APPROVAL
CITY & SOUTHWEST ACOUSTICS ADVISOR

Review of:	Sydney Metro City and Southwest Line Wide Works - CNVIS Addendum Report – Frank Channon Walk	**Document reference:**	TK685-03-17F04 CNVIS_CHANNON WALK (r4) Prepared by Renzo Tonin & Associates Pty Ltd 25 September 2023
Prepared by:	Daniel Weston Acoustics Advisor		
Date of issue:	25 September 2023		

As approved Acoustics Advisor for the Sydney Metro City & Southwest project, and as required under A27 (d) of the project approval conditions (SSI 15-7400), I have reviewed and provided comment on the Construction Noise and Vibration Impact Statement (CNVIS) Addendum Report for Frank Channon Walk (Chatswood Dive).

I am satisfied that the CNVIS Addendum Report is technically valid and includes appropriate noise and vibration mitigation and management. On this basis, I endorse the CNVIS Addendum Report referenced herein.

Daniel Weston, City & Southwest Acoustics Advisor

25 September 2023
TK685-03-17F04 CNVIS_CHANNON WALK (r4)

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Sydney Metro City and Southwest Line Wide Works - CNVIS Addendum Report - Frank Channon Walk

1 Introduction

This technical memorandum is an addendum to the report *Construction Noise and Vibration Impact Statement: Portion* 3 - *Chatswood Station* (*Chatswood CNVIS*[1]) and has been prepared on behalf of Systems Connect in accordance with the Construction Noise and Vibration Management Plan (CNVMP) [SMCSWLWC-SYC-1NL-PM-PLN-000032] for the Design and Construction of the Line-Wide Works (LWW) of the Sydney Metro City & Southwest Project (the Project).

Systems Connect is proposing to undertake the demobilisation and landscaping of the Chatswood Dive site for the Frank Channon walk. The works are scheduled to be completed during standard construction hours. The works will be undertaken on the surface within the Chatswood dive site and on Nelson Street, adjacent to the worksite (see Figure 2.1).

This memorandum has been prepared to address the potential construction noise and vibration impacts from the Frank Channon Walk construction works at the Chatswood Dive site. The works are anticipated to commence in September 2023 and conclude in December 2023.

2 Construction noise and vibration assessment

2.1 Proposed construction activities

Key details regarding the location and layout of the noise generating plant that will operate during these works were informed by the Construction and Environmental Teams. 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.

[1] *Sydney Metro City & Southwest – Line Wide Works, Construction Noise and Vibration Impact Statement: Portion 3 - Chatswood, reference: TK685-03-17F01 CNVIS C2S_P3 CHW(r2), revision 2, dated 8 April 2021*

Figure 2.1 Frank Channon Walk works at Chatswood Dive site

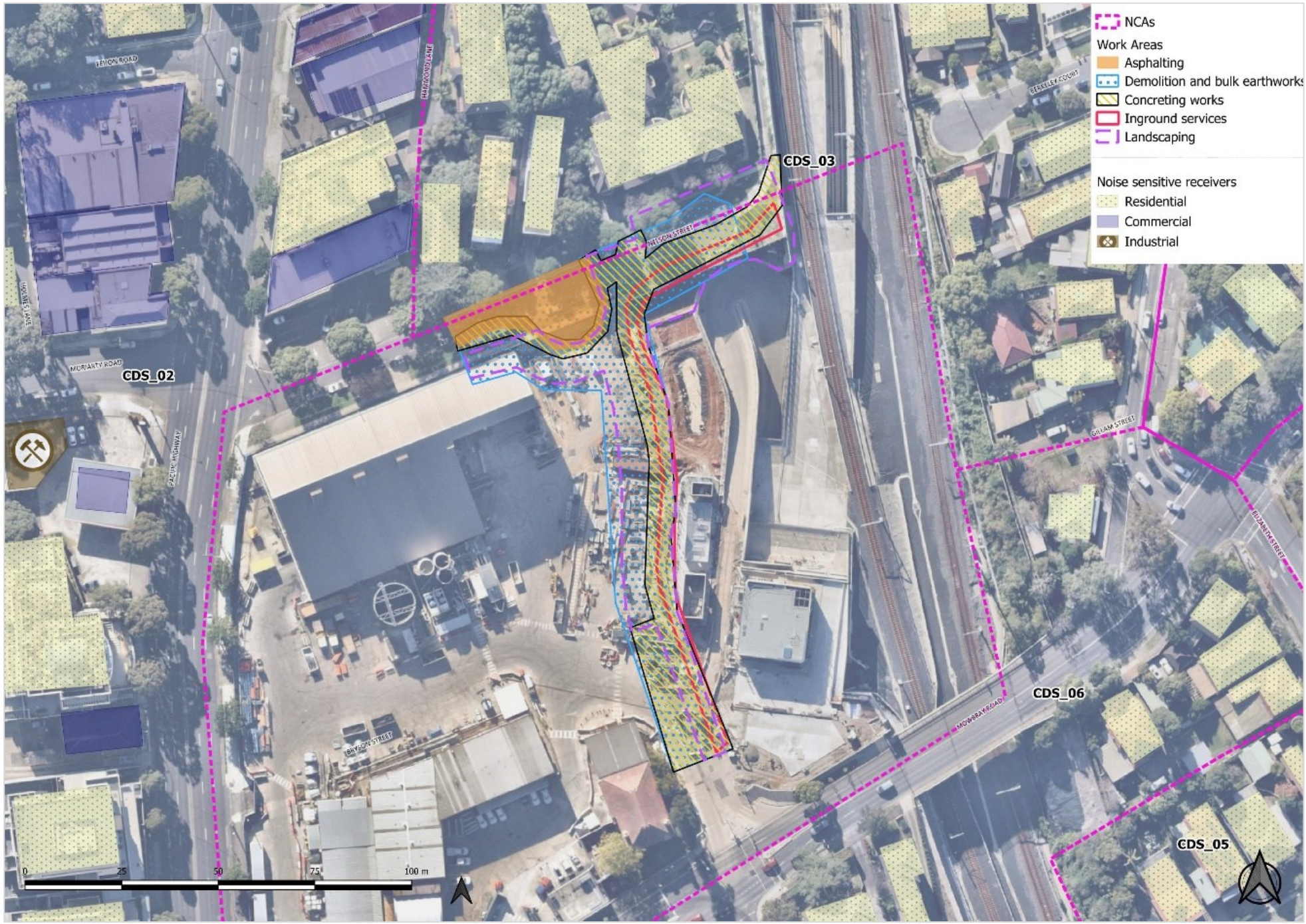

Table 2-1: Construction activities and equipment sound power levels used in noise modelling

Work activity	Work area as shown in Figure 2.1	Indicative timing/duration	Plant/ Equipment	Day 7am – 6pm	Evening 6pm – 10pm	Night 10pm – 7am	Sound Power Level (Lw re: 1pW), dB(A)		Hight noise plant	Vibration intensive plant
							$L_{Aeq(15min)}$	L_{Amax}		
Site establishment Site demobilisation / finishing works	-	1 x day - September 2023	Flat-bed truck (1 delivery, floating in 20t excavator)	1	-	-	102	111	-	-
			20t excavator tracking off flat-bed truck	1	-	-	103	111	-	-
Demolition of existing concrete	Demolition and bulk earthworks	4 weeks - Mid September to Mid-October	20t excavator with hammer	1	-	-	123	123	HN	X
			Road saw	1	-	-	126	129	HN	X
			8t excavator with bucket	1	-	-	103	108	-	-
			Jackhammer	1	-	-	111	121	HN	X
			Truck and dog	1	-	-	106	111	-	-
Regrade / compact subgrade	Demolition and bulk earthworks	3 weeks - Mid October to early November	20t excavator with bucket	1	-	-	103	108	-	-
			8t excavator with bucket	1	-	-	103	108	-	-
			10t roller	1	-	-	114	113	HN	X
			Vibrating plate	1	-	-	108	110	-	X
			Truck and dog	1	-	-	106	111	-	-
Inground services and light poles	Inground services	3 weeks - early November to later November	20t excavator with bucket	1	-	-	103	108	-	-
			8t excavator with bucket	1	-	-	103	108	-	-
		1.5 weeks	Hydrovac	1	-	-	107	111	-	-
		3 weeks - early November to later November	Vibrating plate	1	-	-	108	110	-	X
			Truck and dog	1	-	-	106	111	-	-
FRP road	Concreting / Asphalting	3-4 days throughout December	Concrete pump	1	-	-	103	107	-	-
			Concrete truck	1	-	-	108	111	-	-

Work activity	Work area as shown in Figure 2.1	Indicative timing/duration	Plant/ Equipment	Day 7am – 6pm	Evening 6pm – 10pm	Night 10pm – 7am	Sound Power Level (Lw re: 1pW), dB(A)		Hight noise plant	Vibration intensive plant
							$L_{Aeq(15min)}$	L_{Amax}		
Kerbs and guttering	Concreting	2 days throughout December	Kerb machine	1	-	-	102	103	-	-
			Concrete truck	1	-	-	108	111	-	-
FRP footpath		3-4 days throughout December	Concrete pump	1	-	-	103	107	-	-
			Concrete truck	1	-	-	108	111	-	-
Construct new hoardings		2 weeks - Mid November	3t excavator with bucket and bore attachment	1	-	-	102	106	-	X
		2-3 days - Mid November	Concrete pump	1	-	-	103	107	-	-
			Concrete truck	1	-	-	108	111	-	-
Landscaping	Landscaping	4 weeks - late November to late November	20t excavator with bucket	1	-	-	103	108	-	-
			8t excavator with bucket	1	-	-	103	108	-	-
			Bogie	1	-	-	106	111	-	-
		3-4 days throughout December	Concrete pump	1	-	-	103	107	-	-
			Concrete truck	1	-	-	108	111	-	-

2.2 Construction noise impacts

2.2.1 Predicted construction noise levels

Predicted construction noise levels at the closest noise sensitive receivers are summarised in Table 2-2 and are compared to the ICNG NMLs at the most noise affected receivers. Detailed noise predictions are presented in APPENDIX B.

The noise levels at the nearest affected receivers are predicted to exceed the day NML during all work scenarios, this is due to the close proximity of the works to residential receivers. However, the predicted levels are based on the worst case scenario of the closest distance of the works from residential receivers. The location of the plant during the works will change overs the duration of the works and the impacted receivers will only experience the worst case for a short duration.

Respite periods should be offered in accordance with the Environment Protection Licence (EPL) No 21423 Condition L4.3 in relation to high noise impact works. Noise mitigation and management measures are detailed in Section 2.2.2.

2.2.2 Noise mitigation and management

2.2.2.1 Site noise control measures

Table 2-3 presents the noise mitigation and management measures recommended to reduce and manage potential noise impacts for the proposed construction activities.

Table 2-2: Predicted noise levels at the closest noise sensitive receivers (ICNG NMLs)

NCA	Address	Type of receiver	Predicted levels day (standard) $L_{Aeq,15min}$, dB(A)[1]						ICNG Day 7am-6pm $L_{Aeq,15min}$, dB(A)	
			Demolition	Bulk earthworks	Inground services	Concreting	Asphalting	Landscaping	Highly noise affected level[2]	NML (RBL + 10dB)
CDS_03	7-11 Nelson Street, Chatswood	Residential	77 (97)	79 (85)	74	79	74	83	85[3]	70[3]
CDS_03	15 Nelson Street, Chatswood	Residential	76 (96)	78 (84)	71	78	79	77	75	60
CDS_03	17 Nelson Street, Chatswood	Residential	75 (95)	77 (83)	68	74	77	71	75	60
CDS_03	19 Nelson Street, Chatswood	Residential	74 (94)	76 (82)	67	74	77	72	75	60
CDS_06	344 Mowbray Road, Artarmon	Residential	65 (85)	67 (73)	64	67	55	67	75	60
CDS_03	10 Gordon Avenue, Chatswood	Residential	64 (84)	66 (72)	61	65	66	62	75	60
CDS_03	2 Nelson Street, Chatswood	Residential	64 (84)	66 (72)	66	69	61	69	85[3]	70[3]
CDS_02	552-554 Pacific Highway, Chatswood	Residential	56 (76)	58 (64)	58	58	57	58	75	60

Notes:
1. Bracketed values indicate predicted noise levels from works with high noise impact equipment (i.e. rockhammer and vibratory roller)
2. Highly noise affected level for residential receivers
3. ICNG NMLs can be adjusted by 10 dB(A) due to at-property treatments for the identification of suitable additional mitigation measures.

Table 2-3: Noise mitigation and management 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. Plan traffic flow, parking, loading/unloading, and other vehicle movements to keep vehicles away from sensitive receivers where possible and to minimise reversing movements.	This measure could be feasibly implemented.	Yes	- Potential benefit of 5-10 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	Yes	Yes	Where feasibly concrete agis and trucks should be located away from the sensitive receivers on Nelson Street and closer in the Chatswood dive site.
Limit equipment in use	Only the equipment necessary during each stage of the works will be used.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Cost effectiveness to be determined on a case-by-case basis.	Yes	Yes	Excess equipment will be avoided where it is not needed for the works and where it is reasonable to do without it.
Provide respite for high noise impact works	To manage any high noise impact works and satisfy the EPL, high noise impact works and activities will only be undertaken: a) between 8:00 am and 6:00 pm Monday to Friday; b) between 8:00 am and 1:00 pm Saturday; and c) in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact.	This measure could be feasibly implemented.	Yes	- Sufficient respite from high noise could be achieved at enough receivers. - Satisfies EPL requirement.	Yes	Yes	Respite for high noise impact work would be provided by ensuring high noise works are limited to blocks of no greater than 3 hours, with at least 1 hour respite between blocks.
Timing of equipment in use	Where practicable, activities and plant will be scheduled/limited as outlined in Table 2-1 of this assessment.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Verification monitoring to confirm OOH impacts.	Yes	Yes	Works scheduled for standard construction hours.
Limit activity duration	Any equipment not in use for extended periods shall be switched off. For example, heavy vehicles should switch engines off when not in use.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	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.	This measure could be feasibly implemented. To be determined on a case-by-case basis.	Yes		Yes	Yes	Project team shall review plant and equipment on a case-by-case basis and find opportunities to use items with lower noise impacts.
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.	Yes	Yes	Project team will prioritise use of non-tonal reversing alarms on equipment.

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
Path mitigation measures							
Noise barriers or temporary noise screens	Existing noise barriers at the Chatswood Dive site have been included in the noise modelling, except where noise barrier has been removed as part of the works. Temporary noise barriers or blankets (e.g. Flexshield, Echo-barrier, or similar) to provide noise reduction during the works would be used to shield work areas where the existing noise barrier have been removed as part of the works.	This measure could be feasibly implemented. Temporary noise barriers could be feasibly implemented once works on the boundary are completed	Yes	- Potential benefit of 5-10 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Installation of temporary barrier may damage completed works (e..g landscaping)	Yes, except where barrier might damage completed works	Yes	Existing barriers to be maintained, except where works require the noise barrier to be removed. Temporary noise barriers to be feasibly implemented once works on the boundary are completed, except where barrier might damage completed works.
At-receiver							
At-property treatments	Design and installation of architectural treatments to sensitive receiver buildings to reduce internal noise levels to key rooms.	This measure has already been implemented by TfNSW	Yes	Sufficient noise reduction could be achieved at affected receivers	Yes	Yes	Receivers at 2 Nelson Street and 7-11 Nelson Street, Chatswood have received at-property treatments.
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.	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.
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 monitoring	Noise monitoring to be conducted at key locations to quantify noise impacts at sensitive receivers.	This measure could be feasibly implemented.	Yes	Deemed to be cost effective.	Yes	Yes	Noise monitoring shall be carried out as detailed in this assessment.

2.2.2.2 Additional mitigation measures

Figure 2.2 will be used to advise the appropriate additional mitigation during construction. ICNG NMLs can be adjusted by 10dB(A) due to at-property treatments for the identification of suitable additional mitigation measures.

Figure 2.2: Additional airborne noise mitigation measures

When is the work being undertaken?	Predicted $L_{Aeq,15min}$ noise level above		Identify additional management measures to be implemented	
	Background (RBL)	Noise Management Level (NML)		
Standard Hours M-F 7am to 6pm Sat 8am to 1pm	0 to 10 dB(A)	-	-	-
	> 10 to 20 dB(A)	≤ 10 dB(A)	-	-
	> 20 to 30 dB(A)	> 10 to 20 dB(A)	LB, M	[MM2]
	> 30 dB(A)	> 20 dB(A)	LB, M	[MM2]
OOHW Period 1 M-F 6pm to 10pm Sat 1pm to 10pm Sun/ PH 8am to 10pm	0 to 10 dB(A)	≤ 5 dB(A)	-	-
	> 10 to 20 dB(A)	> 5 to 15 dB(A)	LB	[MM1]
	> 20 to 30 dB(A)	> 15 to 25 dB(A)	LB, M	[MM2]
	> 30 dB(A)	> 25 dB(A)	LB, M, IB, PC, RO, SN	[MM4]
OOHW Period 2 M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	0 to 10 dB(A)	≤ 5 dB(A)	-	-
	> 10 to 20 dB(A)	> 5 to 15 dB(A)	LB, M	[MM2]
	> 20 to 30 dB(A)	> 15 to 25 dB(A)	LB, M, IB, PC, RO, SN	[MM4]
	> 30 dB(A)	> 25 dB(A)	LB, M, IB, PC, RO, SN, AA	[MM5]

Notes: Use the abbreviation codes in the table above to confirm management measures required
Code in square brackets [] refers to noise management code for affected receivers identified in each CNVIS
LB = Letter box drops
M = Monitoring
IB = Individual briefings
SN = Specific notifications
PC = Phone calls and emails
RO = Project specific respite offer
AA = Alternative accommodation

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

2.2.2.3 Noise monitoring

Attended noise monitoring will be undertaken to verify that the construction activities are consistent with the assessed noise modelling scenarios and that noise levels resulting from construction works are not higher than the levels predicted in this addendum. Attended monitoring on private property is subject to obtaining the property owner/occupier's consent (where required).

Attended noise monitoring will be undertaken in the NCAs most impacted by the works. The nominated monitoring locations are identified in Table 2-4, and have been selected as they present the best opportunity to validate the predicted noise levels, depending on the location of the plant.

Table 2-4: Nominated verification monitoring locations

NCA	Nominated receiver address
CDS_03	7-11 Nelson Street, Chatswood
CDS_03	19 Nelson Street, Chatswood
CDS_06	344 Mowbray Road, Artarmon

NCA	Nominated receiver address
CDS_03	2 Nelson Street, Chatswood
CDS_02	552-554 Pacific Highway, Chatswood
Note:	Monitoring on private property is subject to owner consent and where relevant, occupier consent. If property access is denied, monitoring will still be carried out outside property boundaries.

If verification monitoring shows that the external noise levels from the construction works are above the predicted levels, investigation will be undertaken to understand the cause of the exceedance and relevant reasonable and feasible mitigation measures will be implemented.

2.3 Construction vibration impacts

2.3.1 Vibration intensive works and minimum working distance

From the plant and equipment listed in Table 2-1, the work activities with dominant vibration generating plant and equipment are listed in Table 2-5.

Table 2-5 Frank Channon Walk works vibration intensive activities and plant items

Activity	Work area	Vibration intensive plant
Demolition of existing concrete	Demolition	20T excavator with hammer; road saw; jackhammer
Regrade / compact subgrade	Bulk earthworks	10T roller and vibrating plate
Inground services and light poles	Inground services	Vibrating plate
FRP road	Concreting / asphalting	Nil
Kerbs and guttering	Concreting	Nil
FRP footpath	Concreting	Nil
Construct new hoardings	Concreting	3T excavator with bucket and bore attachment
Landscaping	Landscaping	Nil

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 2-6 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.

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 2-6).

Table 2-6 Recommended minimum working distances (m) for managing vibration impact based on screening criteria

Vibration sensitive receiver	Minimum working distances for vibration intensive plant, m[3]					
	20t excavator with hammer	Road saw	Jackhammer	10t roller	Vibrating plate	3t excavator with bore attachment
Structural damage to buildings						
Reinforced or frame structures (Line 1)[1]	5	5	5	5	5	5
Unreinforced or light framed structures[1]	5	5	5	5	5	5
Structurally unsound heritage structures[1, 2]	10	5	5	15	5	10
Disturbance to building occupants						
Critical areas[4,7]	40	15	25	105	25	30
Residences – Day[5]	25	10	15	55	15	20
Residences – Night[5]	-	-	20	-	-	-
Offices[6,7]	20	5	10	30	10	10
Workshops[7]	15	5	5	20	5	10

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

2. In accordance with CNVMP, a site inspection 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.

2.3.2 Vibration assessment

The numbers of buildings which are close to or potentially within the minimum working distances for vibration impact are shown in Table 2-7. More detailed results are presented in APPENDIX D. The figures in APPENDIX D identify the minimum working distances for vibration over aerial photographs that also show the work areas and the land uses.

Table 2-7 Number of buildings within minimum working distances for vibration impact

	Number of buildings within minimum working distances			
	Demolition of existing concrete	Regrade / compact subgrade	Inground services and light poles	Construct new hoardings
Structural damage to buildings				
Reinforced or frame structures (Line 1)[1]	0	0	0	0
Unreinforced or light framed structures[1]	0	0	0	0
Structurally unsound heritage structures[1, 2]	1	1	0	1
Disturbance to building occupants				
Critical areas[4,7]	0	0	0	0

	Number of buildings within minimum working distances			
	Demolition of existing concrete	**Regrade / compact subgrade**	**Inground services and light poles**	**Construct new hoardings**
Residences – Day[5]	4	12	0	4
Residences – Night[5]	-	-	-	-
Offices[6,7]	0	1	0	0
Workshops[6,7]	0	0	0	0

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

2. In accordance with CNVMP, a site inspection 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.

There are no buildings within the minimum working distance for cosmetic damage except for the heritage listed building, Mowbray House for all vibration intensive works. Vibration mitigation measures are outlined in Section 2.3.3.

The nearby residential receivers are predicted to experience vibration which can cause adverse comments during all vibration intensive works except for the inground service works.

2.3.3 Vibration mitigation measures

Reasonable and feasible vibration mitigation measures that should be considered are in the Section 6.3 of the *Chatswood CNVIS* to minimise the impact of vibration on the receivers. In addition to the vibration control measures presented the *Chatswood CNVIS*, the following vibration management measures would be implemented to minimise vibration impact from construction activities to the nearest affected receivers:

- Where practicable, limit vibration intensive activity around Mowbray House to distances beyond the minimum working distances established in Table 2-6.
- A rockbreaker and concrete saw are proposed to be use for demolition of existing concrete hardstand areas, including around Mowbray House. A rockbreaker would be used outside minimum working distance. Where concrete removal is required within minimum working distance it will be saw cut and lifted out with an excavator and bucket to minimise potential vibration impact. Hand-held jackhammers may be used where necessary to remove the slab. Monitoring, as outlined below, should be undertaken during the works.
- Where practicable the vibratory roller should be limited to 'low-vibration' mode to reduce the likelihood of disturbance to residential receivers. Attended vibration measurements are proposed to be carried out proactively and in response to vibration complaints.

- Vibration measurements are recommended at Mowbray House during the following works where vibration intensive plant are within the minimum working distances identified in Table 2-5o ensure vibration is below the relevant limits:
    - Demolition of existing concrete (during works that require a 20t excavator with hammer)
    - Regrade / compact subgrade (during works that require at 10t roller)
    - Construct new hoardings (during works that require a 3t excavator with bucket and bore attachment).

2.4 Ground-borne noise impact

The proposed works are only surface works, therefore the risk of ground-borne noise impact is negligible compared with the impact from airborne noise.

2.5 Construction related road traffic assessment

The number of heavy vehicles associated with the proposed works are less than what was assessed in the *Chatswood CNVIS*. Therefore, construction traffic noise on the local road network associated with the works is predicted to have minimal impact on receivers in proximity to public roads.

3 Conclusion

This technical memorandum is an addendum to the report *Chatswood CNVIS* to review the potential construction noise and vibration impacts associated with the tunnel fit out works at Chatswood Dive site.

Construction noise

Predicted noise levels are expected to be above ICNG NMLs and highly noise affected levels during standard construction hours therefore respite periods shall be offered in accordance with EPL Condition L4.3, as noted in Table 2-3.

No works are scheduled to be completed outside of standard construction hours.

Construction vibration

The proposed works will be carefully managed when close to or within the minimum working distance of the heritage listed Mowbray House located within the Chatswood dive site. Vibration measurements will be undertaken when the vibration intensive works are within the minimum working distance of the structure to ensure vibration levels are below the relevant limits.

A conservative screening test found that vibration impacts from the construction activities are likely to be perceptible and may cause human annoyance.

Vibration mitigation and management measures, including vibration monitoring requirements, have been presented in Section 6 of the *Chatswood CNVIS* to reduce the risk of damage to buildings near the worksites and to manage annoyance from construction vibration.

Ground-borne noise

The proposed works are only surface works, therefore the risk of ground-borne noise impact is negligible.

Construction traffic

The number of heavy vehicles associated with the proposed works are less than what was assessed in the *Chatswood CNVIS*. Therefore, construction traffic noise on the local road network associated with the works is predicted to have minimal impact on receivers in proximity to public roads.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
15.09.2023	Initial issue	0	1	D. Auld	T. Gowen	T. Gowen
20.09.2023	Address AA comments	-	2	T. Gowen	-	M. Tabacchi
21.09.2023	Minor edits	-	3	T. Gowen	-	M. Tabacchi
25.09.2023	Minor edits	-	4	T. Gowen	-	M. Tabacchi

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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 100dBThe sound of a rock band 115dBLimit of sound permitted in industry 120dBDeafening
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 Detailed predicted construction noise levels

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

APPENDIX C Additional noise mitigation

The additional mitigation measures have been provided to Systems Connect in a spreadsheet table in order to more adequately mitigate and manage potential noise impacts.

APPENDIX D Construction vibration impacts

Land-Use file revision_date: rX_dd/mm/yy

Plot Date: 11/09/23 - 15:28 Layout: TK685 Generic Template

GIS File: R:\AssocSydProjects\TK651-TK700\TK685 PK SMCSW Linewide Works (CPB UGL)\00 Project Database\01 GIS\TK685 DA (r0).qgz

125 m
100
75
50
25
0

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

Work area

- Demolition

- Receivers within MWD for cosmetic damage

MWD for cosmetic damage and human annoyance with 20T excavator with hammer

- Reinforced structures (25.0mm/s ppv)
- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (day)

REV	BY	DATE	DESCRIPTION	APPROVER
r0	DA	11/09/23	Prepare figures	TG

0 10 20 30 40 50 m

1:1,000

FULL SIZE A3

A3 Original

Co-ordinate System: MGA Zone 56

NOTE: Do not scale from this drawing.

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Systems Connect

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES

inspired to achieve

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

CHATSWOOD DIVE SITE
Frank Channon Walk

MWD for Cosmetic Damage and Human Annoyance
Work Activity: 20T excavator with hammer

Land-Use file revision_date: rX_dd/mm/yy

Plot Date: 11/09/23 - 15:28 Layout: TK685 Generic Template

GIS File: R:\AssocSydProjects\TK651-TK700\TK685 PK SMCSW Linewide Works (CPB UGL)\00 Project Database\01 GIS\TK685 DA (r0).qgz

125 m
100
75
50
25
0

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

Work area

- Bulk earthworks

- Receivers within MWD for cosmetic damage

MWD for cosmetic damage and human annoyance with 10T roller

- Reinforced structures (25.0mm/s ppv)
- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (day)

REV	BY	DATE	DESCRIPTION	APPROVER
r0	DA	11/09/23	Prepare figures	TG

A3 Original

Co-ordinate System: MGA Zone 56

0 10 20 30 40 50 m

1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

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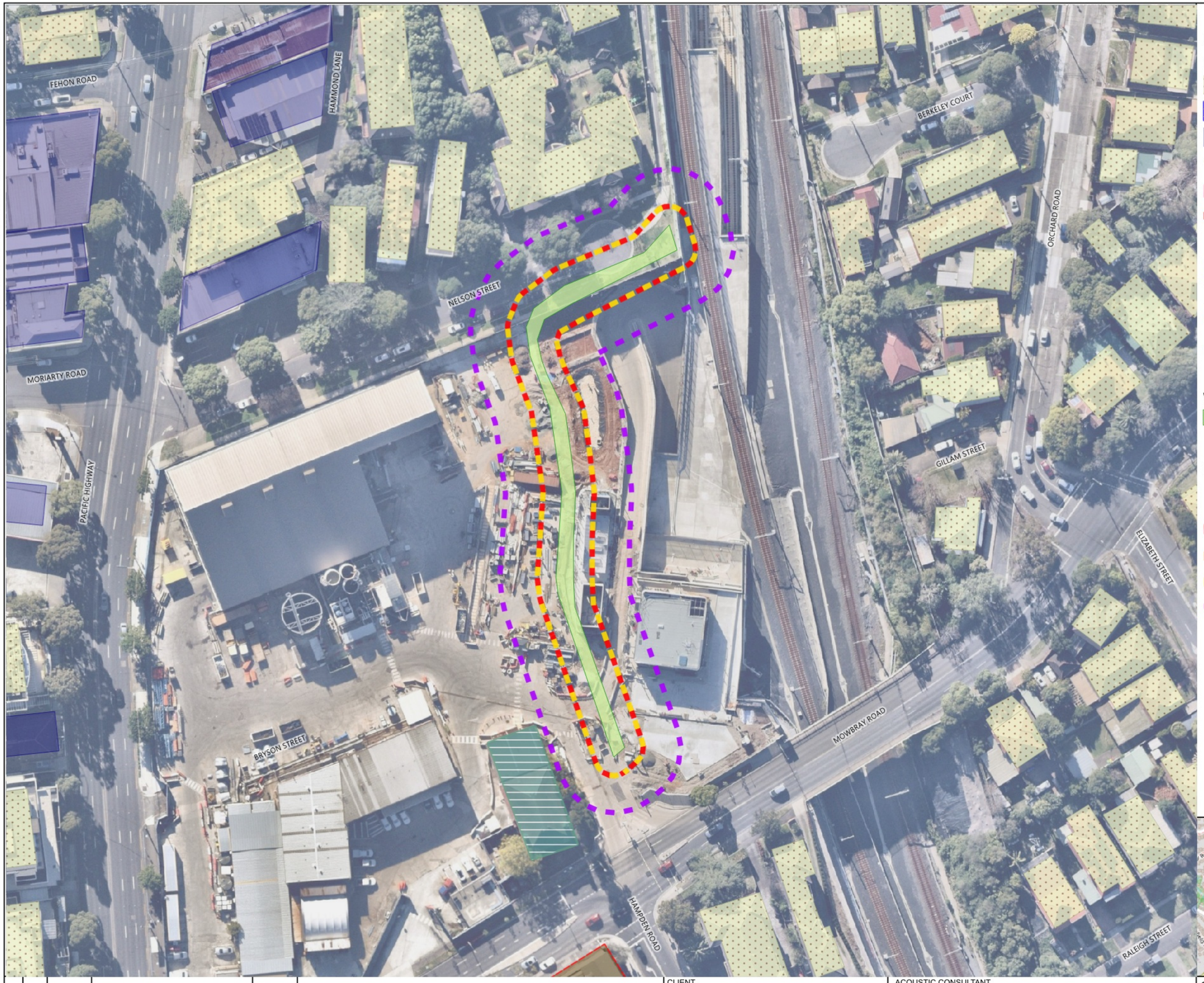
CHATSWOOD DIVE SITE
Frank Channon Walk

MWD for Cosmetic Damage and Human Annoyance
Work Activity: 10T roller

Land-Use file revision_date: rX_dd/mm/yy

Plot Date: 11/09/23 - 15:27 Layout: TK685 Generic Template

GIS File: R:\AssocSydProjects\TK651-TK700\TK685 PK SMCSW Linewide Works (CPB UGL)\00 Project Database\01 GIS\TK685 DA (r0).qgz



125 m

100

75

50

25

0

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

Work area

- Inground services

- Receivers within MWD for cosmetic damage

MWD for cosmetic damage and human annoyance with Vibrating plate

- Reinforced structures (25.0mm/s ppv)
- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (day)

REV	BY	DATE	DESCRIPTION	APPROVER
r0	DA	11/09/23	Prepare figures	TG

A3 Original

Co-ordinate System: MGA Zone 56

0 10 20 30 40 50 m

1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

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CHATSWOOD DIVE SITE
Frank Channon Walk

MWD for Cosmetic Damage and Human Annoyance
Work Activity: Vibrating plate

Land-Use file revision_date: rX_dd/mm/yy

Plot Date: 11/09/23 - 15:29 Layout: TK685 Generic Template

GIS File: R:\AssocSydProjects\TK651-TK700\TK685 PK SMCSW Linewide Works (CPB UGL)\00 Project Database\01 GIS\TK685 DA (r0).qgz

125 m
100
75
50
25
0

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

Work area

- Concreting

Receivers within MWD for cosmetic damage

MWD for cosmetic damage and human annoyance with 3T excavator with bucket anc

- Reinforced structures (25.0mm/s ppv)
- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (day)

REV	BY	DATE	DESCRIPTION	APPROVER
r0	DA	11/09/23	Prepare figures	TG

A3 Original

Co-ordinate System: MGA Zone 56

0 10 20 30 40 50 m

1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

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CHATSWOOD DIVE SITE
Frank Channon Walk

MWD for Cosmetic Damage and Human Annoyance
Work Activity: 3T excavator with bucket and bore attachment