (10pm-7am)
Peak construction	Light vehicles	60 (30 per hour*)	-	120	-
	Heavy vehicles	330 (17 per hour)	36 (4 per hour)	660	72

NOTES:

* Busiest 1 hour before/after shift (6am to 7am; 6pm to 7pm)

OSD = Oversized deliveries that are restricted by the road authority from travelling on public roads during standard construction hours.

To predict road traffic noise levels on the existing road network, the most recent available traffic data for each road forming part of the site access route was obtained by reviewing the EIS Technical Paper 2: Noise and vibration [4]. Base traffic volumes based on the EIS are detailed in Table 3-6.

Table 3-6: Summary of traffic volumes – base (2023/2024) traffic volumes and base traffic volumes with construction traffic

Road	RNP Classification	Distance to nearest representative residential receiver	Posted speed limit	2023/2024 Base				2023/2024 Base + Construction traffic			
				Day (7am to 10pm)		Night (10pm to 7am)		Day (7am to 10pm)		Night (10pm to 7am)	
				Total vehicles	HV%	Total vehicles	HV%	Total vehicles	HV%	Total vehicles	HV%
Peak construction											
Great Western Highway (east of Gipps Street)	Arterial	200 m	80 km/h	44708	3%	7278	2%	45488	4%	7314	3%
Great Western Highway (west of Gipps Street)	Arterial	25 m	80 km/h	43257	3%	7042	2%	44427	4%	7078	3%
Gipps Street/ Kent Road (north of M4)*	Sub-arterial	15 m	80 km/h	21629	6%	3817	3%	22799	9%	3853	5%

NOTES: * Existing roadside noise barrier on western side of Gipps Street, approx. 3.5 metres high

Table 3-7: Predicted construction traffic noise impacts – base (2023/2024) traffic volumes and base traffic volumes with construction traffic

Road	RNP Classification	Day (7am to 10pm)			Night (10pm to 7am)		
		Metric	2023/2024 Base	Base + Construction	Metric	2023/2024 Base	Base + Construction
Peak construction							
Great Western Highway (east of Gipps Street)	Arterial	$L_{Aeq(15\ hour)}$	59	60	$L_{Aeq(9\ hour)}$	53	54
Great Western Highway (west of Gipps Street)	Arterial	$L_{Aeq(15\ hour)}$	69	70	$L_{Aeq(9\ hour)}$	63	64
Gipps Street/ Kent Road (north of M4)*	Sub-arterial	$L_{Aeq(15\ hour)}$	69	70	$L_{Aeq(9\ hour)}$	63	63

NOTES: * Existing roadside noise barrier on western side of Gipps Street, approx. 3.5 metres high

Bold text indicates more than 2 dB(A) increase in road traffic noise levels as a result of construction traffic.

Table 3-7 summarises the predicted construction traffic noise levels during day and night periods.

The predicted road traffic noise levels indicate less than 2dB(A) increase in $L_{Aeq(15h)}$ day on the Great Western Highway and Gipps Street during the peak construction periods. Therefore, the total road traffic noise levels comply with the RNP traffic noise criteria set out in Section 4 of the Claremont Meadows DNVIS.

The predicted road traffic noise levels indicate less than 2dB(A) increase in $L_{Aeq(9h)}$ night on the Great Western Highway and Gipps Street during the peak construction periods. Therefore, the risk of construction traffic impacting the existing traffic noise at receivers on the Great Western Highway at night is low.

3.4 Noise and vibration mitigation and management

The mitigation and management measures outlined in Section 5.3 and Section 6.3 of the Claremont Meadows DNVIS will be implemented to the TBM support works. In addition, the following mitigation measures will be implemented for the TBM support works. These mitigations are included in the predicted levels in this addendum. Consultation with affected receivers will be undertaken in accordance with Section 5.3.2 of the Claremont Meadows DNVIS.

3.4.1 Acoustic enclosure for concrete drop zone

An acoustic enclosure will be constructed around the concrete drop zone in order to minimise the noise impact from concrete deliveries. The acoustic enclosure will consist of a scaffold structure surrounding the concrete drop zone with noise blankets (or similar material) installed on all sides including the roof ensuring there are no gaps by overlapping the noise blankets. The opening of the enclosure must face away from sensitive receivers, to the north-west. The acoustic enclosure may reduce the noise levels from the concrete drop zone by up to 10 dB(A). Details of the acoustic enclosure are specified in Table C2 in APPENDIX C.2.

3.4.2 Acoustic mitigation for mobile crane

Acoustic mitigation of the mobile crane located on the surface of the site will be undertaken. A scaffold structure lined with noise blankets will be constructed to mitigate the noise impact from the mobile crane. The acoustic mitigation should aim to reduce the noise level from the crane by 5 dB(A) as detailed in Table C3 in APPENDIX C.2.

3.4.3 At-receiver (residual impacts)

At-property treatment to mitigate residual impacts (i.e. after implementation of all feasible and reasonable mitigation measures) from the out-of-hours TBM support works have been considered. This

would include the design and installation of architectural treatments to noise affected sensitive receiver buildings to reduce internal noise levels from the works to key rooms.

Predicted noise levels are within 5 dB(A) of the OOH NML based on typical worst-case scenario during the TBM support works. At-property treatment would involve the installation of mechanical ventilation to allow windows facing the worksite to be closed to reduce noise intrusion, whilst maintaining fresh air ventilation within the property. This measure could be feasibly implemented, however in reviewing whether the mitigation measure is reasonable the following was identified:

- Reasonable noise reduction has been achieved by the mitigation measures described in Section 3.4.1 and 3.4.2.
- OOHW residual impacts are marginal (<2 dB(A) above the OOH NML) at up to 17 properties and within 5 dB(A) above the OOH NML at 5 receivers. This is based on typical worst-case scenario during peak TBM support activity with the mitigation measures described in Section 3.4.1 and 3.4.2. The risk of exceedance occurring is considered low.
- The TBM support works would occur over approximately two months, from January to February 2024.
- Where external noise levels are less than 5dB(A) above the NML, internal noise goals can be achieved by closing windows. It is noted that key rooms may be able to close windows and still obtain adequate ventilation from other openings within the residence. Provision of mechanical ventilation can create disruption and can be poorly received.
- Given that the magnitude of the treatment (cost, time, disruption, contractual arrangements with owners etc) is greater than the magnitude of the impact it would address (low risk of exceedance, relatively short duration of impact) and that the option to close windows during the period of works assessed is available without mechanical ventilation, at property treatment is deemed not reasonable, provided OOHW residual impacts are as predicted. Predicted OOHW noise levels will be confirmed by verification monitoring (see section 3.4.4).

3.4.4 Attended noise monitoring

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 (when required). Noise monitoring will be completed in publicly accessible areas on or near the nominated receivers, typically at ground 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 3-8: Nominated verification monitoring locations

Type of monitoring	NCA	Nominated receiver address
Attended	NCA04	1 Water Street, Werrington NSW 2747

Type of monitoring	NCA	Nominated receiver address
Attended	NCA06	5 Dolphin Close, Claremont Meadows NSW 2747
Attended	NCA06	6-8 Mistletoe Avenue, Claremont Meadows NSW 2747
Attended	NCA06	2-52 Putland Street, Claremont Meadows NSW 2747

APPENDIX D.3 identifies the activities where monitoring should be carried out for each NCA.

Noise monitoring should follow the procedures outlined in the Noise and Vibration Monitoring Program (refer to Annexure A of the CNVMP). 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 3-8.

4 Impact classification

The impact classification in Section 9 of the Claremont Meadows DNVIS has been reviewed taking into consideration the outcomes of this Addendum assessment report. There is no change to the noise and vibration impact classification. That is, review of the overall noise impact of the TBM support works at the CMF worksite is considered **low to moderate**. The overall vibration impact of the bulk excavation and tunnelling works at the CMF worksite is considered **low**.

5 Conclusion

In conclusion, the TBM support works associated with the Claremont Meadows Ventilation Facility (not included in the Claremont Meadows DNVIS) have been described in this Claremont Meadows 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

The predicted noise levels indicated there are no highly noise affected receivers over the duration of the TBM support works.

The TBM support works would occur during and outside standard construction hours. The predicted noise levels indicate nearby residential receivers may experience noise levels above the corresponding NMLs outside standard construction hours. Predicted noise levels are within 5 dB(A) of the NML for all the construction noise affected receivers. All reasonable and feasible mitigation measures have been included in the assessment and designed with the aim of achieving noise goals.

Construction ground-borne noise

As discussed in the Claremont Meadows DNVIS, ground-borne noise from the TBM support works is expected to be negligible. The risk of annoyance due to ground-borne noise is considered low.

Construction vibration

As discussed in the Claremont Meadows DNVIS, there are no building/structures within minimum working distances for cosmetic damage and human annoyance.

Construction traffic

The predicted noise impacts comply with the construction traffic noise objectives described in the Claremont Meadows DNVIS.

Impact classification

The overall noise and vibration impact of the CMF TBM support works is considered **low to moderate**.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
11.12.2023	Initial issue	0	1	D. Auld	-	T. Gowen
24.01.2024	Respond to CPBG comments	-	2	D. Auld	-	T. Gowen
14.02.2024	Respond to ER comments	-	3	D. Auld	-	M. Tabacchi

File Path: R:\AssocSydProjects\TM001-TM050\TM008 mt Sydney Metro WSA SBT\1 Docs\02 CLAREMONT M\TM008-02-02F03 SMWSA-SBT_AddendumDNVIS-CMF (r3).docx

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 Western Sydney Airport Out-of-hours Work Protocol Version 2.0 (SM-21-00306108) – 8 November 2021

[4] M2A Joint Venture 2020 Sydney Metro - Western Sydney Airport - Technical Paper 2: Noise and Vibration October 2020

[5] M2A Joint Venture 2020 Sydney Metro - Western Sydney Airport – Submissions Report

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

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

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

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

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

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

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

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

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

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

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

[17] 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 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	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

Land-Use file revision_date: r7_12/07/21
Plot Date: 06/12/23 - 14:35 Layout: TM008 Land Use
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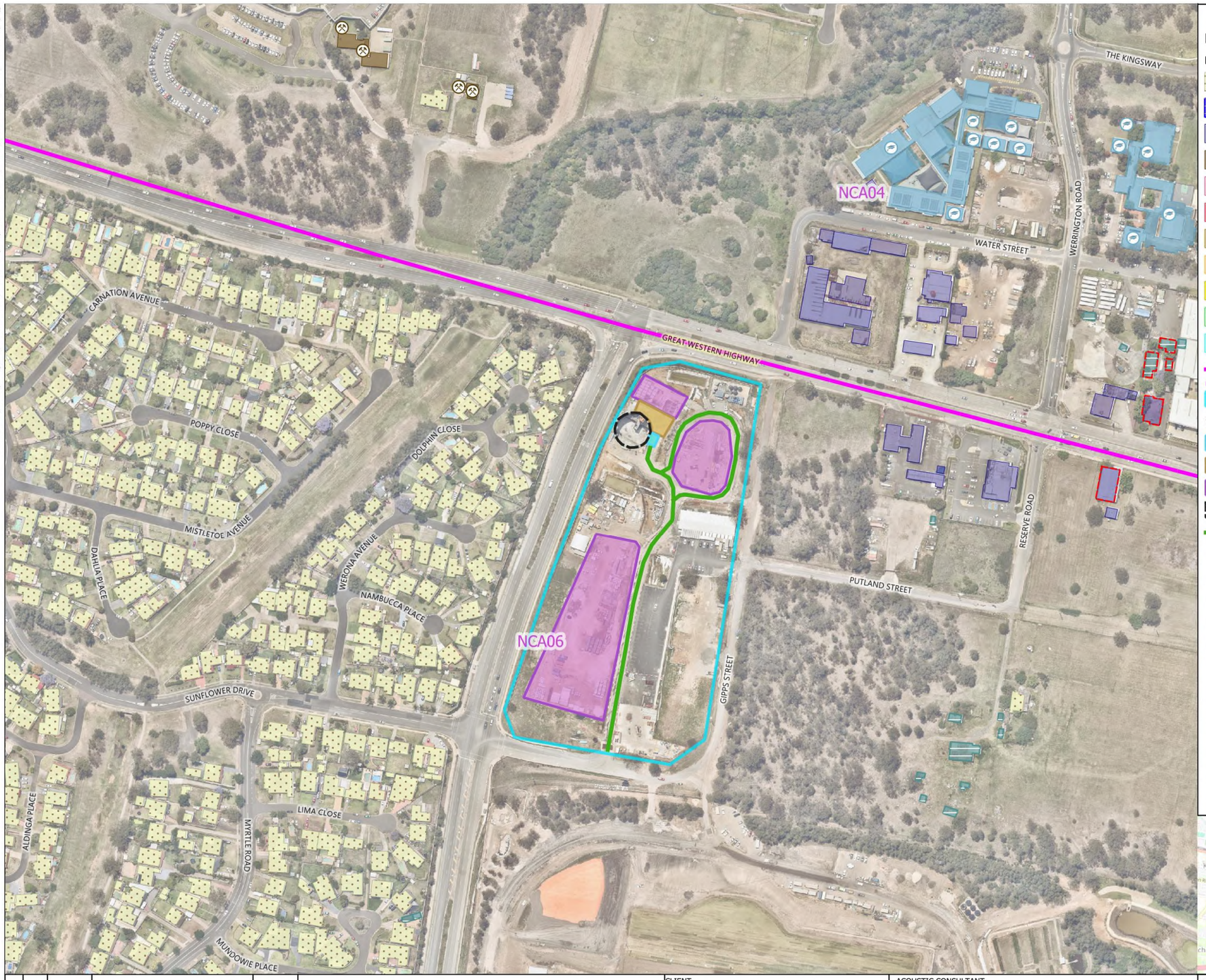

LEGEND

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
- CMF construction footprint

Work areas

- Concrete Drop Zone
- Crane Lifting
- Segment Storage
- Shaft
- Truck Routes

NCA	NMLDS	NMLE	NMLN	LAeq_E
NCA06	47	42	41	49
NCA04	45	37	36	47

REV	BY	DATE	DESCRIPTION	APPROVER
r0	DA	06/12/23	Prepare figures	TG

A3 Original | Co-ordinate System: MGA Zone 56

0 50 100 150 200 m
1:3,000
FULL SIZE A3
NOTE: Do not scale from this drawing.

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Land Use, Compounds and NCAs

B.2 NCAs and noise management levels

Table B.1 **Noise Sensitive Receivers and Construction Noise Management Levels (airborne noise)**

Table B1: Noise Sensitive Receivers and Construction Noise Management Levels (airborne noise) **CLAREMONT MEADOWS VENTILATION FACILITY**

			Existing Noise Levels, dB(A)						Airborne NMLs based on ICNG (external)				Sleep Dist. L_{Amax}		Comments
NCA	Receiver Type	Reference RBL	RBL Day	RBL Evening	RBL Night	LAeq_D	LAeq_E	LAeq_N	NMLDS	NMLDO	NMLE	NMLN	$L_{Aeq(15min)}$	L_{AFmax}	
Residential receivers															
NCA03	Predominantly Residential	NM02	37	37	36	55	59	51	47	42	42	41	41	52	
NCA04	Predominantly Residential	NM14	35	32	31	48	47	43	45	40	37	36	40	52	
NCA05	Predominantly Residential	NM05	40	40	40	54	51	50	50	45	45	45	45	55	
NCA06	Predominantly Residential	NM07	37	37	36	48	49	45	47	42	42	41	41	52	
Other sensitive receivers															
Studio building (music recording studio)									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	-	-	Source: AS2107 'maximum', assuming 20 dB(A) facade loss
Theatre/ Auditorium (Drama Theatre)									50	50	50	50	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss
Cinema space, theatre, auditorium									55	55	55	55	-	-	Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Classrooms at schools and other educational institutions									55	55	55	55	-	-	Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Childcare centre (indoor sleeping areas)									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	-	-	Source: CNVS Section 2.2.1
Hospital wards and operating theatres									65	65	65	65	-	-	Source: ICNG, assuming a conservative façade loss of 20 dB(A)
Places of worship									55	55	55	55	-	-	Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Library (reading areas)									65	65	65	65	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss
Hotel (Sleeping areas: Hotels near major roads)									60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss
Hotel (bars and lounges)									70	70	70	70	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 20 dB(A) facade loss
Community centres – Municipal Buildings									60	60	60	60	-	-	Source: AS2107 'maximum', assuming a conservative façade loss of 10 dB(A)
Bar/ Restaurant (Bars and lounges/ Restaurant)									60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 10 dB(A) facade loss
Café/ Coffee bar									60	60	60	60	-	-	Source: CNVS Section 2.2.1 & AS2107 'maximum', assuming 10 dB(A) facade loss
Railway platform and concourse areas									75	75	75	75	-	-	Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Passive recreation areas (e.g. area used for reading, meditation)									60	60	60	60	-	-	Source: ICNG
Active recreation areas (e.g. sports fields)									65	65	65	65	-	-	Source: ICNG
Commercial premises (including offices and retail outlets)									70	70	70	70	-	-	Source: ICNG
Industrial premises									75	75	75	75	-	-	Source: ICNG

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

APPENDIX C Construction timetable/ activities/ management

C.1 Construction timetable/activities/equipment

Table C1: Construction timetable/ activities/ equipment

CLAREMONT MEADOWS VENTILATION FACILITY

Phase/Staging	Expected Period	Activity/ Work Area	Aspect	Scenario reference	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	End Date	L_{AEq}	Penalty	L_{AMax}			
Phase 1 - TBM Breakthrough, Traverse and Relaunch	Jan - Feb 2024	TBM Breakthrough	TBM Breakthrough	TBMB	180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
					60ft Electric Knuckle Boom EWP	1	1	1			95	-	98	-	-	In Shaft
					Skid Steer	1	1	1			109	-	113	-	-	In Shaft
					TBM	1	1	1			106	-	110	-	-	In Shaft
					5T Excavator	1	1	1			101	-	114	-	-	In Shaft
					Powered hand tools such as hammer drills & diamor	1	1	1			108	-	118	-	-	In Shaft
					Compressed air powered tools	1	1	1			108	-	118	-	-	In Shaft
		Post TBM Breakthrough	Post TBM breakthrough clean up	PTBMB-1	180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
					Excavator 8t - 15t	1	1	1			103	-	108	-	-	In Shaft
			Breakthrough face stabilisation with shotcrete	PTBMB-2	Boom pump	1	1	-			103	-	107	-	-	Surface
					Concrete Agi	1	1	-			108	-	111	-	-	Surface
					Air compressor 425 cfm	1	1	-			70	-	-	-	-	Surface
					60ft Electric Knuckle Boom EWP	1	1	1			95	-	98	-	-	In Shaft
					Concrete trailer pump	1	-	-			103	-	107	-	-	In Shaft
			Installation of concrete precasts, steel modules and steel supports	PTBMB-2	180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
				TBMT-1	Drilling hand tools	1	1	1			106	-	118	-	0	In Shaft
		TBM Traverse	Ring building & bracings	TBMT-1	180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
				TBMT-2	TBM (ring building mode)	1	-	-			106	-	110	-	-	In Shaft
					Drilling hand tools	-	1	1			106	-	118	-	0	In Shaft
					grout pumps	-	1	1			103	-	107	-	-	In Shaft
			Traverse TBM using thrust cylinders	TBMT-2	180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
					TBM (ring building mode)	1	-	-			106	-	110	-	-	In Shaft
					Drilling hand tools	-	1	1			106	-	118	-	0	In Shaft
					grout pumps	-	1	1			103	-	107	-	-	In Shaft
			Grouting underneath invert segment	TBMT-3	180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
					Drilling hand tools	1	1	1			106	-	118	-	0	In Shaft
					grout pumps	1	1	1			103	-	107	-	-	In Shaft
			TBM mechanical maintenance	TBMT-3	180-200T Mobile Crane	1	-	-			104	-	108	-	-	Surface
					Drilling hand tools	1	-	-			106	-	118	-	0	In Shaft
					Drilling hand tools	1	1	1			106	-	118	-	0	In Shaft
					grout pumps	1	1	1			103	-	107	-	-	In Shaft
					water gerni	1	-	-			109	-	115	-	-	In Shaft
					welding machine	1	-	-			96	-	107	-	-	In Shaft
Phase 2 Post-TBM Relaunch		Post-TBM Relaunch (at least 200m in-bye)	Tunnel activities include cutting & clamping of tunnel belt, stripping of tunnel conveyor structures and services	P2	EWP	1	1	1			95	-	98	-	-	In Shaft
			Demolition of blind rings within CMF shaft		180-200T Mobile Crane	1	1	-			104	-	108	-	-	Surface
					Excavator 25t-30t	1	1	-			103	-	108	-	-	In Shaft
			Removal of concrete rubbles and all steel temporary works		180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
					Excavator 25t-30t	1	1	1			103	-	108	-	-	In Shaft
			Installation of conveyor gallows and service pipe stands		180-200T Mobile Crane	1	1	1			104	-	108	-	-	Surface
					EWP	1	1	1			95	-	98	-	-	In Shaft
			Tunnel conveyor belt reconfiguration and belt splicing		EWP	1	1	1			95	-	98	-	-	In Shaft
					Handtools	1	1	1			105	-	118	-	-	In Shaft
			Tunnel ventilation and services reconfiguration		EWP	1	1	1			95	-	98	-	-	In Shaft
					Handtools	1	1	1			105	-	118	-	-	In Shaft
			Tunnel earth ramps installation - granular material capped with concrete (TBC)		Boom pump	1	1	1			103	-	107	-	-	Surface
					Concrete Agi	1	1	1			108	-	111	-	-	Surface
					Excavator 8t - 15t	1	1	1			103	-	108	-	-	In Shaft
					Compactor	1	1	1			108	-	110	-	X	In Shaft
Phase 3 Segment Storage and Lifts		Segment Storage and Lifts	Segment Storage and Lifts	P3	Hydraulic crane 200T	1	1	1			104	-	108	-	-	Lifting segments into shaft
					Concrete truck	3 Per Hour	3 Per Hour	3 Per Hour			108	-	111	-	-	
					Boom pump	1	1	1			103	-	107	-	-	In Shaft
					Telehandler	1	1	1			98	-	102	-	-	
					Forklift	1	1	1			99	-	103	-	-	
					Ventilation fan	1	1	1			98	-	102	-	-	
					Spoil trucks	2 Per Hour	2 Per Hour	2 Per Hour			106	-	111	-	-	
					Segment deliveries	3 Per Hour	3 Per Hour	-			106	-	111	-	-	
					Water pump (diaphragm pump)	1	1	1			99	-	101	-	-	
					Water treatment plant (10l/s)	1	1	1			106	-	109	-	-	

C.2 Specific mitigation measures

Table C2: Noise Shed / Enclosure Design Specifications **CLAREMONT MEADOWS VENTILATION FACILITY**

Area to be Mitigated	Construction component	Reference ID	Indicative element construction
Temporary enclosure - concrete drop zone	Structure	-	Scaffold structure for body of enclosure
	Walls	-	Noise blankets lining walls ensuring no gaps by overlapping blankets
	Roof	-	Noise blankets lining roof ensuring no gaps by overlapping blankets
	Opening	-	Opening should face away from neighbours (i.e. to the north-west)
Acoustic mitigation for mobile crane	Structure	-	Scaffold structure for body of enclosure
	Walls	-	Noise blankets lining walls ensuring no gaps by overlapping blankets

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.
-
- 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 C3: Plant noise level schedule **CLAREMONT MEADOWS VENTILATION FACILITY**

Building/ Area to be Mitigated	Item	Acoustic Requirement	Lw dB(A)
Plant item	Mobile crane	Acoustic silencing subject to achieve	99

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)
- 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 noise impacts

D.1 Predicted noise levels

The detailed predicted levels have been provided to CPBG 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 CPBG in a spreadsheet table.

D.3 Additional management measures

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