

## APPROVAL

### CITY & SOUTHWEST ACOUSTICS ADVISOR

<b>Review of:</b>	<b>Sydney Metro City and Southwest Line Wide Works - CNVIS Addendum Report - Chatswood gantry shed modification</b>	<b>Document reference:</b>	Report Number TK685-03-17F02 CNVIS_ADD C2B_P3 CHW G Shed (r1)
<b>Prepared by:</b>	Daniel Weston Acoustics Advisor		Date 1 October 2011
<b>Date of issue:</b>	9 November 2021		Prepared by Renzo Tonin & Associates for Systems Connect

As approved Acoustics Advisor for the Sydney Metro City & Southwest project, I have reviewed the Construction Noise and Vibration Impact Statement (CNVIS) for the Chatswood gantry shed modification, as required under A27 (d) of the project approval conditions (SSI 15-7400).

I am satisfied that the CNVIS is technically valid and includes appropriate construction noise mitigation and management. On this basis I endorse revision 1 of the CNVIS.



Daniel Weston, City & Southwest Acoustics Advisor

1 October 2021

TK685-03-17F02 CNVIS\_ADD C2B\_P3 CHW G Shed (r1)

Systems Connect  
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North Sydney 2060

## Sydney Metro City and South West Line Wide Works - CNVIS Addendum Report - Chatswood gantry shed modification

### 1 Introduction

#### 1.1 Overview of works

This technical memorandum is an addendum to the report *Construction Noise and Vibration Impact Statement: Portion 3 - Chatswood (Chatswood CNVIS<sup>1</sup>)* 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).

Changes to the Chatswood site construction works being carried out by Systems Connect include the partial removal of the gantry shed to allow the construction of the permanent Dive Service Building to commence. The works have already been assessed in the *Chatswood CNVIS* and will involve the removal of roof and wall panels on the southern side of the shed. Wall panels will be reinstated on the three openings created by the partial shed removal to limit potential noise impacts during the remainder of works inside the gantry shed. The work areas are shown in APPENDIX C. The works are anticipated to commence in October 2021 and conclude in November 2021. The remainder of the gantry shed will be removed as scheduled and assessed in the *Chatswood CNVIS*.

This memorandum has been prepared to address the potential construction noise impacts outside standard construction hours from the construction activities at Chatswood affected by the modification of the gantry shed. These include mechanical and electrical tunnel fit-out work supported from Chatswood and materials deliveries to the gantry shed, including unloading and transfer to the dive and tunnels via the gantry crane. The revised works will be undertaken during standard construction hours and out of hours works.

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<sup>1</sup> *Sydney Metro City & Southwest – Line Wide Works, Construction Noise and Vibration Impact Statement: Portion 3 - Chatswood, reference: TK685-03-17F01 CNVIS C2B\_P3 CHW, revision 2, dated 8 April 2021*

Note that there are no vibration significant activities associated with the works considered in this addendum report. Therefore, there is no assessment of ground-borne noise or vibration impact in this report.

## 1.2 Justification for OOH construction works

As noted in the *Chatswood CNVIS*, tunnel fit-out works are an essential component of the Project due to be completed and open to rail traffic in 2024. This completion date has been calculated assuming track work, tunnel systems works and fit out works within the tunnel will be undertaken 24 hours a day, seven days per week. OOH activity on the surface and inside the dive, particularly after 10pm will be managed to minimise impacts on surrounding sensitive receivers. Deliveries during OOH periods vehicles would be loaded and unloaded within the remaining part of the gantry shed. Concrete deliveries for tunnel works have now been completed.

Environment Protection Licence (EPL) No. 21423 Condition L4.7 allows station and tunnel fit out works and ancillary surface support works; and haulage and delivery and of materials to be undertaken 24 hours a day, 7 days per week at the Chatswood Dive site.

Any work outside standard construction hours must be undertaken in accordance with the Out of Hours Works Procedure and the CNVMP.

## 2 Construction noise assessment

### 2.1 Construction activities

Key details regarding the location and layout of the noise generating plant that will operate at the Chatswood site were informed by the Construction and Environmental Teams and are summarised in Table C1 in APPENDIX C. Table C1 presents the list of plant proposed to be used and their assumed sound power levels. Key activities applicable to this change include:

- SURFACE WORKS: Partial removal of the gantry shed; and
- LOGISTICS: Deliveries to gantry shed.

The partial removal of the gantry shed would be carried out during standard construction hours, as noted in Table C1. The works do not change from the 'demobilisation of gantry shed' activity assessed in the *Chatswood CNVIS*.

The deliveries to the gantry shed occur 24 hours a day, 7 days per week where they are related to tunnel fit out works. This activity does not change because of the partial shed removal, with the exception that the acoustic shed design has been altered.

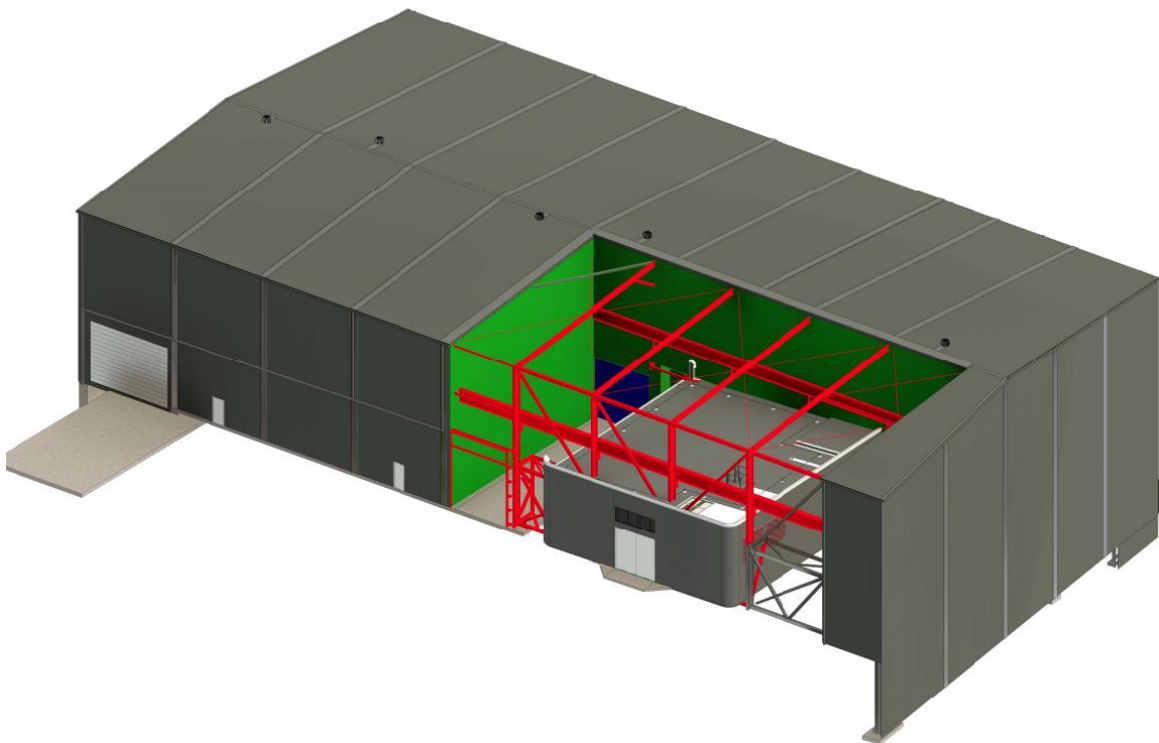
## 2.2 Detailed design outcomes

As noted in Section 5.1.1 of the *Chatswood CNVIS*, Renzo Tonin & Associates played a key role in assisting Systems Connect to determine the noise mitigation measures required to reduce the site's noise impact. Existing mitigation measures from previous stages of the project were incorporated into the site's design and included in the noise modelling results presented in the *Chatswood CNVIS*. This included the acoustic gantry shed for deliveries and concrete pours.

The proposed changes to the acoustic gantry shed are shown in Figure 1. The figure shows the removal of part of the southern facade and roof of the shed, along with the structural support indicated in red. The three new external walls (shown in green) will be clad with 1x 0.48mm BMT corrugate steel + acoustic lining (facing inside of the shed). This will ensure the acoustic integrity of the shed is maintained for the remainder of the deliveries to the gantry shed outside standard construction hours.

Further detail regarding the gantry shed design is include in Appendix C.

Figure 1: Acoustic gantry shed modification (new cladding in light green)



## 2.3 Predicted construction noise levels

Predicted construction noise levels at the closest noise sensitive receivers are summarised in Section 5.2 of the *Chatswood CNVIS* and compared to the ICNG NMLs (see APPENDIX B). Detailed noise predictions are compared to ICNG NMLs and Conditions of Approval E41/E42. Predicted noise levels following the partial removal of the gantry shed (and reinstatement of the new external walls) will be consistent with the results presented in the *Chatswood CNVIS*.

Proposed measures for managing potential noise impacts are provided in Section 5.3 of the Chatswood CNVIS. Additional recommended mitigation measures specific to the partial removal of the gantry shed are presented in Section 2.4 and APPENDIX C.

## 2.4 Noise mitigation and management

In addition to the noise mitigation measures identified in the Chatswood CNVIS (see Section 5.3), Table 1 presents additional noise control measures recommended to reduce and manage potential noise impacts.

**Table 1: Site noise control measures**

Control type	Control measure	Typical use
At source mitigation measures	Limit equipment in use	Plant and equipment operating inside the gantry shed outside standard construction hours should be limited following the partial removal of the shed until all new walls have been reinstated.
Path mitigation measures	Temporary noise barriers or curtains	Where works are required inside the gantry shed outside standard construction hours and prior to the complete reinstatement of the new walls, openings should be covered using temporary noise barriers or curtains (e.g. Flexshield, Echo-barrier, or similar) to provide noise reduction during the works.

### 2.4.1 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 CNVIS. 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, and have been selected as they present the best opportunity to validate the predicted noise levels.

**Table 2: Nominated verification monitoring locations**

NCA	Nominated receiver address	Monitoring location at 1 m from
CDS_03	2 Orchard Street, Chatswood	Western boundary
CDS_06	344 MOWBRAY ROAD ARTARMON	Northern facade

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.

### 3 Conclusion

This technical memorandum is an addendum to the report *Chatswood CNVIS* to review the potential noise impacts from the proposed changes to the gantry shed. The shed will be partially removed, then new external walls will be reinstated to maintain the acoustic integrity of the shed. This will be completed between mid-October and November 2021.

Design details for the reinstated walls of the shed are included in Appendix C. The assessment found that noise levels from the Chatswood site following the changes to the gantry shed will be consistent with the noise levels presented in the *Chatswood CNVIS*. Noise mitigation and management measures are included in Section 2.4 and APPENDIX C of this report.

The findings within the *Chatswood CNVIS* for ground-borne noise, vibration and construction related traffic are unchanged as a result of the proposed changes to the gantry shed.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
1.10.2021	Initial issue	0	1	T. Gowen		M. Tabacchi
File Path: \\SYD-SERVER\rtagroupsyd\AssocSydProjects\TK651-TK700\TK685 PK SMCSW Linewide Works (CPB UGL)\1 Docs\100 CONSTRUCTION\3-17 CNVIS C2S_P3 CHW\TK685-03-17F02 CNVIS_ADD C2B_P3 CHW G Shed (r1).docx						

### Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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.

## 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.

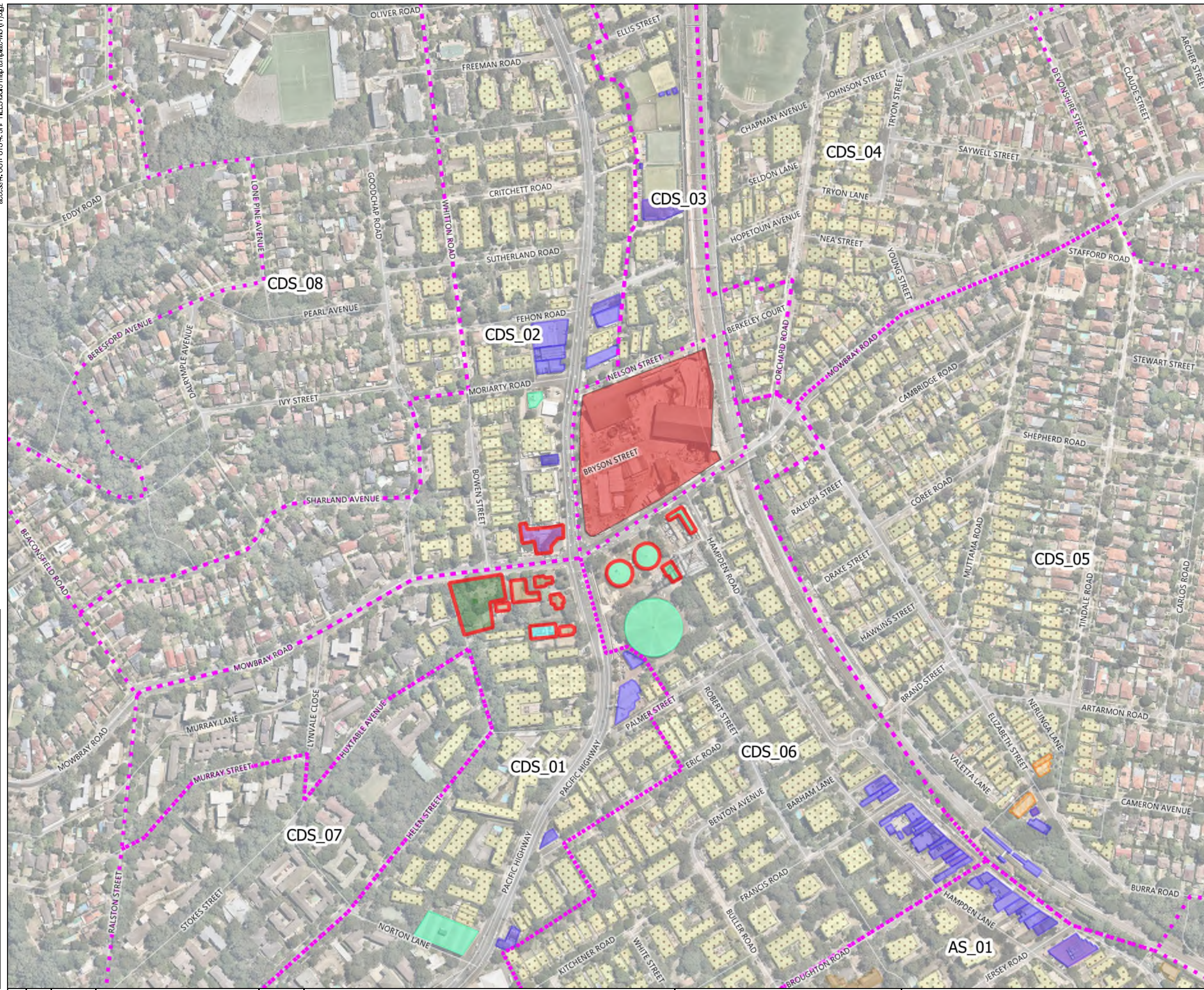
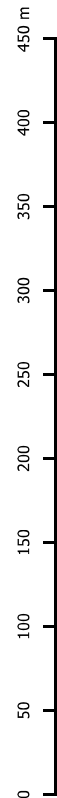
Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights 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 <sub>Max</sub>	The maximum sound pressure level measured over a given period.
L <sub>Min</sub>	The minimum sound pressure level measured over a given period.



L <sub>1</sub>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L <sub>10</sub>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L <sub>90</sub>	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 <sub>eq</sub>	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 <sub>eq</sub> 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      Noise management levels





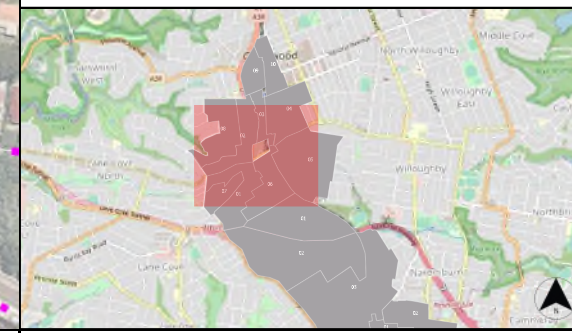
## LEGEND

### Noise sensitive receivers

- |                                                                                     |                        |                                                                                     |                     |
|-------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------|---------------------|
|  | Childcare              |  | Theatre/Auditorium  |
|  | Commercial             |  | Mixed use           |
|  | Educational            |  | Project acquisition |
|  | Hotel/Motel/Hostel     |  | Film/TV studio      |
|  | Industrial             |  | Cinema              |
|  | Medical                |  | Community centre    |
|  | Place of Worship       |  | Library             |
|  | Recording studio       |  | Laboratory          |
|  | Recreational - Active  |  | Other               |
|  | Recreational - Passive |  | Heritage            |
|  | Residential            |                                                                                     |                     |



 Chatswood work area



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REV	BY	DATE	DESCRIPTION	APPROVER
A3 Original			Co-ordinate System: MGA Zone 56	

FULL SIZE A3

NOTE: Do not scale from this drawing.

CLIENT



ACOUSTIC CONSULTANT



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SYDNEY METRO - CHATSWOOD TO SYDENHAM

LINE WIDE WORKS  
Land Use, NCAs  
Work area: Chatswood



Table B1: Noise sensitive receivers and construction noise management levels

CHATSWOOD SMTF

NCA	Nearest construction work area	Receiver Type	Reference RBL	Existing Noise Levels $L_{A90(15min)}$ , dB(A)			Residential NMLs based on ICNG (external), $L_{Aeq(15min)}$				Sleep Dist. $L_{Amax}$		Comments
				RBL Day	RBL Evening	RBL Night	NML DS	NML DO	NML E	NML N	Screening <sup>1</sup>	Max <sup>1</sup>	
Portion 2 & 3	Chatswood to Sydenham (C2S)												
CDS_01	Chatswood Dive	Residential buildings on Pacific Hwy and along Mowbray Road, south of Mowbray Rd. Traffic noise affected.	RTA TH511-L02 516 Pacific Hwy, Chatswood	55	54	42	65	60	59	47	57	65	
CDS_02	Chatswood Dive	Residential apartments on Pacific Highway opposite site and along Mowbray Road, north of Mowbray Rd. Traffic noise affected.	RTA TH511-L02 516 Pacific Hwy, Chatswood	55	54	42	65	60	59	47	57	65	
CDS_03	Chatswood Dive	Residential apartments north of Nelson St and west of rail line	C2S EIS B.24	50	47	39	60	55	52	44	55	65	
CDS_04	Chatswood Dive	Residential buildings north of Mowbray Rd, east of railway line (behind rail barrier)	C2S EIS B.25	41	40	35	51	46	45	40	55	65	
CDS_05	Chatswood Dive	Residential buildings south of Mowbray Rd, east of railway line (behind rail barrier)	C2S EIS B.22	42	41	34	52	47	46	39	55	65	
CDS_06	Chatswood Dive	Residential apartments south of Mowbray Rd and west of rail line	C2S EIS B.24	50	47	39	60	55	52	44	55	65	
CDS_07	Chatswood Dive	Residential buildings west of Pacific Hwy and south of Mowbray Road, shielded by CDS_01	C2S EIS B.22	42	41	34	52	47	46	39	55	65	
CDS_08	Chatswood Dive	Residential buildings west of Pacific Hwy and north of Mowbray Road, shielded by CDS_02	C2S EIS B.25	41	40	35	51	46	45	40	55	65	
AS_01	Artarmon Substation	Residential apartments north of Gore Hill Freeway, west of Reserve Rd, south of Butchers Ln	C2S EIS B.21	49	46	41	59	54	51	46	56	65	
Other sensitive receivers							Sensitive Receiver NMLs based on ICNG (see comments for details), $L_{Aeq(15min)}$						
Studio building (music recording studio)							45	45	45	45	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Studio building (film or television studio)							50	50	50	50	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Cinema space, theatre, auditorium							55	55	55	55	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Hotel (Sleeping areas: Hotels near major roads)							60	60	60	60	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)		
Chilcare centre (internal play and sleeping areas)							50	50	50	50	Source: AAAC - guideline for Child Care Centre Acoustic Assessment, assuming a conservative façade loss of 10 dB(A)		
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: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Office building (general office areas)							65	65	65	65	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Hotel (bars and lounges)							70	70	70	70	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Community centres – Municipal Buildings							60	60	60	60	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 10 dB(A)		
Restaurant, bar (Bars and lounges/ Restaurant)							70	70	70	70	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Railway platform and concourse areas							75	75	75	75	Source: AS2107 ‘maximum’, assuming a conservative façade loss of 20 dB(A)		
Café/ Restaurant/ Bar (outdoors)							60	60	60	60	Source: AS2107 ‘maximum1’		
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: 1 - Levels are estimated assuming an open windows (i.e. 10dBA façade loss)  
DS: standard construction hours from 7 am to 6 pm Monday to Friday and from 8 am to 6 pm Saturday  
DO: 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

Table C1: Construction Activities/ Equipment

CHATSWOOD SMTF

Work activity	Details	Indicative timing/ duration	Plant/ Equipment	Plant/ Equipment (as provided by client)	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)	Penalty	L <sub>Aeq</sub>	L <sub>Amax</sub>	High noise plant (EPL E1)	Vibration intensive plant	Notes			
					7am - 6pm	6pm - 10pm	10pm - 7am										
TRACK CONSTRUCTION ABD TUNNEL FITOUT - inside dive and tunnels																	
Rail and sleeper train consist		Feb 2021 - Mar 2021 Complete	Hiab Excavator w bucket (25t) Front end loader -	Rail set (train consist) Excavator 20t - Rubber tyre Front end loader Rail trolley	1 2 1 1	1 2 1 1	1 2 1 1	98 103 110 -	- - - -	102 108 115 -	- - - -	- - - -	- - - -				
Concrete  <b>WORKS</b>	Dive Concrete Placement	Jan 2021 - Mar 2021 Complete	Concrete pump Concrete Aqi	Concrete pump (line) Concrete Aqi	1 4 p.h.			103 108	- -	107 111	- -	- -	- -	Concrete FRP in dive covered by existing CNVIS Truck drive down ramp to pump			
			Tunnel Concrete Placement - Surface Plant		Mar 2021- Jun 2021 Complete	Concrete vibrator Hand tools (Power) Concrete Aqi Concrete Remixer Concrete Pump (Putzmeister BSC 1409 D) Pressure washer (70Mpa and Nozzel 0.5mm) Concrete Aqi Compressor Excavator w bucket (25t) Excavator w bucket (25t) Tipper Concrete Aqi	5 2 1 1 1 1 up to 4 p.h.	5 2 1 1 1 1 up to 4 p.h.	5 2 1 1 1 1 up to 4 p.h.	97 107 108 111 116 109 108	- - - - - - -	100 118 111 118 115 111 103	- - - - - - -	- - - - - - -	Concrete deliveries will be managed with other deliveries coming to site		
	Tunnel Concrete Placement - Shuttle		Mar 2021- Jun 2021 Complete	Concrete Pump (Putzmeister BSC 1409 D) Concrete Aqi Compressor Excavator w bucket (25t) Excavator 20t Hi-rail Tipper Concrete Aqi	1 1 1 1 1 1 1	1 1 1 1 1 1 1	1 1 1 1 1 1 1	116 108 102 103 103 103 108	- - - - - - -	118 111 103 108 111 111 103	- - - - - - -	- - - - - - -	- - - - - - -	Typically 2 on site at a time. Discharge into surface remixer, pumped via pipe to shuttle at track level Excavator to handle skip bins, tow trailer pump			
	Tunnel Concrete Placement - tunnel concrete train		Mar 2021- Jun 2021 Complete	Concrete Pump (Putzmeister BSC 1409 D) Concrete Aqi Compressor Pressure washer (70Mpa and Nozzel 0.5mm) Pressure washer (70Mpa and Nozzel 0.5mm) Pressure washer (70Mpa and Nozzel 0.5mm)	1 1 1 1 1 1	1 1 1 1 1 1	1 1 1 1 1 1	116 108 102 109 109 109	- - - - - -	118 111 103 115 115 115	- - - - - -	- - - - - -	- - - - - -	Starts in Northern Dive before moving into tunnel			
	Concrete Washing-out / cleanup		Mar 2021- Jun 2021 Complete	Pressure washer (70Mpa and Nozzel 0.5mm) Pressure washer (70Mpa and Nozzel 0.5mm) Pressure washer (70Mpa and Nozzel 0.5mm)	1 1 1	1 1 -	1 1 -	109 109 109	- - -	115 115 115	- - -	- - -	- - -	- - -	Surface Dive Tunnel		
	Remove temporary or defective track in dive / tunnel		Mar 2021- Jun 2021 Complete	Concrete / road / rail saw Excavators with hammers (10-15T) Tipper Welding tools /oxy Handtool - grinder Light vehicles / traffic control utes	1 1 1 1 2 4 p.h.	- - - 1 2 1 p.h.	- - - 1 2 1 p.h.	121 115 103 102 107 89	5 5 - - - -	129 120 111 105 118 100	HN HN - - HN -	- - - - - -	- X - - - -	X X - - - -	Will be done sometime in 2021 for the dive, pending NC works		
	M&E Tunnel Fitout incl. walkways		April 2021 - December 2021	Handtool - rattle gun Handtool - grinder Welding tools /oxy Generator EWP Tipper Forklift	2 2 1 1 2 2 2	2 2 1 1 2 2 2	2 2 1 1 2 2 2	107 107 102 94 95 103 99	- - - - - - -	118 118 105 95 98 111 103	- HN - - - - -	- - - - - - -	- - - - - - -	- - - - - - -	Fixing brackets etc to tunnel/dive wall.		
	BUILDINGS - dive services building, fire services building																
	Dive Services Building																
	Footings & Foundations	Reinforced concrete works and blockwork	April 2021 - Feb 2022	Delivery truck	Flatbed truck	2 p.h.	-	-	102	-	111	-	-	-			
	Insitu Concrete slab			Light vehicles / traffic control utes	Ute	4 p.h.	-	-	89	-	100	-	-	-			
	Blockwork			Water cart	Water Cart	1	-	-	104	-	107	-	-	-	No longer required		
	Structural Steel Installation	Installation of columns, mullions, girts, purlins, etc...		Crane (Grove GMK5130)	Crane (Grove GMK5130)	2	-	-	105	-	103	-	-	-			
				EWP	EWP	2	-	-	95	-	98	-	-	-			
				Hand tools	Hand tools	various	-	-	105	-	111	-	-	-			
				Hand tools (Power)	Power tools	various	-	-	107	-	118	-	-	-			
				Handtool - rattle qun	Rattle gun	2	-	-	107	-	118	-	-	-			
				Concrete vibrator	Vibrator	2	-	-	97	-	100	-	-	-			
				Hiab	Hiab	1	-	-	98	-	102	-	-	-			
				Telehandler / Franna crane (20t)	Telehandler	1	-	-	99	-	103	-	-	-			
				Hand tools	Hand tools	various	-	-	105	-	111	-	-	-			
				Hand tools (Power)	Power tools	various	-	-	107	-	118	-	-	-			
	External Walls, doors, windows, roof and Cladding	Installation of façade, roof, gutters, downpipes, qlazing, doors, windows, etc...	July 2021 - October 2022	EWP	EWP	2	-	-	95	-	98	-	-	-			
				Handtool - rattle gun	Rattle gun	2	-	-	107	-	118	-	-	-			
				EWP	Scissor lift	4	-	-	95	-	98	-	-	-			
				Telehandler / Franna crane (20t)	Telehandler	1	-	-	99	-	103	-	-	-			
Delivery truck				Delivery truck	2 p.h.	-	-	102	-	111	-	-	-				
Hand tools				Hand tools	various	-	-	105	-	111	-	-	-				
Hand tools (Power)				Power tools	various	-	-	107	-	118	-	-	-				
Asphalt Paver				Paver	1	-	-	105	-	112	-	-	-				
Delivery truck				Shuttle buqqies	1	-	-	102	-	111	-	-	-				
Vibratory Roller - smooth drum (up to 14T)				Roller (smooth drum) 14t	5	-	-	112	-	118	HN	-	X				
Internal finishes	Walls, doors, painting, tiling, painting, lift install, waterproofing, floors, etc....		Delivery truck	Delivery truck	4 p.h.	-	-	102	-	111	-	-	-				
			Water cart	Watercart	2 p.h.	-	-	104	-	107	-	-	-				
			Hand tools	Hand tools	various	-	-	105	-	111	-	-	-				
			Bobcat	Bobcat	2	-	-	104	-	107	-	-	-				
			Road Planer	Profiler	1	-	-	110	5	124	HN	-	-				
			Water cart	Road sweeper	1	-	-	104	-	107	-	-	-				
			Fire services Building														
			Footings & Foundations	Reinforced concrete works and blockwork	June 2022 - August 2022	Delivery truck	Flatbed truck	2 p.h.	-	-	102	-	111	-	-	-	
			Blockwork			Water cart	Water Cart	1	-	-	104	-	107	-	-	-	
			Structural Steel Installation	Installation of columns, mullions, girts, purlins, etc...		Crane (Grove GMK5130)	Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	-	
EWP	EWP	2				-	-	95	-	98	-	-	-				
Hand tools	Hand tools	various				-	-	105	-	111	-	-	-				
Hand tools (Power)	Power tools	various				-	-	107	-	118	-	-	-				
Handtool - rattle qun	Rattle qun	2				-	-	107	-	118	-	-	-				
Concrete vibrator	Vibrator	2				-	-	97	-	100	-	-	-				
Hiab	Hiab	1				-	-	98	-	102	-	-	-				
Telehandler / Franna crane (20t)	Telehandler	1				-	-	99	-	103	-	-	-				
Hand tools	Hand tools	various				-	-	105	-	111	-	-	-				
Hand tools (Power)	Power tools	various				-	-	107	-	118	-	-	-				
External Walls, doors, windows, roof and Cladding	Installation of façade, roof, gutters, downpipes, qlazing, doors, windows, etc...	August 2022 - October 2022	EWP	EWP	2	-	-	95	-	98	-	-	-				
			Handtool - rattle qun	Rattle qun	2	-	-	107	-	118	-	-	-				
			EWP	Scissor lift	1	-	-	95	-	98	-	-	-				
			Telehandler / Franna crane (20t)	Telehandler	1	-	-	99	-	103	-	-	-				
			Delivery truck	Delivery truck	2 p.h.	-	-	102	-	111	-	-	-				
			Asphalt Paver	Paver	1	-	-	105	-	112	-	-	-				
			Delivery truck	Shuttle buqqies	1	-	-	102	-	111	-	-	-				
			Vibratory Roller - smooth drum (up to 14T)	Roller (smooth drum) 14t	1	-	-	112	-	118	HN	-	X				

Table C1: Construction Activities/ Equipment CHATSWOOD SMTF

Work activity	Details	Indicative timing/ duration	Plant/ Equipment	Plant/ Equipment (as provided by client)	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)			High noise plant (EPL E1)	Vibration intensive plant	Notes
					7am - 6pm	6pm - 10pm	10pm - 7am	L <sub>Aeq</sub>	Penalty	L <sub>Amax</sub>			
			Delivery truck	Delivery truck	2 p.h.	-	-	102	-	111	-	-	
			Water cart	Watercart	2 p.h.	-	-	104	-	107	-	-	
			Hand tools	Hand tools	various	-	-	105	-	111	-	-	
			Bobcat	Bobcat	2	-	-	104	-	107	-	-	
			Road Planer	Profiler	1	-	-	110	5	124	HN	-	
			Water cart	Road sweeper	1	-	-	104	-	107	-	-	
			SURFACE WORKS										
Partial removal of gantry shed	Removal of part of the southern side of the Gantry shed	October 21 - November 21	Delivery truck	Delivery truck	2 p.h.			102	-	111	-	-	
			Hand tools	Hand tools	various			105	-	111	-	-	
			Hand tools (Power)	Power tools	various			107	-	118	-	-	
			EWP	EWP	2			95	-	98	-	-	
			Handtool - rattle gun	Rattle gun	2			107	-	118	-	-	
			EWP	Scissor lift	2			95	-	98	-	-	
			Telehandler / Franna crane (20t)	Telehandler	1			99	-	103	-	-	
Demobilisation of gantry shed	Removal of: Gantry crane remainder of Gantry shed	March 2022 - July 2022	Mobile crane (20t-250t)	Mobile Crane 100t	1			104	-	108	-	-	
			Delivery truck	Delivery truck	2 p.h.			102	-	111	-	-	
			Hand tools	Hand tools	various			105	-	111	-	-	
			Hand tools (Power)	Power tools	various			107	-	118	-	-	
			EWP	EWP	2			95	-	98	-	-	
			Handtool - rattle gun	Rattle gun	2			107	-	118	-	-	
			EWP	Scissor lift	2			95	-	98	-	-	
Hardstand removal	Eastern side of site	July 2022 - August 2022	Telehandler / Franna crane (20t)	Telehandler	1			99	-	103	-	-	
			Mobile crane (20t-250t)	Mobile Crane 100t	1			104	-	108	-	-	
			Excavators with hammers (35-45T)	Excavator 30t with hammer	1			118	5	123	HN	X	
			Truck and Dog	Truck & dog	2 p.h.			106	-	111	-	-	
			Bobcat	Bobcat	1			104	-	107	-	-	
			Vibratory Roller - smooth drum (up to 14T)	Roller (smooth drum) 14t	1			112	-	118	HN	X	
			Water cart	Road sweeper	1			104	-	107	-	-	
Drainage and services (and sed basin construction)		August 2022 - October 2022	Excavator w bucket (25t)	Excavator 20t	1			103	-	108	-	-	
			Excavator w bucket (25t)	Excavator 30t	2			103	-	108	-	-	
			Truck and Dog	Truck & dog	2 p.h.			106	-	111	-	-	
			Bobcat	Bobcat	1			104	-	107	-	-	
			Vibratory Roller - smooth drum (up to 14T)	Roller (smooth drum) 14t	1			112	-	118	HN	X	
			Water cart	Road sweeper	1			104	-	107	-	-	
			Mobile crane (20t-250t)	Mobile crane 100t	1			104	-	108	-	-	
Finishing works	Fencing; landscaping...	November 2022 - March 2023	Excavator w bucket (25t)	Excavator 30t	2			103	-	108	-	-	
			Truck and Doq	Truck & doq	2 p.h.			106	-	111	-	-	
			Bobcat	Bobcat	1			104	-	107	-	-	
			Vibratory Roller - smooth drum (up to 14T)	Roller (smooth drum) 14t	1			112	-	118	HN	X	
			Water cart	Road sweeper	1			104	-	107	-	-	
			Hand tools	Hand tools	various			105	-	111	-	-	
			Delivery truck	Delivery truck	2 p.h.			102	-	111	-	-	
Demobilisation of site	Removal of: Spoil shed Workshop; Water treatment plant Site sheds and hoardings	November 2022 - March 2023	Hand tools	Hand tools	various			105	-	111	-	-	
			Hand tools (Power)	Power tools	various			107	-	118	-	-	
			EWP	EWP	2			95	-	98	-	-	
			Handtool - rattle qun	Rattle gun	2			107	-	118	-	-	
			EWP	Scissor lift	2			95	-	98	-	-	
			Telehandler / Franna crane (20t)	Telehandler	1			99	-	103	-	-	
			Mobile crane (20t-250t)	Mobile Crane 100t	1			104	-	108	-	-	
Hardstand removal	Western side of site	November 2022 - March 2023	Excavators with hammers (35-45T)	Excavator 30t with hammer	1			118	5	123	HN	X	
			Truck and Doq	Truck & doq	2 p.h.			106	-	111	-	-	
			Bobcat	Bobcat	1			104	-	107	-	-	
			Vibratory Roller - smooth drum (up to 14T)	Roller (smooth drum) 14t	1			112	-	118	HN	X	
			Water cart	Road sweeper	1			104	-	107	-	-	
			Excavator w bucket (25t)	Excavator 20t	1			103	-	108	-	-	
			LOGISTICS										
Deliveries	Delivery to spoil shed	March 2021 - December 2022	Delivery truck	Delivery truck	4 p.h.	4 p.h.	4 p.h.	102	-	111	-	-	Deliveries to spoil shed and deliveries to gantry shed will be managed so as not to occur concurrently.
			Telehandler / Franna crane (20t)	Telehandler/forklift/franna	2	1	1	99	-	103	-	-	
			Mobile crane (20t-250t)	Mobile crane 100t	1	1	1	104	-	108	-	-	
Deliveries	Delivery to gantry shed	March 2021 - March 2022	Delivery truck	Delivery truck	4 p.h.	4 p.h.	4 p.h.	102	-	111	-	-	Deliveries once sheds removed during standard hours only, except for OSDs
			Telehandler / Franna crane (20t)	Telehandler/forklift/franna	2	1	1	99	-	103	-	-	
			Gantry crane 40T (MDS)	Gantry crane 40t	2	2	2	100	-	106	-	-	
Concrete deliveries	Tunnel fitout	March 2021 - September 2021 Complete	Concrete pump	Concrete pump (line)	1	1	1	103	-	107	-	-	OOH inside gantry shed - not concurrent with other deliveries
			Concrete Aqi	Concrete Aqi	4 p.h.	4 p.h.	4 p.h.	108	-	111	-	-	
Concrete deliveries	Surface works	March 2021 - May 2022	Concrete pump	Concrete pump (line)	1	-	-	103	-	107	-	-	OOH inside gantry shed - not concurrent with other deliveries
			Concrete Aqi	Concrete Aqi	4 p.h.	-	-	108	-	111	-	-	
Material movement	Between spoil shed and gantry shed Around whole site	March 2021 - September 2022	Delivery truck	Flat bed truck/hiab	2	1	1	102	-	111	-	-	
			Telehandler / Franna crane (20t)	Telehandler/forklift/franna	2	1	1	99	-	103	-	-	

Table C2: Construction Timetable

Work Activity	Description of Activity	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23
Track construction	Rail and sleeper consist																											
	Concrete																											
	Welding																											
	M&E Fitout																											
Dive Service Building	Footings & Foundations & Structural steel																											
	External finishes, internal finishes and fitout																											
	External																											
	External																											
Fire Services Building	Footings & Foundations & Structural steel																											
	External finishes, internal finishes and fitout																											
	External																											
	External																											
Surface works	Partial removal of gantry shed																											
	Demobilisation of gantry shed																											
	Hardstand removal (eastern side of site)																											
	Drainage and services																											
Logistics	Finishing (Fencing and landscaping)																											
	Demobilisation - spoil shed, water treatment plant, site sheds																											
	Hardstand removal (western side of site)																											
	Delivery to spoil shed																											
Logistics	Delivery to gantry shed																											
	Concrete deliveries																											
	Material movement																											
	Material movement																											



Figure C1: Construction Site Layout

CHATSWOOD SMTF

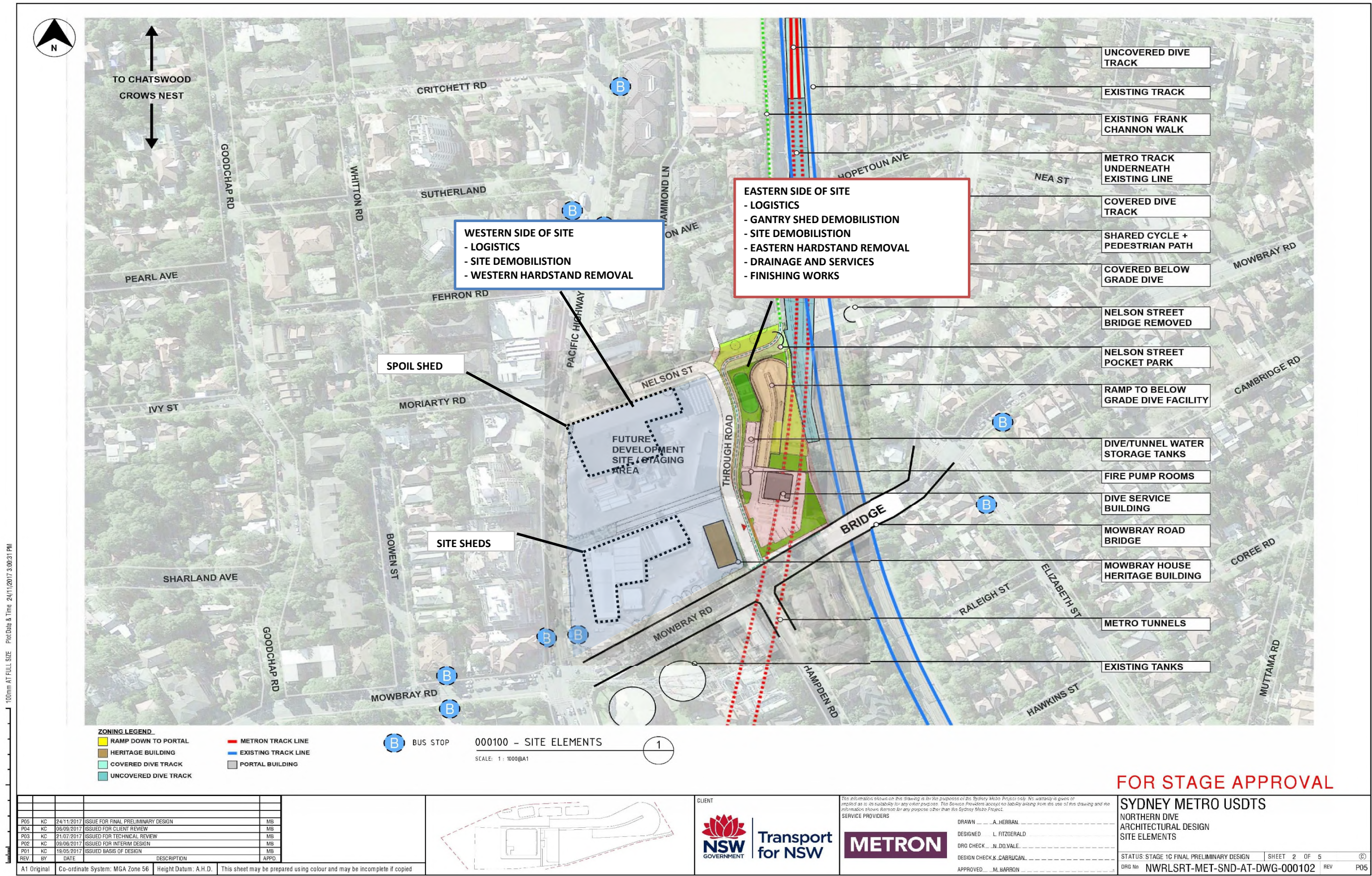




Figure C1: Construction Site Layout  
Figure C1b: Gantry Shed

CHATSWOOD SMTF  
CHATSWOOD SMTF

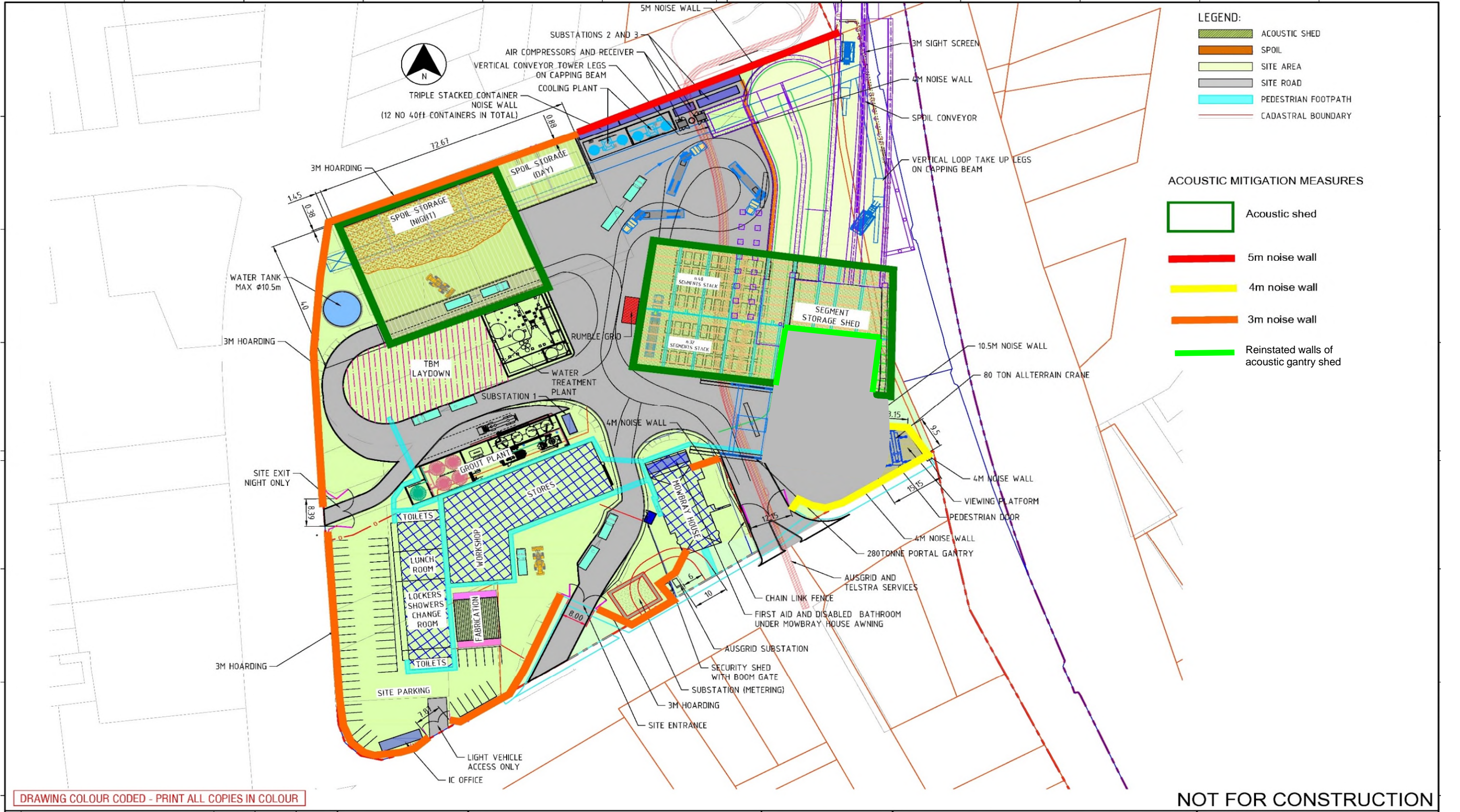


Table C4: Noise shed / enclosure design specificationsCHATSWOOD SMTF

Area to be Mitigated	Construction component	Sound transmission loss	Indicative element construction
		Reference ID	
Gantry shed	Existing Walls	F017	Double Skin Steel, such as External side: 1 x 0.48 mm BMT corrugated sheet steel + 60mm insulation with perforated foil on inside face + 250mm girt Inside: 1 x 0.42 mm BMT corrugated sheet steel.
	Reinstated Walls	F002	1x 0.48mm BMT corrugated steel
	Roof	F017	Double Skin Steel, such as External side: 1 x 0.48 mm BMT corrugated sheet steel + 60mm insulation with perforated foil on inside face + 250mm girt Inside: 1 x 0.42 mm BMT corrugated sheet steel.
	Insulation inside double skin walls/roofs		Foil side of the acoustic insulation to be interfaced with the steel layer so that glasswool is exposed to the cavity (not against the steel)
	Acoustic lining	-	Acoustic lining with roofing blanket with perforated foil e.g. Permastop building blanket 55mm Sisilation Light Duty on inner skin facing inside shed of: - upper section of walls (above 2.5 m); - Underside of roof
	Doors	-	Oversized roller door (larger than wall opening) and rubber seals side and bottom Access doors to be selected to not acoustically compromise the overall building element it sits within.
	Openings (ventilation/ access)		Any necessary ventilation openings should face away from neighbours and also fitted with acoustic louvres / attenuators or doors to achieve requirements.

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.
- By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the assembly, a higher rating implying a higher sound reduction performance.
- Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.
- The sealing of all gaps is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
- Check design of all junction details with acoustic consultant prior to construction.
- Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
- The information provided in this table is subject to modification and review without notice.
- The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.
- Only the buildings elements noted in Table C4 have been assessed. It is assumed that all other items will not impact the acoustic properties, or can be sufficiently acoustically treated.