

Temporary Noise Barrier Strategy – St Peters Interchange

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Document Approval

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Signature:						

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Details of Revision Amendments

Document Control

The Project Director is responsible for ensuring that this Strategy is reviewed and approved. The Engineering and Design Director is responsible for updating this Strategy to reflect changes to the Project, legal and other requirements, as required.

Amendments

Any revisions or amendments must be approved by the Project Director before being distributed or implemented.

Revision Details

Revision	Details
00	Prepared for Implementation
01	Updated to address DPE Comments

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1. Introduction

1.1. Project Description

WestConnex is one of the NSW Government's key infrastructure projects which aims to ease congestion, create jobs and connect communities. It is the largest integrated transport and urban revitalisation project in Australia.

The 33 kilometer project was a key recommendation of the State Infrastructure Strategy released in October 2012. It brings together a number of important road projects which together form a vital link in Sydney's Orbital Network. They include a widening of the M4 east of Parramatta, a duplication of the M5 East and new sections of motorway to provide a connection between the two key corridors.

Figure 1 - WestConnex Project Map



WestConnex will support Sydney's long term growth and boost the city's economic productivity. It will:

- Provide quicker, more reliable trips between Western Sydney and the Port Botany/Sydney Airport precinct to support Sydney's urban freight task
- Help distribute traffic across the wider road network, removing bottlenecks and relieving congestion for local trips
- Provide better connections along the M4 and M5 corridors to cater for the forecast growth in employment and population along these routes
- Allow urban revitalisation and increase opportunities for active and public transport along and across Parramatta Road.

The WestConnex project includes a number of stages:

- Stage 1a – M4 Widening
- Stage 1b – M4 East
- Stage 2 – New M5

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- Stage 3 – M4-M5 Link

In November 2015, the Sydney Motorway Corporation (SMC) awarded the CPB Contractors Dragados Samsung Joint Venture (CDS JV) the contract for the design and construction of Stage 2 – New M5. The New M5 will run from the existing M5 East corridor at Beverly Hills via a tunnel to St Peters, providing improved access to the airport, south Sydney and Port Botany precincts.

Key features of the New M5 include:

- New twin tunnels which are higher, wider and flatter. These will more than double capacity along the M5 East corridor and provide motorway access to north of Sydney Airport
- A new interchange at an industrial site at St Peters, which reduces the impact on nearby residential areas
- Connections from the interchange to key roads in the area, including Campbell Road/Street, Euston Road and across the canal to Bourke Road
- Widening of Campbell Road/Street and Euston Road through existing road widening reservations
- Western tunnel entry and exit points at Kingsgrove.

Stage 2 of WestConnex is being accelerated following an historic funding agreement signed by the Australian and New South Wales Governments in May 2014.

This has allowed work to start on the M5 - King Georges Road Interchange upgrade.

The duplication of the M5 East corridor will improve travel times and reliability for the 100,000 motorists which use this key route every day.

It will allow for improved movement of freight to and from the Port Botany area and provide an express route between Western Sydney and Sydney Airport once WestConnex is completed.

1.2. Purpose of this Plan

The CDS JV has prepared this Temporary Noise Barrier Strategy – St Peters Interchange (TNBS-SPI) in accordance with Condition of Approval (CoA) 20.

The TNBS for St Peters Interchange takes into account works which influence possible noise barriers incorporating construction compounds;

- C8 – Canal Rd
- C9 – Campbell Rd
- C10 – Landfill Closure
- C11 - Burrows Rd

1.3. Scope of this Document and Compliance with D20

This document provides the structure and details of the TNBS required for the project as prescribed in CoA D20. This strategy focuses on the St Peters Interchange site. This TNBS will form part of the project wide TNBS as detailed in the New M5 Staging Report. This report is submitted to address works under Stage 2(d) which includes surface construction activities at the St Peters Interchange (SPI) construction sites as detailed in Section 1.3 of the New M5 Staging Report Rev 01.

Table 1.1 shows where compliance with CoA D20 is addressed within this document.

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Table 1.1: Compliance with D20

D20 Requirements	Compliance
The Proponent must develop and implement a Temporary Noise Barrier Strategy which includes:	
a) identification and confirmation of all temporary noise barriers including -	Section 2.5
(i) the provision of a temporary noise barrier on the northern side of the Kingsgrove North construction compound to provide noise mitigation to highly affected residents at a level greater than that identified in the documents referred to in condition A2(b),	Section 1.3 - See Temporary Noise Barrier Strategy – Kingsgrove M5N-CN-PLN-WSW-001, CoA D20 (a) (i) is not addressed within this TNBS
(ii) consideration of the installation of temporary noise barriers on the southern and northern side of the M5 East Motorway during the relocation of the existing permanent noise barriers (or detail on why these noise barriers are not considered feasible and reasonable),	Section 1.3 - See Temporary Noise Barrier Strategy – Kingsgrove M5N-CN-PLN-WSW-001, CoA D20 (a) (ii) is not addressed within this TNBS
(iii) consideration of the installation of temporary noise barriers along Campbell Road, Campbell Street and Euston Road (or detail on why these noise barriers are not considered feasible and reasonable),	Section 1.3 - A separate TNBS will be developed to address the management and mitigation of construction noise along Campbell Road, Campbell Street and Euston Road, CoA D20 (a) (iii) is not addressed within this TNBS
(iv) temporary noise barriers around construction compounds;	Section 2.5 This TNBS covers noise barriers for construction compounds C8, C9, C10 and C11. Separate TNBS will be developed in accordance with Pre-Construction Compliance Report M5N-ES-RPT-PWD-0003 rev00 for other construction compounds.
b) the consultation and decision-making process for all temporary noise barriers; and	Section 3.1 to 3.4
c) an acoustic report detailing the final barrier heights, material analysis and predicted benefits.	Appendix A - Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds)

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D20 Requirements	Compliance
<p>The temporary barrier options must be developed in consultation with the landowners adjacent to the barrier locations prior to the adoption of a final design.</p>	<p>Section 3.1 to 3.4</p>
<p>The Temporary Noise Barrier Strategy must be approved by the Secretary prior to site establishment works or construction works at the Kingsgrove North construction compound, the permanent noise barriers on the northern and southern side of the M5 East Motorway are removed, and/or road widening works are undertaken along Campbell Road, Campbell Street or Euston Road.</p>	<p>This TNBS does not cover compounds for which condition D20 requires approval by the Secretary.</p>

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2. Temporary Noise Barrier Strategy

2.1. Temporary Barrier Overview

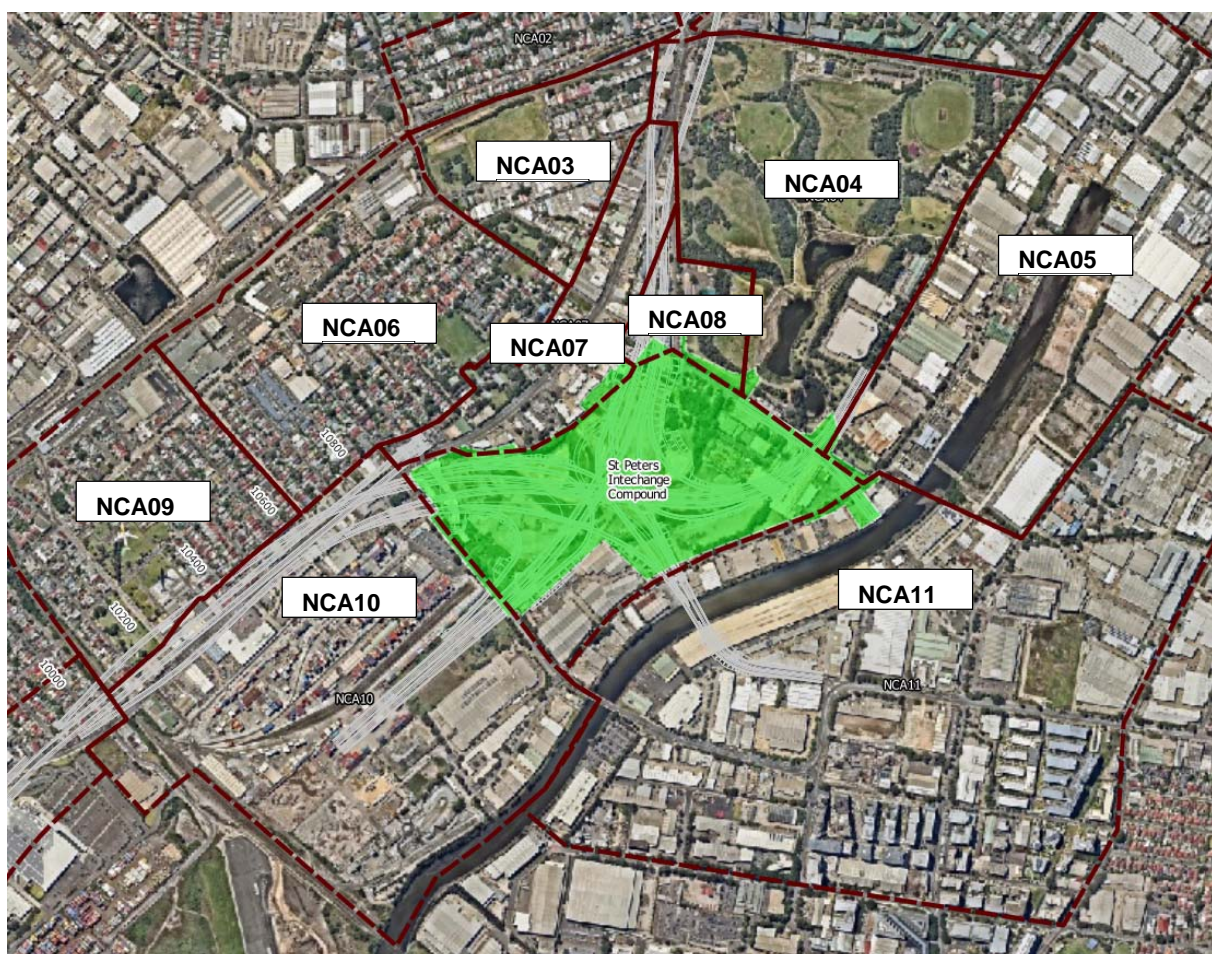
The overall approach of the TNBS is to ensure that reasonable and feasible temporary noise barrier solutions are developed and implemented in accordance with CoA whilst specifically consulting with stakeholders and highly effected landowners to address their concerns.

2.2. Identify Sensitive Receivers

A key component of the TNBS is to identify sensitive receivers based on the proposed construction footprint. Sensitive receivers are detailed in the Construction Noise and Vibration Management Plan (CNVMP). Sensitive receivers have been reviewed considering CoA D20 and specifically identified for consultation, especially landowners, tenants and residents close to proposed temporary noise barriers. Reference the Construction Noise and Vibration Management Plan Appendix B for identified sensitive receivers to St Peters Interchange works.

The nearest effected sensitive receivers to the temporary noise barriers have been classified as the properties with future line of sight to the barriers. These are detailed in Section 3.3.

Figure 2 - Sensitive Receiver Catchments: Extract from CNVMP:



2.3. Noise Objectives

Construction noise management levels have been developed using NSW Interim Construction Noise Guideline (ICNG), in accordance with CoA D16(a). Objectives have been set in the form of Construction Noise Management Levels.

Residential receivers are considered noise affected where construction noise levels are greater than the noise management levels (NMLs) as determined above, NMLs are detailed in Appendix A - Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds), Appendix B. Noise affected levels represent the point above which there may be some community reaction to noise, where this scenario is anticipated predicted and/or measured construction noise levels exceed NMLs, all feasible and reasonable work practices will be applied to meet NMLs.

During standard construction hours a highly affected noise objective of LAeq(15min) 75 dB(A) applies at all receivers.

Reference Appendix A - Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds) Sections 3.1 for further details.

2.4. Construction Noise Assessment

Modeling and assessment of airborne noise impacts from activities associated with the construction works have been determined by modeling the noise sources, receiver locations, topographical features, and possible noise mitigation measures using a Cadna-A computer noise model specifically developed for this project. The model calculates the contribution of each noise source at identified sensitive receivers and allows for the prediction of the total noise from a site for various stages of construction.

The model is used to determine the impact of construction noise from construction compounds C8, C9, C10 and C11 for various construction stages, identified as V01 through to V08 below in Table 2.2. Timing of stages is indicative and used as a guide for modeling purposes. Note that Installation of environmental controls includes the installation of temporary noise barriers, a key component of early site mobilisation works is to enable the erection of temporary noise barriers. Table 2 below shows modeling assumptions, further details can be found in Appendix A - Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds) Sections 4, including the full scope of each modelled construction stage (Appendix D of the appended Acoustic Report).

Table 2 - Noise modelling assumptions - SPI civil and tunnelling support sites

Activity/ Work Area	Aspect	Includes OOHW?	Approx. timing	Modelled construction stage								
				V01	V02	V03	V04	V05	V06	V07	V08	
Canal Road compound (C8) Civil works site establishment	Power Generator	No	07-09 2016									
	Installation of enviro controls	No	07-09 2016									
	Demolition of existing structures	Yes	07-09 2016									
	Crushing & Screening	No	07-09 2016									

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Activity/ Work Area	Aspect	Includes OOHW?	Approx. timing	Modelled construction stage									
				V01	V02	V03	V04	V05	V06	V07	V08		
	Vegetation Clearing	Yes	07-09 2016	Green	Purple								
	Establishment of construction facilities and access roads	No	07-09 2016		Purple	Cyan	Red						
	Road and intersection modifications and traffic controls	Yes	07-09 2016		Purple	Cyan							
	Installation of Site Hoarding	Yes	07-09 2016	Green	Purple	Cyan							
SPI Portal civil and surface works	Piling; Excavation of decline	No	2016-2018							Orange			
	Earthworks	No	2016-2018								Orange		
	Road tie-in works	No	2016-2018									Orange	
Campbell Road Civil and Local Roads compound (C9) Civil works and local roads site establishment	Power Generator	No	08-12 2016	Green	Purple	Cyan	Red						
	Installation of enviro controls	No	08-12 2016		Purple								
	Demolition of existing structures (major)	No	08-12 2016	Green	Purple	Cyan	Red						
	Vegetation Clearing	No	08-12 2016		Purple								
	Establishment of construction facilities (local roads/ civil works)	No	08-12 2016			Cyan	Red						
	Road and intersection modifications traffic controls	Yes	08-12 2016		Purple	Cyan							
SPI Northern Ramps civil and surface works	Earthworks	No	2016-2018							Orange			
	Dynamic compaction & Piling	No	2016-2018								Orange		
	Road tie-in works	No	2016-2018									Orange	
SPI Tunnelling support compound (C10) Tunnelling Support Site Establishment	Installation of enviro controls	No	07-09 2016		Purple								
	Demolition of existing structures	No	07-09 2016		Purple								
	Vegetation Clearing	No	07-09 2016		Purple								
	Establishment of construction facilities	No	07-09 2016			Cyan	Red						
	Road and intersection modifications and traffic controls	Yes	07-09 2016		Purple	Cyan							
	Piling (shed)	No	08-09 2016				Red						
	Tunnel support works	Yes	2016-2018							Blue			

Impacts to sensitive receivers have been determined and will be reviewed during design development and construction. Noise mitigation measures in the form of temporary noise barriers have been developed to address predicted noise levels for both standard hours and evening/night works, noise levels are detailed in Appendix A - Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds) Sections 4.3.1 and 4.3.2.

To mitigate the impact of high impact activities in accordance with CoA D16 high impact activities will be subject to respite periods and maximum durations.

Mitigation measures will be refined as design and construction methods are finalised, mitigation measures will be detailed in the Construction Noise and Vibration Impact Statement for the St Peters Interchange.

Burrows Rd Compound

The assessment undertaken as part of Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds) - Appendix A considered noise generating activities from all activities at the St Peters Interchange, including the Burrows Rd Compound and construction activities that would propagate noise in an easterly direction from the SPI site to receivers across Burrows Road. Noise generation at Burrows Rd Compound relate to activities such as light vehicle movements, use of toilets and showers and air-conditioning. The perimeter of a substantial portion of the compound is shielded by site sheds. The receivers of noise propagating in an easterly direction from the site and compound are commercial and industrial premises, there are no residential receivers in this direction. These factors when assessed indicate that a noise barrier for the Burrows Rd Compound will not provide beneficial acoustic attenuation.

Gardeners Bridge Compound

A Temporary Noise Barrier Strategy is being prepared for Local Road Works in the Alexandria, St Peters and Mascot suburbs. The Gardeners Bridge compound is a compound for Local Road Works and will be included in the Temporary Noise Barrier Strategy for Local Road Works.

2.5. Noise Barrier Design

The strategy focuses on modeling impacts based on proposed construction methodologies, determining the noise impacts of such methodologies, identifying sensitive receivers, consultation with sensitive receivers to help develop and finalise temporary noise barrier options based on Sections 2.4 above. Barrier options have been developed considering a variety of acoustic ratings and noise wall performance levels, options have been subsequently matched to required Rw ratings determined from the modeling process. Noise barrier design specifications have been classified using the below performance criteria;

- Low – Rw 10 to 15
- Medium – Rw 15 to 20
- Medium to High – Rw 20 to 25
- High – Rw 25 to 30
- Very High – Rw > 30

Noise barriers are specified below in Table 2.3 which is derived from Appendix A - Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds). Barriers are specified by location and required Rw rating as determined by noise modeling, a variety of barrier options were considered where chosen barrier options were based on ensuring actual barrier acoustic ratings are greater than specified Rw ratings. In all instances traditional plywood hoardings meet required Rw ratings as detailed below.

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The Environmental Impact Assessment did not identify any barriers to be installed along Burrows Rd. This has been confirmed in modelling for the St Peters Interchange site. Results of this modelling addressing Compound 11 on Burrows Rd are included in the Temporary Noise Barrier Strategy – Local Road Upgrades.

Noise barriers (identified in Figure 3) have been designed and positioned to achieve noise reduction required to achieve the ICNG goal levels for surrounding sensitive receivers.

Figure 3 - Noise Barrier Locations

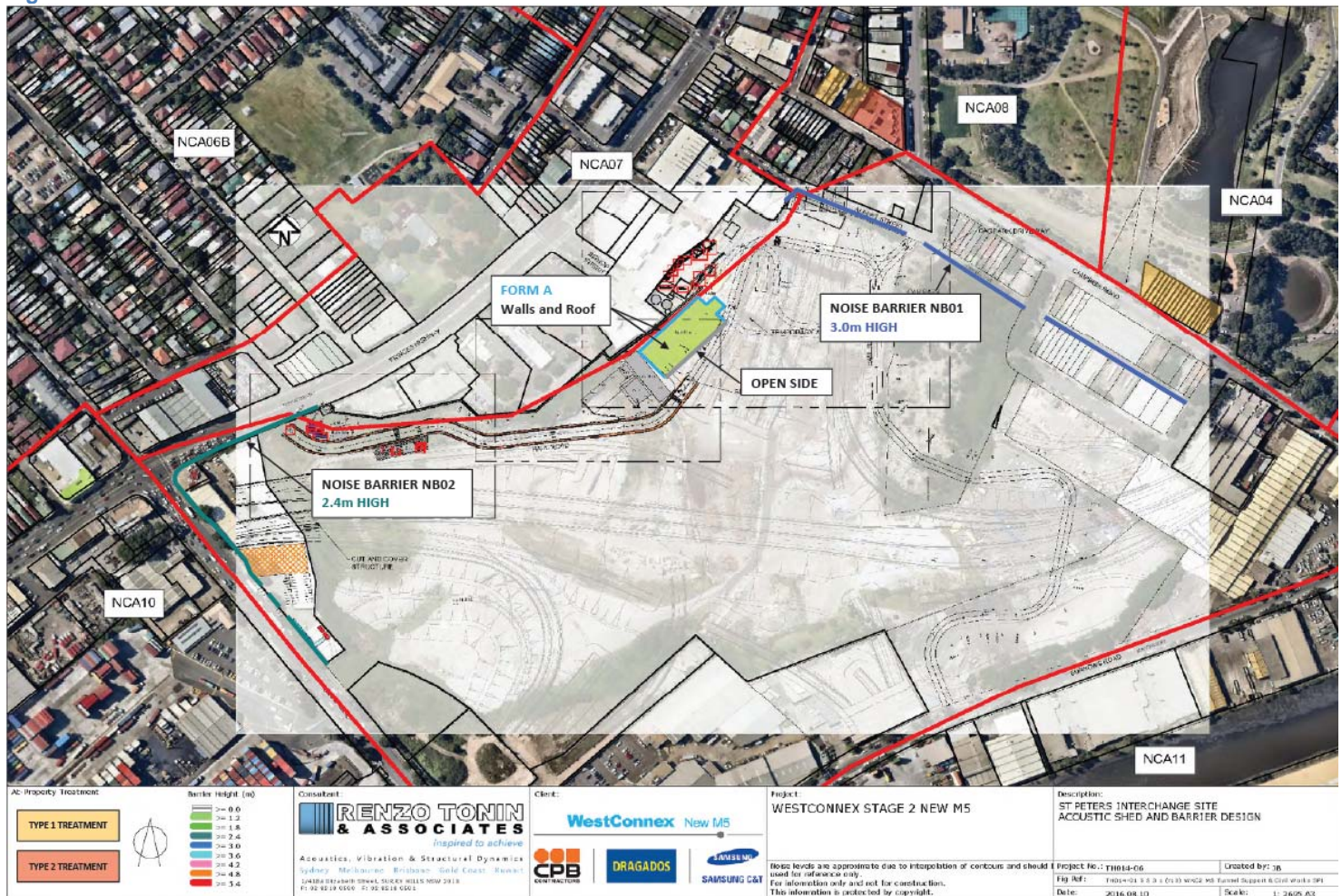


Table 3 - Noise Barrier Distance to Nearest Resident

Noise Barrier	Location	Barrier Height	Distance to Nearest Resident
NB01	Campbell Rd Compound (C9) & Landfill Compound (C10) - North East Boundary	3m	Approximately 65m
NB02	Canal Rd Compound (C8) – Western and Eastern Boundary	2.4m	Approximately 30m

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Table 4 - Noise Barrier Specifications

Noise Barrier	Location	Barrier Height	Required Rw	Proposed Construction	Acoustic Rating Rw
NB01	Campbell Rd Compound (C9) & Landfill Compound (C10) - North East Boundary	3m	Rw 15-20	17mm plywood	Rw 24
NB02	Canal Rd Compound (C8) – Western and Eastern Boundary	2.4m	Rw 15-20	17mm plywood	Rw 24

2.6. Noise Barrier Installation

Noise barrier NB01 will be installed in three phases; the western portion during site establishment and the central portion following the removal of 'Bradshaw Mt' (a vegetated spoil hill within the St Peters Interchange Site), estimated for first quarter 2017. There are currently two rows of vacant terrace houses, other properties and 'Bradshaw Mt' providing acoustic attenuation between the site and many residential properties in Campbell St and Barwon Park Rd. This attenuation will cease following demolition of the properties and removal of 'Bradshaw Mt'.

The proposed location of the eastern portion of NB01 currently has warehouses / factories facing onto Holland St. The eastern portion of NB01 (third phase) will be installed first quarter 2017 (dependent of property acquisition) when the structures on the compound are demolished and the designed earth levels formed. Properties on Campbell Ln and Campbell Rd backing onto this location provide significant noise attenuation.

Noise barrier NB02 will be installed early in site establishment. Due to the narrow footpaths on Canal Rd and Princes Hwy sections of the NB02 barrier will be installed during the evening and night when a traffic lane closure can be granted by the Transport Management Centre, this has been modeled in an out of hours construction noise and vibration impact assessment.

Table 5 - Noise Barrier Installation

Noise Barrier	Location	Commence Installation	Comments
NB01	Campbell Rd Compound (C9) – (Eastern Portion of NB01)	Following demolition of properties on Holland St (early 2016).	The timing and sequence of installing this barrier will be dictated by dates properties are acquired and provided by RMS to CDS-JV.
	Central Portion	Following removal of 'Bradshaw Mountain'.	The central portion along Campbell Ln, is proposed to be installed along the current boundary which has a vegetated spoil hill known as Bradshaw Mt, due to be removed as part of the works.
	Landfill Compound (C10) – (Western Portion of NB01)	During AFMP works / site establishment.	The western extent of NB01 will be constructed by attaching 17mm plywood to the existing colourbond fence.
NB02	Canal Rd Compound – Western and Eastern Boundary	During AFMP works / site establishment	- Planned during site establishment. For areas where night time lane closures are required the works will

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Noise Barrier	Location	Commence Installation	Comments
			occur over 10 nights spread over three weeks to comply with the Environmental Protection Licence.



2.8. Noise Mitigation Development

As detailed design development continues it is evident that currently proposed noise mitigation measures are generally achieving superior noise mitigation outcomes than those previously proposed within the EIS. This is demonstrated in the below comparison where predicted impacts presented in the EIS are compared to current detailed design predicted impacts. Predicted impacts have been broken down into those that fall within standard hours and those outside standard hours as below.

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Impacts are presented as follows for standard hours (Day):





-  Complies with NML
-  Exceeds NML by less than 10 dB(A) - Noise Effected
-  Exceeds NML by more than 10 dB(A) - Noise Effected
-  > 75 dB(A) - Highly Noise Effected

Table 6 -Summary of construction noise impacts (standard hours)

NCA	Level of compliance with NML for construction stage																			
	V01		V02		V03		V04		V05		V06		V07		V08					
	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD				
NCA03		[[[[[
NCA04		[[[[[[
NCA06		[[[[[[[
NCA07		[[[[[[[
NCA08		[[[[[[[
NCA09		[[[[[[[
NCA10		[[[[[[[
NCA11		[[[[[[[[

Notes
 All works to be undertaken during Standard construction hours (7am to 6pm Monday to Friday; 8am to 1pm Saturday)
 EIS refers to results presented in EIS noise and vibration assessment report
 DD refers to detailed design noise assessment. Number in brackets refers to noise predictions without temporary noise barriers.
 OSR = Other sensitive receiver surrounding work area. Worst affected OSR noted.

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Impacts are presented as follows for nonstandard hours (Evening and Night):






























































































-  Complies with NML
-  < 5 dB(A) above NML - Construction Noise Noticeable
-  5 to 15 dB(A) above NML - Construction Clearly Noise Noticeable
-  > 15 to 25 dB(A) above NML - Construction Noise Moderately Intrusive
-  > 25 dB(A) above NML - Construction Noise Highly Intrusive

Table 7 - Summary of construction noise impacts (OOHW)

NCA	Level of compliance with NML for construction stage															
	V01		V02		V03		V04		V05		V06		V07		V08	
	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD
NCA03	-	-	-		-		-	-		 []	 []	 []	 []			
NCA04	-	-	-		-		-	-		 []	 []	 []	 []			
NCA06	-	-	-		-		-	-		 []	 []	 []	 []			
NCA07	-	-	-		-		-	-		 []	 []	 []	 []			
NCA08	-	-	-		-		-	-		 []	 []	 []	 []			
NCA09	-	-	-		-		-	-		 []	 []	 []	 []			
NCA10	-	-	-		-		-	-		 []	 []	 []	 []			
NCA11	-	-	-		-		-	-		 []	 []	 []	 []			

Notes All works to be undertaken during OOHW Evening 6pm to 10pm Monday to Sunday; or OOHW Night 10pm to 7am Monday to Friday and 10pm to 8am Saturday, Sunday and public holidays; OOHW Day 1pm to 6pm Saturday and 8am to 6pm Sundays and public holidays.

Level of compliance reported is based on worst case impact for OOHW period (typically night period)

EIS refers to results presented in EIS noise and vibration assessment report. ** Activity not modelled as OOHW in EIS

DD refers to detailed design noise assessment. Number in brackets refers to noise predictions without temporary noise barriers.

OSR = Other sensitive receiver surrounding work area. Worst affected OSR noted.

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3. Stakeholder Consultation

3.1. Consultation

CPBDS-JV has adopted a well-coordinated, targeted and personalised approach to consult with highly affected properties and other key stakeholders regarding the temporary noise barriers following the principles and processes outlined in the Community Communication Strategy. Consultation has been carried out with landowners directly adjacent to NB02 and within line of sight for NB01, as CDS-JV is the tenant directly adjacent to these barriers.

3.2. Affected stakeholders

During temporary noise barrier design development and optioning phases properties adjacent to proposed noise barrier locations were identified via desktop analysis and verified by site assessments. Identified properties were consulted as above and where possible feedback was included in designs of the temporary noise barriers. Further information will be provided just prior to the commencement of temporary noise barrier construction. Properties adjacent to proposed temporary noise walls were consulted, a report detailing the consultation is attached as Appendix B.

Consultation was undertaken with nine commercial properties located directly adjacent to proposed temporary noise barriers. Figure 3.1 show properties consulted.

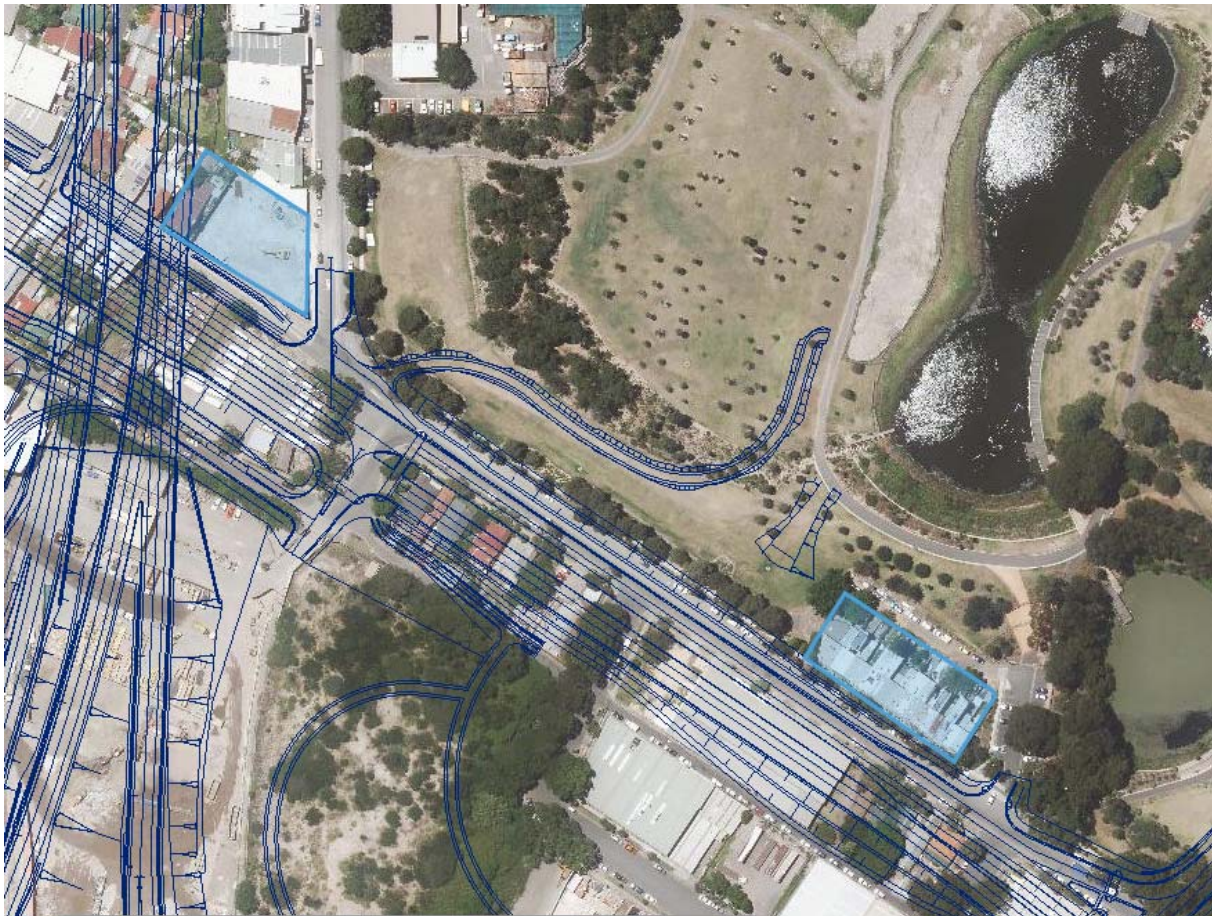
In addition to consulting with commercial properties adjacent to proposed temporary noise barriers, CPBDS-JV also consulted with key stakeholder Inner West Council for NB02.

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Figure 4 - Properties Consulted for NB02



Figure 5 - Properties Consulted for NB01



3.3. Communication and Consultation Activities

CPBDS-JV has consulted with commercial and residential properties adjacent and near to the proposed temporary noise barriers using specific temporary noise barrier related communications and engagement activities, including one-on-one briefings, council interface meetings and notifications.

- **One-on-one briefings**

Briefings were conducted with property adjacent or near to the proposed barriers. The purpose of these briefings was to consult with impacted stakeholders prior to the adoption of a final design.

These briefings were undertaken by a door-knock and performed by the Community Relations Lead and Project Manager or Environment Manager for the area.

The following tools were used during these briefings to facilitate stakeholder's understanding of the proposed barriers options:

- Maps and plans to illustrate proposed barrier locations and project design
- Colour samples
- St Peters Interchange fact sheet, community update and other relevant project communications

Where a resident was not at home a calling card stating the intent of the consultation and CDS-JV contact details were left.

- **Council Interface Meeting**

Regular interface meetings are being held with Inner West Council on a recurring basis. This forum has been organised to enable Council to be kept informed and engaged on a one-on-one basis covering a range of project matters, including proposed temporary noise barrier options.

Temporary noise barrier options for NB02 were presented at council interface meeting on 13 May 2016. Formal correspondence was also sent to the council on 30 May 2016 outlining a proposal for the Princes Highway section of the noise barrier and/or sent to councils in the interim period.

- **Notification**

Notification will be sent to directly adjacent commercial properties to inform them of works to install the temporary noise barriers. The notification will detail the location of the barrier works, timing and impacts. Ongoing notifications and project updates will be provided as works progress.

3.4. Decision Making Process

Noise Barrier 01

All stakeholders consulted for NB01 were residential. There was generally a low level of interest in the noise barriers as they are between 65 and 80m from the properties. Of more pressing concern for residents was the final operational design of Campbell St and Campbell Rd and construction related impacts of the local roads upgrades. Key trends are evident in the feedback received as detailed summarised below;

- Three residents preferred the noise barriers to be painted pale eucalypt, all other residents consulted were ambivalent. It was explained that Sydney Motorway Corporation may elect to attach branding in the future to the noise barrier.
- No objection to proposed height of 3 metres.
- Generally not concerned about the noise barrier as there are more substantive issues for the residents.

It is noted that the apartment complex at 53 Barwon Park Rd has a wall that faces the St Peters Interchange. The windows of these apartments facing the site (excepting the penthouse) are set high in the walls and do not provide line of site for the residents.

- The above data has been considered and will be accounted for in the final design of NB01 and NB02 as below;
 - Pale eucalypt colour will be incorporated.
 - A plywood finish noise barrier will be used. The plywood will either be attached to an existing Colourbond fence or attached to posts set in the ground.
 - Proposed heights will be incorporated into final design.

The above demonstrates that residents near to the proposed temporary noise barriers have been consulted and feedback received has been incorporated in the development of final barrier designs.

Noise Barrier 02

All commercial properties consulted in relation to NB02 engaged proactively in open discussions regarding proposed temporary noise barriers and at the time of the consultation there were no significant issues raised regarding proposed options. Key trends are evident in the feedback received as detailed summarised below;

- No preference towards noise barrier finish or colour, accepting of the project's proposal to use Windspray colour and the potential for future project branding to be applied to the barrier.
- No objection to proposed height of 2.5 metres.
- Generally not concerned about the noise barrier as it is on the opposite side of the road from their properties.
- The above key trends have been considered and will be accounted for in the final design of NB02 as below;
 - Windspray colour will be incorporated.
 - A plywood finish noise barrier will be used. The plywood will either be inserted into the top of concrete jersey barriers or attached to piled posts.
 - Proposed heights will be incorporated into final design.

The above demonstrates that commercial properties adjacent to the proposed temporary noise barriers have been consulted and feedback received has been incorporated in the development of final barrier designs.

3.5. Monitoring and reporting

All stakeholder interactions regarding the implementation of the temporary noise barrier strategy with adjacent properties has been recorded in the project's community contact database and included in monthly and quarterly progress reports.

4. Ongoing Monitoring

The strategy sets the overall approach to how construction and traffic noise will be mitigated during construction. The effectiveness of the strategy will rely on multiple iterations of implementation of the strategy principles as design and construction methodologies are refined and implemented. Ongoing noise monitoring will be performed in accordance with the Noise and Vibration Management Plan.

5. Conclusion

The CDS JV has prepared this TNBS in accordance with the Conditions of Approval (CoA), in particular condition D20.

The strategy sets the overall approach to how construction and traffic noise will be mitigated during construction. The strategy focuses on modeling impacts based on proposed construction methodologies, determining the noise impacts of such methodologies, identifying sensitive receivers, consultation with sensitive receivers to help develop and finalize temporary noise barrier options and ongoing monitoring of the overall effectiveness of the strategy. This strategy demonstrates that optimum barrier solutions have been developed utilizing sound analytical modeling which demonstrates the benefit of proposed solutions and at the same time is a desired solution for highly effected residents as the consultation process demonstrates.

A key component of the implementation of the overall strategy is the Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (Kingsgrove Compounds) found in Appendix A.



Appendix A: Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI Compounds)

WESTCONNEX NEW M5

Construction Noise and Vibration: Temporary Noise Barrier Acoustic Report (SPI compounds)

13 July 2016

CPB Dragados Samsung Joint Venture

TH014-05 01F18 WXC_M5N Temp Barrier Nse Rep_SPI (r0)

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Important Disclaimer:

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

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, 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.

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1 Introduction

1.1 Relevant requirements and purpose of this report

This Construction Noise and Vibration Temporary Noise Barrier Acoustic Report (TNBAR) has been prepared to address the Conditions of Approval for the WestConnex New M5 Project (New M5 or Project), more specifically Condition D20.

D20 The Proponent must develop and implement a Temporary Noise Barrier Strategy which includes:

(a) identification and confirmation of all temporary noise barriers including -

(i) the provision of a temporary noise barrier on the northern side of the Kingsgrove North construction compound to provide noise mitigation to highly affected residents at a level greater than that identified in the documents referred to in condition A2(b),

(ii) consideration of the installation of temporary noise barriers on the southern and northern side of the M5 East Motorway during the relocation of the existing permanent noise barriers (or detail on why these noise barriers are not considered feasible and reasonable),

(iii) consideration of the installation of temporary noise barriers along Campbell Road, Campbell Street and Euston Road (or detail on why these noise barriers are not considered feasible and reasonable),

(iv) temporary noise barriers around construction compounds;

(b) the consultation and decision-making process for all temporary noise barriers; and

(c) an acoustic report detailing the final barrier heights, material analysis and predicted benefits.

The temporary barrier options must be developed in consultation with the landowners adjacent to the barrier locations prior to the adoption of a final design.

The Temporary Noise Barrier Strategy must be approved by the Secretary prior to site establishment works or construction works at the Kingsgrove North construction compound, the permanent noise barriers on the northern and southern side of the M5 East Motorway are removed, and/or road widening works are undertaken along Campbell Road, Campbell Street or Euston Road. This identifies the temporary noise walls to be installed at the Kingsgrove Road site, at the Western end of the M5N.

This TNBAR forms part of the Temporary Noise Barrier Strategy and has been prepared to address the temporary noise barriers associated with the Project's St Peters Interchange compounds C8, C9 and C10 to satisfy condition D20(a)(iv).

Separate acoustic reports have been prepared to address the temporary noise barriers at other compounds associated with the Project, including:

- Kingsgrove Road compounds C1, C2 and C3 and western surface works
- Bexley Road compounds C4, C5 and C6 and Arncliffe compound C7
- Local Roads compounds C11, C12, C13 and C14.

This report will be submitted to the Department of Environment and Planning (DEP) as part of the Temporary Noise Barrier Strategy required by Condition D20.

1.2 Structure of this report

This report is structured as follows:

- **Section 2** Description of work area and noise sensitive receivers surrounding the site;
- **Section 3** Noise objectives; and
- **Section 4** Construction Noise Assessment.

1.3 Quality assurance

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

2 Work area and sensitive receivers

2.1 Description of work area

This TNBAR provides information on the temporary noise barriers associated with the SPI compounds of the M5N Project, more specifically in relation to:

- Temporary noise barriers to mitigate construction noise associated with the Canal Road construction compound C8, located on the corner of Princes Highway and Canal Road
- Temporary noise barriers to mitigate construction noise associated with the Campbell Road construction compound C9, located along the Campbell Road site boundary
- Temporary noise barriers to mitigate construction noise associated with the SPI Tunnel Support construction compound C10, located on the northern side of the SPI site

Figure B1 in Appendix B shows the SPI construction work areas addressed in this report.

2.2 Sensitive receivers

In order to assess and manage construction noise impact, the residential areas surrounding the Project have been divided into Noise Catchment Areas (NCAs) based on each area's similar acoustic environment prior to the commencement of construction works. The NCAs have been based on those established in the EIS, with some modifications to allow for site specific characteristics identified during the detailed assessment and delivery phase. The NCAs are identified in more detail in the Construction Noise and Vibration Management Plan (CNVMP) prepared for the Project.

An indicative list of the nearest and potentially worst affected noise and vibration sensitive receivers and their respective NCAs are summarised in Table 2.1 below.

Table 2.1 Nearest Residential Noise and Vibration Sensitive Receivers

NCA	Receiver Type	Nearest construction work area	Distance from receiver to works
NCA03	Residential	SPI Tunnel Support compound (C10) Campbell Road compound (C9)	230m
NCA04	Residential	Campbell Road compound (C9) SPI Tunnel Support compound (C10)	20m
NCA05	Industrial	Campbell Road compound (C9)	80m
NCA06	Residential	Canal Road compound (C8) SPI Tunnel Support compound (C10)	75m
NCA07	Industrial	SPI Tunnel Support compound (C10)	<5m (Adjacent)
NCA08	Residential	SPI Tunnel Support compound (C10)	12m
NCA09	Residential	Canal Road compound (C8)	260m
NCA10	Commercial	Canal Road compound (C8) SPI Tunnel Support compound (C10)	25m

NCA	Receiver Type	Nearest construction work area	Distance from receiver to works
NCA11	Industrial	Canal Road compound (C8) Campbell Road compound (C9) SPI Tunnel Support compound (C10)	200m

All relevant residential sensitive receivers in the vicinity of the worksites are identified on aerial photographs located in APPENDIX B.

3 Noise Objectives

3.1 Construction Noise Management Levels

Construction noise management levels have been determined using the NSW Interim Construction Noise Guideline (ICNG), in accordance with Condition D16(a).

Figure B1 and Table B1 in APPENDIX B identify the adopted construction noise management levels (NMLs) for the nearest noise sensitive receivers to the worksite. The NMLs for residential receivers are based on long-term noise monitoring conducted by AECOM on behalf of SMC to quantify ambient noise levels for the Environmental Impact Statement (EIS) as noted in the CNVMP. The NMLs are derived from the lowest measured RBLs within each NCA and are generally considered to be conservative.

The NMLs for 'other' sensitive receivers are from the ICNG, as reported in Section 3.1.1 of the CNVMP.

Residential receivers are considered 'noise affected' where construction noise levels are greater than the NMLs identified in APPENDIX B. The noise affected level represents the point above which there may be some community reaction to noise. Where predicted and/or measured construction noise levels exceed NMLs, all feasible and reasonable work practices will be applied to meet the NMLs.

During standard construction hours a highly affected noise objective of $L_{Aeq(15min)}$ 75 dB(A) applies at all receivers.

Any construction related activities that could exceed the NMLs shall be identified and managed in accordance with the CNVMP.

4 Construction Noise Assessment

4.1 Noise prediction methodology

Modelling and assessment of airborne noise impacts from activities associated with the construction works were determined by modelling the noise sources, receiver locations, topographical features, and possible noise mitigation measures using a Cadna-A computer noise model developed for this Project. The model calculates the contribution of each noise source at identified sensitive receiver locations and allows for the prediction of the total noise from a site for the various stages of the construction works.

The noise prediction models take into account:

- Location of noise sources and sensitive receiver locations;
- Height of sources and receivers referenced to one metre digital ground contours for the site area and surrounding area;
- Sound Power Levels (L_w) of plant and equipment likely to be used during the various construction activities are included in Table C2 in Appendix C - Construction Timetable/ Activities/ Equipment. Table C2 also identifies the plant and equipment that will be operating during standard construction hours and outside of standard construction hours.
- Separation distances between sources and receivers;
- Ground type between sources and receivers; and
- Attenuation from barriers (natural and purpose built).

Key details regarding the construction site layout, the likely plant and equipment (including truck movements), and hours of operation were informed by the Design and Construction Teams. This information is presented in APPENDIX C and formed the basis for all modelling assumptions used in this assessment.

4.2 Preliminary detailed design outcomes

During the development of the site design, Renzo Tonin & Associates are playing a key role in assisting CDS JV to determine the physical noise mitigation measures required to reduce noise impact from the operation of the site. The following sections describe briefly the noise design methodology and outcomes, including the location of acoustic sheds and the length, height and location of noise walls required around the site. To ensure the timely and efficient provision of inputs to the design process, these mitigation measures were documented in the Noise Design Report.

A noise management schedule has been prepared for the site identifying the noise mitigation strategies that are to be incorporated into the site design to minimise noise impact where it may occur. The schedule is presented in Table C2 in APPENDIX C. Further to this, Table C3 sets out the noise wall schedule in relation to temporary noise barriers for the construction phase of the Project.

Figure B1 and Figure B2 in APPENDIX B identify noise wall/ hoarding locations around each site.

4.3 Predicted noise levels

The stages/operations considered in the noise model are summarised in the table below. For more detail on specific works being undertaken for each modelling scenario see the activity and timing Table C.1 in APPENDIX C.

Table 4.1 Noise modelling assumptions - SPI civil and tunnelling support sites

Activity/ Work Area	Aspect	Includes OOHW?	Approx. timing	Modelled construction stage								
				V01	V02	V03	V04	V05	V06	V07	V08	
Canal Road compound (C8) Civil works site establishment	Power Generator	No	07-09 2016	■	■	■	■					
	Installation of enviro controls	No	07-09 2016	■								
	Demolition of existing structures	Yes	07-09 2016	■								
	Crushing & Screening	No	07-09 2016	■								
	Vegetation Clearing	Yes	07-09 2016	■	■							
	Establishment of construction facilities and access roads	No	07-09 2016		■	■	■	■				
	Road and intersection modifications and traffic controls	Yes	07-09 2016		■	■						
	Installation of Site Hoarding	Yes	07-09 2016	■	■	■						
SPI Portal civil and surface works	Piling; Excavation of decline	No	2016-2018							■		
	Earthworks	No	2016-2018								■	
	Road tie-in works	No	2016-2018									■
Campbell Road Civil and Local Roads compound (C9) Civil works and local roads site establishment	Power Generator	No	08-12 2016	■	■	■	■					
	Installation of enviro controls	No	08-12 2016		■							
	Demolition of existing structures (major)	No	08-12 2016	■	■	■	■					
	Vegetation Clearing	No	08-12 2016		■							
	Establishment of construction facilities (local roads/ civil works)	No	08-12 2016			■	■	■				
	Road and intersection modifications traffic controls	Yes	08-12 2016		■	■						
SPI Northern Ramps civil and surface works	Earthworks	No	2016-2018							■		
	Dynamic compaction & Piling	No	2016-2018								■	
	Road tie-in works	No	2016-2018									■
SPI Tunnelling support compound (C10) Tunnelling Support Site Establishment	Installation of enviro controls	No	07-09 2016		■							
	Demolition of existing structures	No	07-09 2016		■							
	Vegetation Clearing	No	07-09 2016		■							
	Establishment of construction facilities	No	07-09 2016			■	■	■				
	Road and intersection modifications and traffic controls	Yes	07-09 2016		■	■						

Activity/ Work Area	Aspect	Includes OOHW?	Approx. timing	Modelled construction stage									
				V01	V02	V03	V04	V05	V06	V07	V08		
	Piling (shed)	No	08-09 2016										
	Tunnel support works	Yes	2016-2018										

Sections 4.3.1 and 4.3.2 below summarise the impacts for each construction stage in each NCA in terms of compliance with the NMLs during standard construction hours and for OOHW respectively. The colours in the table indicate whether or not receivers in the NCA comply with the NML and, where exceedance of the NML occurs, the perceived impact of the exceedance.

APPENDIX D provides a summary, for comparative purposes of the predicted noise levels from the:

- EIS Technical working paper: Noise and vibration;
- detailed design without noise mitigation; and
- detailed design incorporating the design noise mitigation.

4.3.1 Predicted noise levels for standard-hours works

The impacts presented are as follows for **Standard Hours**:

- ◆ Complies with NML
- ◆ Exceeds NML by less than 10 dB(A) – noise affected
- ◆ Exceeds NML by more than 10 dB(A) – noise affected
- ◆ > 75 dB(A) – highly noise affected

Table 4.2 Summary of construction noise impacts (standard hours)

NCA	Level of compliance with NML for construction stage							
	V01	V02	V03	V04	V05	V06	V07	V08
NCA03	◆	◆	◆	◆	◆	◆	◆	◆
NCA04	◆	◆	◆	◆	◆	◆	◆	◆
NCA06	◆	◆	◆	◆	◆	◆	◆	◆
NCA07	◆	◆	◆	◆	◆	◆	◆	◆
NCA08	◆	◆	◆	◆	◆	◆	◆	◆
NCA09	◆	◆	◆	◆	◆	◆	◆	◆
NCA10	◆	◆	◆	◆	◆	◆	◆	◆
NCA11	◆	◆	◆	◆	◆	◆	◆	◆

Notes All works to be undertaken during Standard construction hours (7am to 6pm Monday to Friday; 8am to 1pm Saturday)
OSR = Other sensitive receiver surrounding work area. Worst affected OSR noted.

- The site establishment of the Canal Road and the Burrows Road compounds will be of minimal noise impact – some receivers in NCAs 06, 07 and 10 will be noise affected during these works, mainly as a result of vegetation clearing and demolition works on these sites.
- The demolition works along Campbell Road associated with the Campbell Road compound will have higher noise impact to receivers in NCA 04, in particular the row of terraces opposite the compound site on Campbell Road. Vegetation clearing and demolition will generate higher noise impact, mainly because these works need to be completed to enable the installation of environmental controls, including temporary noise walls and construction hoardings. It is unlikely that noise walls or construction hoarding can be installed prior to these activities being completed. Noise walls and hoardings will be installed as early as practicable. High noise generating works will be managed through offering respite as noted in the Section 4.4.1.
- Excavation works associated with the SPI portal at the SPI compound may generate noise levels that will be clearly audible to highly intrusive, again to the nearest receivers in NCA 08 and to the commercial properties backing onto the site in NCA 07. Activities such as rock hammering during excavation works and piling works are likely to cause receivers in NCA 07 to be highly noise affected. Noise from these activities may also be clearly audible at the nearest affected receivers in only NCA 04, 06 and 07. High noise generating works will be managed through offering respite as noted in the Section 4.4.1.
- During the earthworks, piling and compaction associated with the SPI Northern Ramps the nearest receivers in in NCA 04, NCA 07 and NVA08 may be highly noise affected. Noise walls and construction hoarding will be installed as outlined in APPENDIX C to reduce noise levels during the construction phase.
- NCA 03, 09 and 11 will not be noise affected during the site establishment of the SPI Tunnel support site or tunnel support works.
- Excavation works associated with the tunnelling support portal, in particular as rock hammering may generate noise levels that will be clearly audible to highly intrusive to the nearest receivers in NCAs 04, 06, and 08 and to the commercial properties backing onto the site in NCA 07. Activities such during excavation works and piling works are likely to cause receivers in NCA 08 to be highly noise affected.
- Construction noise impacts from the tunnelling support operations are predicted to comply with the NMLs during standard construction hours.
- Measures for managing the noise impacts are provided in detail in the CNVIS prepared for the site, including the use of respite periods for high noise impact activities such as rock breaking and piling. The operational at-property treatments will also be installed as early as practicable during the site establishment works to ensure receivers highly noise affected as well as noise affected during OOHW receive the benefit of at-property treatment during the construction phase.

Measures for managing the noise impacts are outlined in Section 4.4.

4.3.2 Predicted noise levels for OOHW

The impacts presented are as follows for OOHW Evening and Night:






















































-  Complies with NML
-  < 5 dB(A) above NML - construction noise noticeable
-  5 to 15 dB(A) above NML - construction noise clearly audible
-  > 15 to 25 dB(A) above NML - construction noise moderately intrusive
-  > 25 dB(A) above NML - construction noise highly intrusive

Table 4.3 Summary of construction noise impacts (OOHW)

NCA	Level of compliance with NML for construction stage							
	V01	V02	V03	V04	V05	V06	V07	V08
NCA03	-			-				
NCA04	-			-				
NCA06	-			-				
NCA07	-			-				
NCA08	-			-				
NCA09	-			-				
NCA10	-			-				
NCA11	-			-				

Notes All works to be undertaken during OOHW Evening 6pm to 10pm Monday to Sunday; or OOHW Night 10pm to 7am Monday to Friday and 10pm to 8am Saturday, Sunday and public holidays; OOHW Day 1pm to 6pm Saturday and 8am to 6pm Sundays and public holidays.

Level of compliance reported is based on worst case impact for OOHW period (typically night period)

- indicates that OOHW is not anticipated for this construction stage

Predicted noise levels include existing permanent noise walls and earth mounds as these will not have been removed at the time of the works.

OSR = Other sensitive receiver surrounding work area. Worst affected OSR noted.

Noise impacts associated with the OOHW at the SPI compounds include:

- Receivers in NCA03, NCA09, and NCA11 will be unaffected by all of the St Peters Interchange site establishment out-of-hours works
- For the various combinations of hoarding installation and tree removal along Canal Road, as well as high voltage power crossing and power pad installation, the worst impacts are when all of those activities are occurring simultaneously. The nearest receivers in NCA06 and NCA07 will be affected by moderately to highly intrusive noise levels during the works. Noise may be clearly audible at the closest receivers in NCA04 and NCA10. Temporary, relocatable screens will be used during these OOHW to reduce noise impacts. Where practicable, higher noise impact activities, in particular use of the concrete saw will be limited to before midnight (note that works cannot commence until 10:00 pm due to Road Occupancy Licence

requirements). In addition to this, respite offers and alternative accommodation will be offered in accordance with the OOHW protocol.

- Receivers in NCA17 and NCA26 will be impacted by noise levels 5 to 15dB(A) above the NML during the site establishment OOHW. Noise from these activities may be clearly audible to residents in these NCAs.
- Construction noise impacts from the tunnelling support operations are predicted to comply with the NMLs during the OOHW period. There is a marginal exceedance [within 2 dB(A)] at 3 receivers in NCA15 during the night period, caused by spoil haul trucks moving on site.

Measures for managing the noise impacts outlined in Section 4.4.

4.4 Noise Mitigation and Management

4.4.1 High noise impact activities

To limit the potential impact from high noise impact activities such as piling, jack hammering and rock hammering, the works will be carried out with respite periods as set out in condition of approval D16, such that:

- High noise impact activities (including jackhammering and rock breaking) are only carried out between:
 - 8 am and 6pm Monday to Friday; and
 - 8 am and 1 pm Saturday;
- High noise impact activities are carried out in continuous blocks of up to 3 hours. Respite from high noise impact activities will be provided between each block for at least 1 hour. No high noise impact activities will be carried out during this 1-hour respite period.

4.4.2 Other noise control measures

Other noise mitigation measures and noise monitoring requirements are addressed in the following documents:

- Construction Noise and Vibration Impact Statement: Site Establishment (Project Wide) [ref: TH014-05 01F02 WCX_NM5]
- Construction Noise and Vibration Impact Statement: SPI Site Establishment OOHW [ref: TH014-05 01F12 WCX_NM5]
- Construction Noise and Vibration Impact Statement: SPI Tunnel Support site [ref: TH014-05 01F—TBC]

- Construction Noise and Vibration Impact Statement: SPI civil and surface works [ref: TH014-05 01F—TBC].

The required locations, heights and performance requirements of the site boundary noise walls and hoardings are presented **Table C3** in APPENDIX C and **Figure B1** in APPENDIX B. The Weighted Sound Reduction Index (Rw) for each noise wall is nominated. Based on the required acoustic rating, suitable noise wall constructions have been established through discussion with CDS.

There is one noise shed to be constructed at the SPI tunnel support site:

- Spoil Shed (C10 compound).

An acoustic enclosure schedule has been developed and is presented as **Table C4** in APPENDIX C.

Plant and equipment used on site shall achieve the noise level requirements in **Table C1** of APPENDIX C. More specifically, tunnel ventilation fans and front end loaders used in the spoil shed shall be managed to achieve the performance requirements in **Table C5** of APPENDIX C.

5 Conclusion

This Construction Noise and Vibration Temporary Noise Barrier Acoustic Report has been prepared to identify and confirm:

- Temporary noise barriers to mitigate construction noise associated with the SPI Canal Road compound C8, located on the corner of Princes Highway and Canal Road
- Temporary noise barriers to mitigate construction noise associated with the SPI Campbell Road construction compound C9, located on Campbell Road
- Temporary noise barriers to mitigate construction noise associated with the SPI Tunnel Support construction compound C10, located on the northern side of SPI site.

Impacts predicted as a result of construction activity following the installation of temporary noise barriers have been quantified and reported in Section 4, in relation to construction noise impact.

Noise management schedules for the site have been developed identifying the noise mitigation strategies that are to be incorporated into the site design to minimise noise impact where it may occur.

The schedules are:

- Table C2 in APPENDIX C setting out the Construction Noise Management schedule
- Table C3 in APPENDIX C setting out the Noise Wall / Hoarding Design specifications
- Table C4 in APPENDIX C setting out the Noise Shed/ Enclosure Design specifications
- Figure B1 in APPENDIX B identifying noise walls and hoarding locations around the site.

A comparison of the predicted noise levels in the EIS compared to those predicted from the detailed design is presented in APPENDIX D.

References

1. Department of Environment and Climate Change 2009 NSW Interim Construction Noise Guideline (ICNG),
2. Environment Protection Authority 1999 NSW Environmental Criteria for Rd Traffic Noise
3. Department of Environment Conservation NSW 2006 Assessing Vibration; a technical guideline
4. British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz)
5. British Standard BS 7385 Part 2-1993, Evaluation and measurement for vibration in buildings
6. German Standard DIN 4150-3 : 1999-02, Structural vibration - Effects of vibration on structures, February 1999
7. ASHRAE Applications Handbook (SI) 2003, Chapter 47 Sound and Vibration Control, pp47.39-47.40
8. Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration, p16
9. Australian Standard AS/NZS 2107:2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors*
10. Roads and Maritime Services 2014 QA Specification G36 Environmental Protection Edition 4 / Revision 3
11. AECOM Australia Pty Ltd 2015 WestConnex The New M5 – Technical Working Paper: Noise and Vibration Report Revision 8 – 20-Nov-2015
12. Renzo Tonin & Associates WestConnex Stage 2 M5 East Operational Noise Management Report (ONMR), 8 July 2015 [ref: TH014-01 01BF01 ONMR (r5)]
13. Transport for NSW Construction Noise Strategy (ref: 7TP-ST-157/2.0) April 2012
14. Minister for Planning Infrastructure approval SSI 6788 dated 20 April 2016

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.

Absorption Coefficient α	The absorption coefficient of a material, usually measured for each octave or third-octave band and ranging between zero and one. For example, a value of 0.85 for an octave band means that 85% of the sound energy within that octave band is absorbed on coming into contact with the material. Conversely, a low value below about 0.1 means the material is acoustically reflective.
Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Active recreation	Active recreation area, characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion, e.g. school playground, golf course
Air-borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receiver.
Alternate Solution	An Alternative Solution is a design that complies with the relevant Performance Requirements of the National Construction Code other than by using Deemed-to-Satisfy Provisions.
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.
Amenity	A desirable or useful feature or facility of a building or place.
AS	Australian Standard
Assessment period	The time period in which an assessment is made. e.g. Day 7am-6pm, Evening 6pm-10pm, Night 10pm-7am.
Assessment Point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Audible Range	The limits of frequency which are audible or heard as sound. The normal hearing in young adults detects ranges from 20 Hz to 20 kHz, although some people can detect sound with frequencies outside these limits.
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.
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. 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 LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Barrier (Noise)	A natural or constructed physical barrier which impedes the propagation of sound and includes fences, walls, earth mounds or berms and buildings.
Berm	Earth or overburden mound.
Buffer	An area of land between a source and a noise-sensitive receiver and may be an open space or a noise-tolerant land use.
Bund	A bund is an embankment or wall of brick, stone, concrete or other impervious material, which may form part or all of the perimeter of a compound.
BS	British Standard
CoRTN	United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)"

Decibel [dB]	<p>The units of sound measurement. The following are examples of the decibel readings of every day sounds:</p> <p>0dB The faintest sound we can hear, defined as 20 micro Pascal</p> <p>30dB A quiet library or in a quiet location in the country</p> <p>45dB Typical office space. Ambience in the city at night</p> <p>60dB CBD mall at lunch time</p> <p>70dB The sound of a car passing on the street</p> <p>80dB Loud music played at home</p> <p>90dB The sound of a truck passing on the street</p> <p>100dB The sound of a rock band</p> <p>115dB Limit of sound permitted in industry</p> <p>120dB Deafening</p>
dB(A)	<p>A-weighted decibel. 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 is denoted as dB(A). Practically all noise is measured using the A filter.</p>
dB(C)	<p>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. The dB(C) level is not widely used but has some applications.</p>
Diffraction	<p>The distortion of sound waves caused when passing tangentially around solid objects.</p>
DIN	<p>German Standard</p>
DnT,w	<p>Weighted Standardised Field Level Difference</p> <p>A measure of sound insulation performance of a building element. It is characterised by the difference in noise level on each side of a wall or floor. It is measured in-situ.</p> <p>It is a field measurement that relates to the Rw laboratory measured value but is not equal to it because an in-situ space is not of the same quality as a laboratory space.</p> <p>The value is indicative of the level of speech privacy between spaces. The higher its value the better the insulation performance.</p>
ECRTN	<p>Environmental Criteria for Road Traffic Noise, NSW, 1999</p>
EPA	<p>Environment Protection Authority</p>
Field Test	<p>A test of the sound insulation performance in-situ. See also 'Laboratory Test'</p> <p>The sound insulation performance between building spaces can be measured by conducting a field test, for example, early during the construction stage or on completion.</p> <p>A field test is conducted in a non-ideal acoustic environment. It is generally not possible to measure the performance of an individual building element accurately as the results can be affected by numerous field conditions.</p>
Fluctuating Noise	<p>Noise that varies continuously to an appreciable extent over the period of observation.</p>
Free-field	<p>An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.</p>
Frequency	<p>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.</p>
Ground-borne noise	<p>Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.</p>

Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).
Impact Noise	The noise in a room, caused by impact or collision of an object onto the walls or the floor. Typical sources of impact noise are footsteps on the floor above a tenancy and the slamming of doors on cupboards mounted on the common wall between tenancies.
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.
INP	NSW Industrial Noise Policy, EPA 1999
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.
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dB(A).
ISEPP	State Environmental Planning Policy (Infrastructure), NSW, 2007
ISEPP Guideline	Development Near Rail Corridors and Busy Roads - Interim Guideline, NSW Department of Planning, December 2008
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L10(1hr)	The L10 level measured over a 1 hour period.
L10(18hr)	The arithmetic average of the L10(1hr) levels for the 18 hour period between 6am and 12 midnight on a normal working day.
L90	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).
LAeq or Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the LAeq.
LAeq(1hr)	The LAeq noise level for a one-hour period. In the context of the NSW EPA's Road Noise Policy it represents the highest tenth percentile hourly A-weighted Leq during the period 7am to 10pm, or 10pm to 7am (whichever is relevant).
LAeq(8hr)	The LAeq noise level for the period 10pm to 6am.
LAeq(9hr)	The LAeq noise level for the period 10pm to 7am.
LAeq(15hr)	The LAeq noise level for the period 7am to 10pm.
LAeq (24hr)	The LAeq noise level during a 24 hour period, usually from midnight to midnight.
Lmax	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAm _{ax} .
Lmin	The minimum sound pressure level measured over a given period. When A-weighted, this is usually written as the LA _{min} .
Ln,w	Weighted Normalised Impact Sound Pressure Level A measure of the sound level transmitted from impacts on a floor to a tenancy below. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from a standard tapping machine. A lower value indicates a better performing floor.

LnT,w	<p>Weighted Standardised Field Impact Sound Pressure Level</p> <p>As for Ln,w but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement.</p> <p>The equivalent measurement in a laboratory is the Ln,w.</p> <p>A lower value indicates a better performing floor.</p>
Laboratory Test	<p>The performance of a building element when measured in a laboratory. The sound insulation performance of a building element installed in a building however can differ from its laboratory performance for many reasons including the quality of workmanship, the size and shape of the space in which the measurement is conducted, flanking paths and the specific characteristics of the material used which may vary from batch to batch.</p>
Loudness	<p>A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.</p>
Microphone	<p>An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.</p>
NCA	<p>Noise Catchment Area. An area of study within which the noise environment is substantially constant.</p>
Noise	<p>Unwanted sound</p>
NRC	<p>Noise Reduction Coefficient.</p> <p>A measure of the ability of a material to absorb sound. The NRC is generally a number between 0 and 1 but in some circumstances can be slightly greater than 1 because of absorption at the edges of the material. A material with an NRC rating of 1 absorbs 100% of incoming sound, that is, no sound is reflected back from the material.</p> <p>The NRS is the average of the absorption coefficient measured in the octave bands 250Hz, 500Hz, 1kHz & 2kHz which correspond to the predominant frequencies associated with the human voice.</p>
Passive recreation	<p>Area specifically reserved for passive recreation, characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion e.g. reading, meditation</p>
Reflection	<p>Sound wave reflected from a solid object obscuring its path.</p>
Reverberation Time	<p>The time (in seconds) it takes for a noise signal within a confined space to decay by 60dB. The longer the reverberation time (usually denoted as RT60), the more echoic a room. Longer reverberation times generally result in higher noise levels within spaces.</p>
RMS	<p>Root Mean Square value representing the average value of a signal.</p>
Rw	<p>Weighted Sound Reduction Index</p> <p>A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory.</p> <p>The term supersedes the value STC which was used in older versions of the Building Code of Australia. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the DnT,w.</p> <p>The higher the value the better the acoustic performance of the building element.</p>
R'w	<p>Weighted Apparent Sound Reduction Index.</p> <p>As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement.</p> <p>The higher the value the better the acoustic performance of the building element.</p>
RNP	<p>Road Noise Policy, NSW, March 2011</p>
SEL	<p>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.</p>
Sound	<p>A fluctuation of air pressure which is propagated as a wave through air.</p>

Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the R_w and the sound insulation between two rooms can be described by the D_nT,w .
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 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 of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 micro Pascal.
Spoil	Soil or materials arising from excavation activities.
Standardised	A method of adjusting the measured noise indices in-situ so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the $L'_{n,w}$ impact sound pressure level measured in a room is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the reverberation time in the receiving room is set at 0.5 seconds. This enables the same value to be reported independent of whether the room contains carpet and furnishings and the like. See also 'Normalised'.
STC	Sound Transmission Class A measure of the sound insulation performance of a building element. It is measured in controlled conditions in a laboratory. The term has been superseded by R_w .
Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft. See also 'Impact Noise'.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.
Transmission Loss	The sound level difference between one room or area and another, usually of sound transmitted through an intervening partition or wall. Also the vibration level difference between one point and another. For example, if the sound level on one side of a wall is 100dB and 65dB on the other side, it is said that the transmission loss of the wall is 35dB. If the transmission loss is normalised or standardised, it then becomes the R_w or $R'w$ or D_nT,w .

APPENDIX B **Nearest Sensitive Receivers and Noise Management Levels**

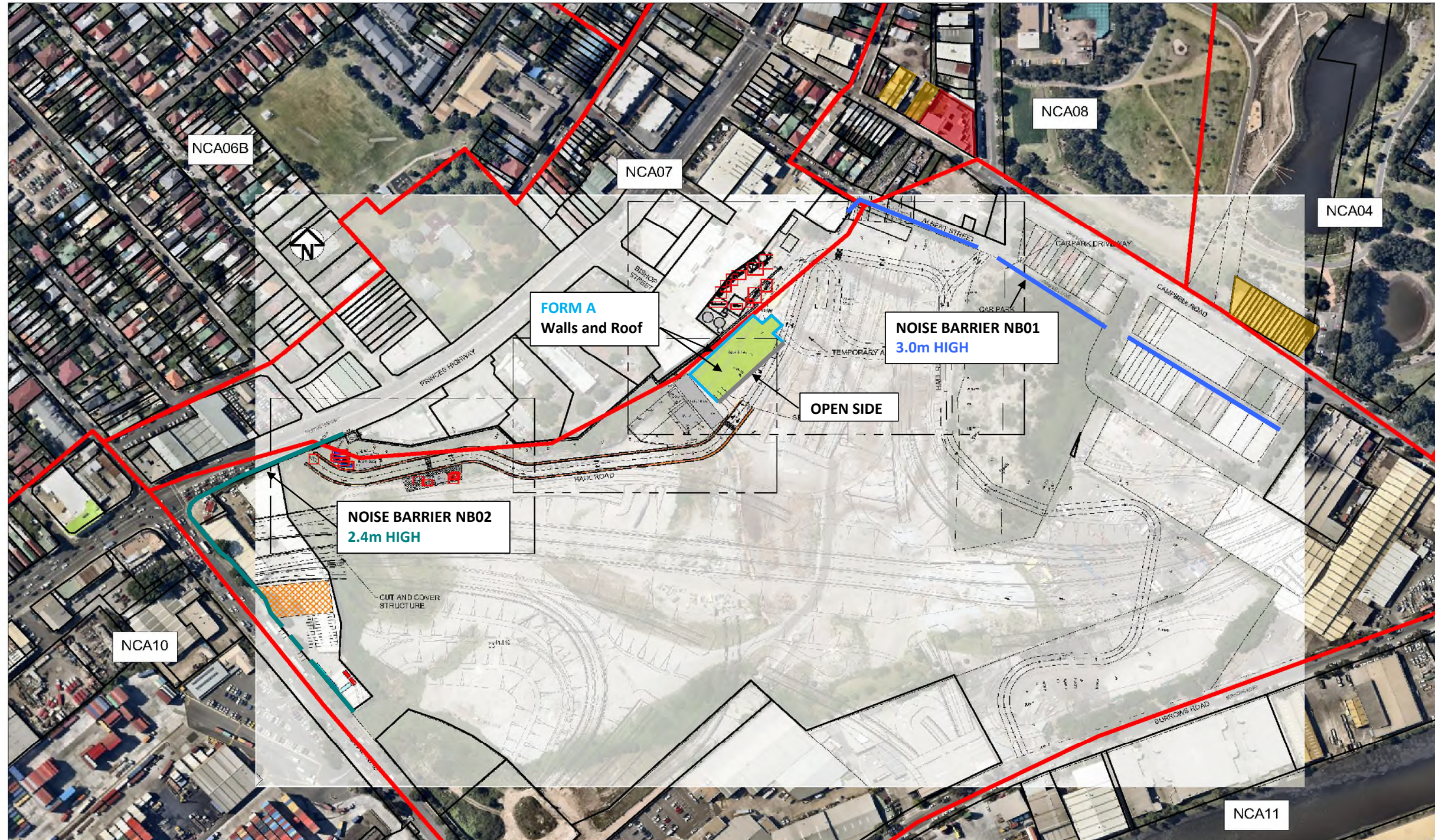
Table B1: Noise Sensitive Receivers and Construction Noise Management Levels

St Peters Interchange Tunnel Support Works

NCA	Receiver Type	Reference RBL	Rating Background Levels (RBLs)			Residential Noise Management Levels (NMLs) $L_{Aeq}(15 \text{ min})$				Sleep Dist. L_{Amax}		Comments
			Day	Evening	Night	Day (S)	Day (O)	Evening	Night	Screening	Max	
NCA01	Residential Industrial	NL01	57	51	40	67	62	56	45	55	65	Based on NCAs and NMLs presented in the EIS.
NCA02	Residential Commercial	NL02	50	46	39	60	55	51	44	54	65	Based on NCAs and NMLs presented in the EIS.
NCA03	Residential Commercial	NL02	50	46	39	60	55	51	44	54	65	Based on NCAs and NMLs presented in the EIS.
NCA04	Residential Active recreation	NL01	57	51	40	67	62	56	45	55	65	Based on NCAs and NMLs presented in the EIS.
NCA05	Commercial Industrial	NL01	57	51	40	67	62	56	45	55	65	Based on NCAs and NMLs presented in the EIS.
NCA06	Residential School	NL02	50	46	39	60	55	51	44	54	65	Based on NCAs and NMLs presented in the EIS.
NCA07	Commercial Active recreation	NL05	52	50	44	62	57	55	49	59	65	Based on NCAs and NMLs presented in the EIS.
NCA08	Commercial Industrial	NL03	54	45	40	64	59	50	45	55	65	Based on NCAs and NMLs presented in the EIS.
NCA09	Residential Passive recreation	NL19	60	54	43	70	65	59	48	58	65	Based on NCAs and NMLs presented in the EIS.
NCA10	Industrial	NL06	58	56	49	68	63	61	54	64	65	Based on NCAs and NMLs presented in the EIS.
NCA11	Commercial Industrial	NL04	58	52	42	68	63	57	47	57	65	Based on NCAs and NMLs presented in the EIS.
ID Other Sensitive Receivers												
OSR	Educational facility	ICNG	-	-	-	55	55	55	55	-	-	When premise is in use. External.
OSR	Childcare centre	ICNG	-	-	-	55	55	55	55	-	-	Daytime NML of 55dB(A) is external equivalent of 45dB(A) internal goal for classrooms with windows open.
OSR	Places of Worship	ICNG	-	-	-	55	55	55	55	-	-	NML of 55dB(A) is external equivalent of 45dB(A) internal goal for places of worship with windows open, when in use. Ref: ICNG p13
OSR	Hotel/ Motel	AS2107	-	-	-	60	60	60	60	-	-	NML of 60dB(A) is external equivalent of 40dB(A) internal goal for hotels on busy roads based on AS2107 assuming windows closed
OSR	Active recreation areas	ICNG	-	-	-	65	65	65	65	-	-	Ref: ICNG p13
OSR	Commercial Receivers/ Offices	ICNG	-	-	-	70	70	70	70	-	-	When premise is in use. External.
OSR	Industrial Receivers	ICNG	-	-	-	75	75	75	75	-	-	When premise is in use. External.

Figure B1: Site general arrangement showing noise mitigation

St Peters Interchange Tunnel Support Works



<p>At-Property Treatment</p> <p>TYPE 1 TREATMENT</p> <p>TYPE 2 TREATMENT</p>	<p>Barrier Height (m)</p> <ul style="list-style-type: none"> >= 0.0 >= 1.2 >= 1.8 >= 2.4 >= 3.0 >= 3.6 >= 4.2 >= 4.8 >= 5.4 	<p>Consultant:</p> <p>RENZO TONIN & ASSOCIATES <i>inspired to achieve</i></p> <p>Acoustics, Vibration & Structural Dynamics Sydney Melbourne Brisbane Gold Coast Kuwait 1/418A Elizabeth Street, SURRY HILLS NSW 2010 P: 02 8218 0500 F: 02 8218 0501</p>	<p>Client:</p> <p>WestConnex New M5</p> <p>CPB CONTRACTORS DRAGADOS SAMSUNG SAMSUNG C&T</p>	<p>Project:</p> <p>WESTCONNEX STAGE 2 NEW M5</p> <p>Noise levels are approximate due to interpolation of contours and should be used for reference only. For information only and not for construction. This information is protected by copyright.</p>	<p>Description:</p> <p>ST PETERS INTERCHANGE SITE ACOUSTIC SHED AND BARRIER DESIGN</p> <p>Project No.: TH014-06 Created by: jg Fig Ref: TH014-01 5 5 3 1 (r13) WXC2 M5 Tunnel Support & Civil Works SPI Date: 2016.08.10 Scale: 1: 2695 A3</p>
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APPENDIX C Construction Timetable/ Activities/ Management

Table C1a: Tunnel Support Construction Timetable/ Activities/ Equipment

St Peters Interchange Tunnel Support Works

Activity/ Work Area	Aspect	Plant/ Equipment	Net Power kW	Operating Weight kg	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise		Notes
					7am - 6pm	6pm - 10pm	10pm - 7am	L _{Aeq}	L _{A1}	
TUNNEL SUPPORT SITE ESTABLISHMENT										
General Site Establishment	Installation of enviro controls	Excavator w bucket	120	35 tonne	2	-	-	103		Surface
		Franna Crane	205	20 tonne	1			99		Surface
		Small Truck		<20 tonne	4 p.h.			107		Surface
	Demolition of existing structures	Excavator w bucket	120	35 tonne	2	-	-	103		Surface
		Excavator w rockhammer		30 tonne	2			121		Surface
		Truck & Dog	120		4 p.h.			108		Surface
	Vegetation Clearing	Excavator w bucket	120	35 tonne	2	-	-	103		Surface
		Chainsaw			1			116		Surface
		Tub grinder/ mulcher			1			120		Surface
	Establishment of construction facilities	Small Truck		<20 tonne	4 p.h.			107		Surface
		Excavator w bucket	120	35 tonne	2	-	-	103		Surface
		Franna Crane	205	20 tonne	1			99		Surface
		Small Truck		<20 tonne	4 p.h.			107		Surface
		Concrete agi	120		4 p.h.			108		Surface
		Concrete pump	130		1	-	-	99		Surface
	Road and intersection modifications and installation of traffic controls.	Workshop Hand Tools			1	-	-	107		Surface
		Truck	205	20 tonne	1			99		Surface
		Scissor Lift			1			95		Surface
Franna Crane		205	20 tonne	1			99		Surface	
Line marking truck				1			108		Surface	
Tunnelling Support Establishment	Piling; Excavation of decline	Concrete pump	130		1	-	-	99		Surface
		Excavator w bucket	150	35T	1	-	-	103		Surface
		Concrete Agi	120		4 p.h.	4 p.h.	-	108		Surface
	Portal Excavation & Construction Excavation of soil and rock; Hammering/rock breaking;	Concrete Agi	120		12 p.h.	4 p.h.	-	108		Surface
		Excavator w bucket	120	35T	2	-	-	103		Surface
		Excavator w rockhammer	150+	45T	1	-	-	128		Surface
		Drilling machine Diesel	205		1	-	-	125		Surface
		Pneumatic Hammer			1	-	-	115		Surface
		Truck & Dog (spoil haulage)	120		20 p.h.	4 p.h.	-	108		Surface; No Evening shift
		Shotcrete Rig Diesel			1	1	-	104		Surface; No Evening shift
TUNNELLING SUPPORT										
Construction Compound & Car Park	General worksite and Car parking	Light vehicle	80		20 per hour	12 p.h.	12 p.h.	89		Surface; Compound and car park will operate for the entire duration of construction works. Busy on shift changes only.
		Water treatment plant pumps	10		2	2	2	97		
Site sheds, workshop, car parking & laydown areas	Workshop; Deliveries; Maintenance; Storage	Road truck (deliveries to site)			4 p.h.	-	-	108		Surface
		Compressor	110	2660	2	2	2	70		Surface
		Workshop Hand Tools			1	1	1	107		Surface
		Franna Crane	205	20 tonne	1	1	1	99	106	Surface
Tunnelling Support Site	Tunnelling & Support	Water cart		15kL	4 p.h.	4 p.h.	-	104		Surface
		Road Header 1,000V Electric	350		4	4	4	111		Underground
		Dust Scrubber			4	4	4	110 (with attenuator)		Underground
		Ventilation fan Zitron 2xZVN 1-16-110/4. (Drive 7). With silencers			2	2	2	103 (without attenuator)		Surface
	Spoil Handling	Ventilation fan Zitron 2xZVN 1-16-220/4. (Drive 8). With silencers			2	2	2	107 (without attenuator)		Surface
		Moxie (spoil out of tunnel)	95	38T	20 p.h.	20 p.h.	16 p.h.	110		Underground
	Tunnel Lining	Truck & Dog (spoil haulage)			16 p.h.	16 p.h.	4 p.h.	108	117 (air brakes)	Surface; Limited to 4 p.h. at night
		FE Loader in spoil loading shed	130		2	2	1	110 (without silencer kit)		Surface; with acoustic shed
		Concrete pump	130		2	-	-	N/A		Underground
		Compressor	90		2	2	2	N/A		Underground
		Concrete truck	120		4 p.h.	4 p.h.	4 p.h.	108	117 (air brakes)	Surface; From BP or offsite - TBC
		Pneumatic vibrator	30		4	-	-	N/A		Underground

Table C1b: Civil Works Construction Timetable/ Activities/ Equipment

St Peters Interchange Tunnel Support Works

Activity/ Work Area	Aspect	Plant/ Equipment	Net Power kW	Operating Weight kg	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise		Notes
					7am - 6pm	6pm - 10pm	10pm - 7am	L _{Aeq}	L _{A1}	
CIVIL EARLY WORKS/ SITE ESTABLISHMENT										
Site Establishment	Power Generator	Generator	25 kVA		2	2	2	95		Power generator may be required during site establishment
	Installation of enviro controls	Excavator w bucket	120	35 tonne	2	-	-	103		
		Franna Crane	205	20 tonne	1	-	-	99		
	Demolition of existing structures	Small Truck		<20 tonne	4 p.h.	-	-	107		
		Excavator w bucket	120	47 tonne	2	-	-	103		
		Excavator w rockhammer		30 tonne	2	-	-	121		
	Crushing & Screening	Truck & Dog	120		8 p.h.	-	-	108		
		Norberg Lototrack LT100R Crushing &	100		1	-	-	117		
		Excavator w bucket	120	35 tonne	2	-	-	103		
		Truck & Dog	120		4 p.h.	-	-	108		
	Vegetation Clearing	Excavator w bucket	120	35 tonne	2	-	-	103		
		Chainsaw			1	-	-	116		
		Tub grinder/ mulcher			1	-	-	120		
		Concrete agi			4 p.h.	-	-	108		
		Scissor Lift			2	-	-	95		
		Small Power Tools				-	-	101		
		Small Truck		<20 tonne	4 p.h.	-	-	107		
	Establishment of construction facilities	Excavator w bucket	120	35 tonne	2	-	-	103		
		Franna Crane	205	20 tonne	1	-	-	99		
		Small Truck		<20 tonne	8 p.h.	-	-	107		
	Road and intersection modifications and installation of traffic controls.	Truck	205	20 tonne	2	-	-	99		
		Scissor Lift			2	-	-	95		
		Franna Crane	205	20 tonne	2	-	-	99		
	Access Roads	Drill Rig (Rock Bolting)		23	2	-	-	120		
		Shotcrete Rig Diesel		15	1	-	-	104		
		Excavator w bucket		45 tonne	2	-	-	106		
		Articulated Dump Truck		30	4	-	-	110		
		Excavator w rockhammer		45T	1	-	-	128		
CIVIL/ SURFACE WORKS										
Construction Compound & Car Park	General worksite and Car parking	Light vehicle	80		20 p.h.	12 p.h.	12 p.h.	89		Operates for entire duration of construction works.
		Water treatment plant pumps	10		2	2	2	97		
Site sheds, workshop, car parking & laydown areas	Workshop; Deliveries; Maintenance; Storage	Road truck (deliveries to site)			8 p.h.	-	-	108		Operates for entire duration of construction works.
		Compressor	110	2660	2	2	2	70		
		Workshop Hand Tools			2	1	1	107		
		Franna Crane	205	20 tonne	2	1	1	99	106	
		Water cart		15kL	4 p.h.	4 p.h.	-	104		Covers all civil work areas during the evening
Portal Surface Site	Piling; Excavation of decline	Piling Rig (bored)		100 tonne	2	-	-	110		Note:Sheet piling is not expected to be required for these works. TBC at detailed design.
		Concrete pump	130		1	-	-	99		
		Excavator w bucket	150	35T	1	-	-	103		
		Jack Hammer		20 kg	1	-	-	114		Jackhammer top of piles
		Concrete Agi	120		4 p.h.	4 p.h.	-	108		
	Earthworks	Excavator w bucket	120	35T	2	-	-	103		No OOHW anticipated, with the exception of excavation support works, where required for safety (concrete lining) or ongoing maintenance of site (water pumps). OOHW to be managed to ensure compliance with the OOHW NMLs.
		Excavator w rockhammer	150+	45T	1	-	-	128		
		Drilling machine Diesel	205		1	-	-	125		
		Pneumatic Hammer			1	-	-	115		
		Bulldozer D7		D7	1	-	-	115		
		Grader		25 tonne		-	-	114		
		Truck & Dog (spoil haulage)	120		20 p.h.	4 p.h.	-	108		
		Shotcrete Rig Diesel			1	1	-	104		
		Articulated Dump Truck		40		-	-	110		
		825H Compactor		35		-	-	106		
		Norberg Lototrack LT100R Crushing &		20		-	-	117		
		Metso Screen		20		-	-	108		
		Concrete Agi	120		4 p.h.	4 p.h.	-	108		
	Road tie-in works	Paver			2	-	-	103		
		Daymakers		900kg	3	3	-	70		
		Franna Crane		20 tonne	2	1	-	99		
		Road truck			4 p.h.	-	-	108		
		Road profiler		17 tonne	1	-	-	110		
		Asphalt truck & sprayer			1	-	-	128		
		Roller		12 tonne	1	-	-	101		
		Concrete saw	22 hp		1	-	-	119		
		Line marking truck			1	-	-	108		

Table C1b: Civil Works Construction Timetable/ Activities/ Equipment

St Peters Interchange Tunnel Support Works

Activity/ Work Area	Aspect	Plant/ Equipment	Net Power kW	Operating Weight kg	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise		Notes
					7am - 6pm	6pm - 10pm	10pm - 7am	L _{Aeq}	L _{A1}	
CIVIL EARLY WORKS/ SITE ESTABLISHMENT										
		Water cart		15kL	4 p.h.	-	-	104		
CIVIL/ SURFACE WORKS										
Northern Ramps Surface Site	Earthworks	Excavator w bucket	120	35T	2	-	-	103		
		Excavator w rockhammer	150+	45T	1	-	-	128		
		Road truck			4 p.h.	-	-	108		
		Roller		12 tonne	1	-	-	101		
		Water cart		15kL	4 p.h.	-	-	104		
		Grader		25 tonne				114		
		Truck & Dog (spoil haulage)	120		20 p.h.	-	-	108		
		Concrete pump			1	1	-	104		
		Concrete Agi	120		4 p.h.	4 p.h.	-	108		
		Rapid Impact/Dynamic Compaction		60 tonne				108		
		Driven Piles;		85 tonne	2			121		
		1400 Piles 12 months duration		80 tonne	2			105		
		Road tie-in works			2	-	-	103		
			Daymakers		900kg	-	3	70		
			Franna Crane		20 tonne	2	1	99		
			Road truck			4 p.h.	-	108		
			Road profiler		17 tonne	1	-	110		
			Asphalt truck & sprayer			1	-	128		
			Roller		12 tonne	1	-	101		
			Concrete saw	22 hp		1	-	119		
			Line marking truck			1	-	108		
			Water cart		15kL	4 p.h.	-	104		
	EAST VENTILATION STATION									
Construction Compound & Car Park	General worksite and Car parking	Light vehicle	80		20 p.h.	-	12 p.h.	89		
		Water treatment plant pumps	10		2	2	2	97		
Site sheds, workshop, car parking & laydown areas	Workshop; Deliveries; Maintenance; Storage	Road truck (deliveries to site)			4 p.h.	-	-	108		
		Compressor	110	2660	2	-	-	70		
		Workshop Hand Tools			1	-	-	107		
		Franna Crane	205	20 tonne	1	-	-	99	106	
		Water cart		15kL	4 p.h.	-	-	104		
Ventilation Station works	Construction of Vent Stack	Crane - wheeled		100T	1	-	-	105		
		Saw Cutting Reo			1	-	-	119		
		Saw Cutting Formwork			1	-	-	104		
		Concrete pump	130		1	-	-	99		
		Tower Crane			1	-	-	105		
		Concrete Agi			1	-	-	108		
		Concrete Grinding Machine			1	-	-	108		
		Concrete saw			1	-	-	121		
		Concrete Vibrator			2	-	-	97		
Concrete Grinding Machine			1	-	-	117				

No OOHW anticipated, with the exception of excavation support works, where required for safety (concrete lining) or ongoing maintenance of site (water pumps). OOHW to be managed to ensure compliance with the OOHW NMLs.

Table C2: Construction Noise Management Schedule**St Peters Interchange Tunnel Support Works**

Area to be Managed	Mitigation/ Management Measure	Typical Details	Comments
Tunnel site establishment			
1	Noise barriers	3m temporary barrier on northeast boundary from offices to earthmound 3m temporary barrier on northeast boundary from earthmound to warehouses 2.4m temporary barrier on northwest boundary from above decline to south of 1 Canal Rd	see Table C3 for details see Table C3 for details see Table C3 for details
2	At-property treatment (operational noise)	See SPI CNVIS	
3	Work outside Standard Construction Hours	Limited (covered by OOHW CNVIS)	
4	High noise impact works	Some 'Highly Noise Affected' Receivers during standard hours (site establishment/ initial excavation works). Respite periods for high noise activities.	Commercial receivers only.
Tunnel decline ramp excavation			
1	Noise barriers	As above	
2	Work outside Standard Construction Hours	EVE works (6pm to 10 pm): Restricted as outlined below; NIGHT works (10 pm to 7 am): None.	
3	Truck movement restrictions for OOHW period	Evening: ≤ 12 concrete trucks per hour; Night: 0 trucks per hour.	
Tunnel RH Support, Spoil Handling and Tunnel Lining			
1	Noise barriers	As above	
2	Work outside Standard Construction Hours	EVE works (6 pm to 10 pm): Restricted as outlined below NIGHT works (10 pm to 7 am): Restricted as outlined below	
3	Workshop	Partial acoustic enclosure: 3 walls + roof, open side oriented away from receivers EVE/ NIGHT: 1 handtool only	
4	Spoil bin area	Partial acoustic enclosure: part wall + roof, open on side facing away from Princes Hwy DAY/ EVE: ≤ 2 Front End Loaders (FELs); NIGHT: ≤ 1 FEL.	see Table C4 for details
5	Water Treatment Plant Pumps	Partial acoustic enclosure	see Table C5 for performance requirements
6	Compressors	Partial acoustic enclosure	see Table C5 for performance requirements
7	Ventilation Fan	Attenuator/ acoustic enclosure	see Table C5 for performance requirements
8	Concrete Truck restrictions for OOHW period	EVE/ NIGHT: ≤ 4 trucks per hour	Compression braking and air brake release will be managed on site
9	Spoil Truck restrictions for OOHW period	EVE: ≤ 16 trucks per hour NIGHT: ≤ 4 trucks per hour	Entry and Exit
10	Shotcreting for OOHW period	NIGHT: Shotcreting limited to bottom of decline	
11	Residual impacts	Properties where (after application of the above) noise levels exceed NML	Subject to verification testing during first 12 months on site
		DAY: none EVE: 6 (See Table C6 and Table C7 for additional details) NIGHT: 20 (See Table C6 and Table C7 for additional details)	

Table C3: Noise Barrier Design Specifications**St Peters Interchange Tunnel Support Works**

Noise barrier reference	Location	Noise barrier height	Required Rw	Proposed Construction	Acoustic Rating of Construction*
NB01	Campbell Road Compound Northeast boundary between 36 Albert St and large earth mound	3m	Rw 15-20 Medium	17 mm plywood hoarding	Rw 24
NB02	Campbell Road Compound Northeast boundary from south of large earth mound to 47-49 Campbell Rd	3m	Rw 15-20 Medium	17 mm plywood hoarding	Rw 24
NB03	Canal Road Compound From west of 310 Princes Highway, to south of 1 Canal Rd, with openings for vehicle access	2.4m	Rw 15-20 Medium	17 mm plywood hoarding	Rw 24

Notes:

Noise barrier performance: Low - Rw 10-15; Medium - Rw 15-220; Medium-High - Rw 20-25; High - Rw 25; Very High - Rw 30

* estimated by calculations and/or reference to other similar barrier type data

GENERAL

- The specified 'required rating' 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.

Table C4: Noise Shed / Enclosure Design Specifications

St Peters Interchange Tunnel Support Works

Area to be Mitigated	Construction component	Acoustic element type
Spoil Shed	North/east/west walls	Form A
	South wall	Open
	Roof	Form A
	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 on underside of roof
	Doors	None
	Ventilation Openings	Any necessary ventilation openings should face away from neighbours, placed down low so that noise walls can effectively shield them from neighbours, and also fitted with acoustic louvres / attenuators.

Notes:

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

GENERAL

- The underside of the roof and (where possible) internal walls should be lined with acoustic insulation to reduce the build-up of sound inside the shed
- The specified performances must be achieved by the product selected.
- The sealing of all gaps is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
- Check design of all junction details with acoustic consultant prior to construction.
- Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
- The information provided in this table is subject to modification and review without notice.
- The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

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

Wall/ roof type	Sound transmission loss per octave spectrum dB						
	63	125	250	500	1000	2000	4000
FORM A	8	10	14	18	18	21	25
FORM B	8	10	25	38	50	60	69
FORM C	16	20	24	29	33	35	41
FORM D	20	24	29	33	38	41	46
FORM E	20	30	36	44	51	63	72

Table C5: Plant and Equipment Specifications**St Peters Interchange Tunnel Support Works**

Building/ Area to be Mitigated	Item	Acoustic Requirement	Octave spectrum dB								Lw dB(A)	
			31.5	63	125	250	500	1000	2000	4000		8000
Tunnel ventilation	Ventilation Fan - ZVN 1-16-110/4	Sound power level at surface outlet after attenuator		93	106	104	96	92	91	97	96	103
Tunnel ventilation	Ventilation Fan - ZVN 1-16-220/4	Sound power level at surface outlet after attenuator		98	110	108	100	97	95	101	100	107
Plant item	Front end loader 25 t	Plant sound power level to be confirmed in accordance with CNVMP Appendix F.1		120	112	111	105	104	102	99	90	110
Plant item	Workshop Franna Crane 20 t	Plant sound power level to be confirmed in accordance with CNVMP Appendix F.1	112	105	97	94	94	95	91	85	77	98
Plant item	Water Treatment Plant Pumps	Plant sound power level to be confirmed in accordance with CNVMP Appendix F.2		98	93	94	92	92	91	84	74	97
Plant item	Compressor inside container control room	Plant sound power level to be confirmed in accordance with CNVMP Appendix F.3	51	63	52	57	66	67	59	61	62	70

Notes:

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

GENERAL

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

Table C6: Managing Residual Impacts during 'out of standard hours' work

ID	Noise Mitigation/ Management Measure
1	At some receiver locations noise levels may exceed the NMLs and there are no physical mitigation measures that can be applied to achieve the NMLs Therefore, after all reasonable and feasible noise mitigation measures have been applied, the way forward is to seek a negotiated agreement with the affected receiver
2	The Construction Noise and Vibration Management Plan (CNVMP) identifies the management measures that can be applied to deal with residual impacts, including noise monitoring, letter box drops, phone calls, individual briefings, respite offers and alternative accommodation. Further mitigation measures may include changing operational procedures at night in order to reduce noise impacts, e.g. reduce the number of trucks on site during the night period (10 pm to 7am). The appropriate management measure would be determined by the degree of exceedance of the NML.
3	Where, after the application of all reasonable and feasible mitigation measures, noise levels still exceed the NML, then at property treatments may need to be considered. The following provides guidance on the level of treatment required in relation to the exceedance above the external NML.

Treatment 1	Mechanical ventilation only
<5dB(A) reduction	Where external noise levels are less than 5dB(A) above the external assessment criteria, the internal noise goals may be achieved with windows closed. A light framed building with single glazed windows will provide a minimum noise reduction of up to 15dB(A) from outside to inside when windows are closed. If the internal noise goals can only be achieved with windows closed, then mechanical ventilation should be considered to ensure fresh airflow inside the dwelling so to meet the requirements of the Building Code of Australia.
Treatment 2	Mechanical ventilation and sealing of wall vents
5-10 dB(A) reduction	Where external noise levels are less than 10dB(A) above the external assessment criteria, the internal noise goals may be achieved with windows closed. A light framed building with single glazed windows will provide a minimum noise reduction of up to 20dB(A) from outside to inside (ENMM p20) when windows are closed and wall vents are sealed. If the internal noise goals can only be achieved with windows closed, then mechanical ventilation should be considered to ensure fresh airflow inside the dwelling so to meet the requirements of the Building Code of Australia. It is important to ensure that mechanical ventilation does not provide a new noise leakage path into the dwelling and does not create a noise nuisance to neighbouring residential premises.
Treatment 3	Upgraded seals for windows and doors
10-12dB(A) reduction	Where external noise levels are only slightly greater than 10dB(A) above the external assessment criteria, then in addition to installing mechanical ventilation (Treatment 1) and sealing of wall vents (Treatment 2), special acoustic grade seals should be installed on windows and perimeter doors exposed to road traffic noise to enable the internal noise criteria to be achieved with windows and doors shut.
Treatment 4	Upgraded windows, glazing and doors
>12 dB(A) reduction	Where the predicted external noise level exceeds the external assessment criteria by significantly more than 10dB(A), then upgraded windows and glazing and the provision of solid core doors would be required on the facades exposed to the works, in addition to the mechanical ventilation, sealing of wall vents and acoustic seals for windows and doors described in Treatments 1, 2 and 3, respectively. Note that these upgrades are only suitable for masonry type buildings. It is unlikely that this degree of upgrade would provide significant benefits to light framed structures should there be no acoustic insulation in the walls.

4 All reasonable and feasible mitigation has been explored for the site. Exceedance of the sleep disturbance NML is predicted to occur at up to 15 receivers in NCA 15 in the area opposite the driveway exit from the site. The following at-property treatment may be required to reduce noise impact from the site:

Treatment Type	No. Residences	No. Apartment Blgs
Treatment 1	19	-
Treatment 2	-	1
Treatment 3	-	-
Treatment 4	-	-

5 At property treatment requirements will be reviewed once site access is gained and prior to the commencement of 24 hour operations. The review will include on site testing of trucks driving on site and entering/existing the site to verify noise levels predicted by the noise model. Once the noise model is verified, properties likely to exceed the OOHW (Night) NML and the sleep disturbance NML will be identified for consideration of at-property treatment.

Table C7 Receivers requiring additional treatment SPI Tunnel Support

Receiver		Type of treatment		
		DAY (STANDARD)	EVENING (OOHW)	NIGHT (OOHW)
NCA	Address	Tunnel support	Tunnel support	Tunnel support
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA04	[REDACTED]			Type 1
NCA08	[REDACTED]		Type 2	Type 2
NCA08	[REDACTED]		Type 1	Type 1
NCA08	[REDACTED]		Type 1	Type 1
NCA08	[REDACTED]		Type 1	Type 1
NCA08	[REDACTED]		Type 1	Type 1
NCA08	[REDACTED]		Type 1	Type 1

APPENDIX D Comparison of EIS predictions to detailed design

The noise modelling assumptions for the SPI compounds (C8, C9 and C10) are as follows:

- V01
 - Power Generator (C8, C9)
 - Installation of enviro controls (C8)
 - Demolition of existing structures (C8*, C9)
 - Vegetation Clearing (C8*)
 - Installation of site hoarding (C8)
- V02
 - Power Generator (C8, C9)
 - Installation of enviro controls (C9, C10)
 - Demolition of existing structures (C9, C10)
 - Vegetation Clearing (C8, C9, C10)
 - Establishment of construction facilities (C8)
 - Road/ intersection modifications; installation of traffic controls (C8*, C9*, C10*)
 - Installation of site hoarding (C8)
- V03
 - Power Generator (C8, C9)
 - Demolition of existing structures (C9)
 - Establishment of construction facilities (C8, C9, C10)
 - Road/ intersection modifications; installation of traffic controls (C8*, C9*, C10*)
 - Installation of site hoarding (C8)
- V04
 - Power Generator (C8, C9)
 - Demolition of existing structures (C9)
 - Establishment of construction facilities (C8, C9, C10)
 - Piling of spoil shed (C10)
- V05
 - Tunnel support works (C10*)
- V06
 - Piling; Excavation of decline (C8)
 - Earthworks (C9)
 - Tunnel support works (C10*)
- V07
 - Earthworks (C8)

- Dynamic compaction & Piling (C9)
- Tunnel support works (C10*)
- V08
 - Road tie-in works (C8, C9)
 - Tunnel support works (C10*)

Note: * refers to activity to be carried out in standard construction hours in addition to OOHW.

The impacts presented in the following tables show a comparison between the predicted impacts presented in the EIS compared with the detailed design. Note that Renzo Tonin & Associates did not prepare the EIS for the New M5. The results presented for the EIS noise predictions are therefore based on our best interpretation of the results presented in the EIS Technical Working Paper; Noise and Vibration [11].

The impacts presented are as follows for **Standard Hours**:

- ◆ Complies with NML
- ◆ Exceeds NML by less than 10 dB(A) – noise affected
- ◆ Exceeds NML by more than 10 dB(A) – noise affected
- ◆ > 75 dB(A) – highly noise affected

The impacts presented are as follows for **OOHW Evening and Night**:

- ◆ Complies with NML
- ◆ < 5 dB(A) above NML - construction noise noticeable
- ◆ 5 to 15 dB(A) above NML - construction noise clearly audible
- ◆ > 15 to 25 dB(A) above NML - construction noise moderately intrusive
- ◆ > 25 dB(A) above NML - construction noise highly intrusive

Table D.1 Summary of construction noise impacts (standard hours)

NCA	Level of compliance with NML for construction stage															
	V01		V02		V03		V04		V05		V06		V07		V08	
	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD
NCA03	🟢	[🟢]	🟡	[🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟡 [🟡]	🟡	🟡 [🟡]	🟡	🟢 [🟢]
NCA04	🟡	[🟡]	🟡	[🟡]	🟡	🟡 [🟡]	🟡	🟡 [🟡]	🟢	🟢 [🟢]	🟢	🟡 [🟡]	🟡	🟡 [🟡]	🟢	🟡 [🟡]
NCA06	🟡	[🟡]	🟡	[🟢]	🟡	🟢 [🟡]	🟡	🟡 [🟡]	🟡	🟢 [🟢]	🟢	🟢 [🟢]	🟡	🟡 [🟡]	🟡	🟢 [🟢]
NCA07	🟡	[🟡]	🟡	[🟢]	🟡	🟡 [🟡]	🟡	🟡 [🟡]	🟡	🟢 [🟢]	🟡	🟡 [🟡]	🟡	🟡 [🟡]	🟡	🟢 [🟢]
NCA08	🟡	[🟢]	🟡	[🟡]	🟡	🟡 [🟡]	🟡	🟡 [🟡]	🟡	🟢 [🟢]	🟡	🟡 [🟡]	🟡	🟡 [🟡]	🟡	🟢 [🟢]
NCA09	🟢	[🟢]	🟢	[🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]
NCA10	🟡	[🟡]	🟢	[🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]
NCA11	🟢	[🟢]	🟢	[🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟢 [🟢]	🟢	🟡 [🟡]	🟢	🟡 [🟡]	🟢	🟢 [🟢]

Notes

All works to be undertaken during Standard construction hours (7am to 6pm Monday to Friday; 8am to 1pm Saturday)

EIS refers to results presented in EIS noise and vibration assessment report

DD refers to detailed design noise assessment. Number in brackets refers to noise predictions without temporary noise barriers.

OSR = Other sensitive receiver surrounding work area. Worst affected OSR noted.

Table D.2 Summary of construction noise impacts (OOHW)

NCA	Level of compliance with NML for construction stage															
	V01		V02		V03		V04		V05		V06		V07		V08	
	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD	EIS	DD
NCA03	-	-	-	🟢	-	🟢	-	-	🟡	🟢 [🟢]		🟢 [🟢]		🟢 [🟢]		🟢 [🟢]
NCA04	-	-	-	🟡	-	🟡	-	-	🟠	🟢 [🟡]		🟢 [🟡]		🟢 [🟡]		🟢 [🟡]
NCA06	-	-	-	🟠	-	🟠	-	-	🟠	🟢 [🟡]		🟢 [🟢]		🟢 [🟢]		🟢 [🟢]
NCA07	-	-	-	🟠	-	🟠	-	-	🟠	🟢 [🟡]		🟢 [🟢]		🟢 [🟢]		🟢 [🟢]
NCA08	-	-	-	🟢	-	🟢	-	-	🟠	🟡 [🟠]		🟡 [🟠]		🟡 [🟠]		🟡 [🟠]
NCA09	-	-	-	🟢	-	🟢	-	-	🟢	🟢 [🟢]		🟢 [🟢]		🟢 [🟢]		🟢 [🟢]
NCA10	-	-	-	🟡	-	🟢	-	-	🟢	🟢 [🟢]		🟢 [🟢]		🟢 [🟢]		🟢 [🟢]
NCA11	-	-	-	🟢	-	🟢	-	-	🟢	🟢 [🟢]		🟢 [🟢]		🟢 [🟢]		🟢 [🟢]

Notes All works to be undertaken during OOHW Evening 6pm to 10pm Monday to Sunday; or OOHW Night 10pm to 7am Monday to Friday and 10pm to 8am Saturday, Sunday and public holidays; OOHW Day 1pm to 6pm Saturday and 8am to 6pm Sundays and public holidays.

Level of compliance reported is based on worst case impact for OOHW period (typically night period)

EIS refers to results presented in EIS noise and vibration assessment report. ** Activity not modelled as OOHW in EIS

DD refers to detailed design noise assessment. Number in brackets refers to noise predictions without temporary noise barriers.

OSR = Other sensitive receiver surrounding work area. Worst affected OSR noted.

Temporary Noise Barrier Strategy - St Peters Interchange



Appendix B: Community Consultation Records

Stage 2 Beverly Hills-St Peters Snapshot Report

Door knock: 15 Jun 2016

<i>Event Type</i>	Door knock
<i>Event Date</i>	15 Jun 2016 9:00 AM (GMT +10)
<i>Event End Date</i>	15 Jun 2016 10:30 AM (GMT +10)
<i>Location</i>	Canal Road and Princes Highway, St Peters
<i>Summary</i>	Consultation regarding temporary noise barrier options along Canal Road and Princes Highway.
<i>Team Response</i>	<p>[REDACTED] door knocked stakeholder to provide details regarding the options for the Canal Road and Princes Highway temporary noise barrier.</p> <p>Location - along Canal Road and Princes Highway. Plan showing location shown to stakeholders.</p> <p>Finish - proposed finish along Canal Road concrete barriers with wooden panel inserted on top. Along Princes Highway posts with wooden panels attached. Sketch of design shown to stakeholders.</p> <p>Height - proposed height is 2.5 metres at both locations.</p> <p>Colour - proposed colour is Windspray. Sample of colour shown to stakeholders. Advised some project related branding may be added to the hoarding in the future.</p>
<i>Issues</i>	Consultation: WestConnex Initiated Information

Stakeholders:

<i>Full Name</i>	<i>Organisation</i>	<i>Address</i>	<i>Comments or discussion</i>
[REDACTED]	[REDACTED]	[REDACTED]	No issues raised regarding temporary noise barrier, accepting of the proposal presented.
[REDACTED]	[REDACTED]	[REDACTED]	No issues raised regarding temporary noise barrier, accepting of the proposal presented. Stakeholder noted they have had ongoing liaison with SMC regarding the project. They would like to have a property condition survey and asked for the information to be emailed through.

Stage 2 Beverly Hills-St Peters Snapshot Report

<i>Full Name</i>	<i>Organisation</i>	<i>Address</i>	<i>Comments or discussion</i>
█	█	█	No issues raised regarding temporary noise barrier, accepting of the proposal presented. Stakeholder's primary concern was traffic impacts and access to the property. She provided the contact details for the property owner for follow-up regarding the condition survey.
█	█	█	Stakeholder requested the information be emailed to them as they are busy at the moment. Information emailed on 17/06/2016 and invited stakeholder to provide feedback. No response received.
	█	█	No issues raised regarding temporary noise barrier, accepting of the proposal presented.
	█	█	No one at property. Sorry we missed you card left requesting stakeholder contact the project team. No response received to sorry we missed you card. Information about noise barriers emailed on 10/07/2016.
█	█	█	No issues raised regarding temporary noise barrier, accepting of the proposal presented.
	█	█	No issues raised regarding temporary noise barrier, accepting of the proposal presented.
	█	█	No issues raised regarding temporary noise barrier, accepting of the proposal presented.
		█	No one was present at the property and it appeared to be abandoned/dilapidated. No option to leave sorry we missed you card.

Stage 2 Beverly Hills-St Peters Snapshot Report

Team Members:

<i>Full Name</i>	<i>Organisation</i>	<i>Phone</i>	<i>Mobile</i>	<i>Email</i>	<i>Projects</i>
[REDACTED]	[REDACTED]			[REDACTED]	Stage 2 Beverly Hills-St Peters (Data Editor)

Stage 2 Beverly Hills-St Peters Snapshot Report

Door knock: 13 Jul 2016 & 14 July 2016

<i>Event Type</i>	Door knock
<i>Event Date</i>	13 Jul 2016 4:30 PM – 6:15 PM 14 Jul 2016 4:30PM – 5:00PM
<i>Location</i>	Campbell Road/Street
<i>Summary</i>	Consultation regarding temporary noise barrier options along northern side of SPI site, near Campbell Road/Street.
<i>Team Response</i>	<p>██████████ door knocked stakeholder to provide details regarding the options for the SPI temporary noise barrier adjacent Campbell Road/Street.</p> <p>Location - along the SPI construction site, approximately 80 metres from properties along Campbell Road/Street. The barrier will be visible once properties are removed. Plan showing location shown to stakeholders.</p> <p>Finish - proposed finish of the barrier is plywood. Showed stakeholder an example of the noise barrier.</p> <p>Height - proposed height is 3 metres.</p> <p>Colour - showed stakeholders three colour options being considered and asked them their preference. Advised some project related branding may be added to the hoarding in the future.</p> <p>Timing - advised the noise barrier will be constructed progressively from late this year, due to the need to remove properties and the earth mound first.</p>
<i>Issues</i>	Consultation: WestConnex Initiated Information

Stakeholders:

<i>Full Name</i>	<i>Address</i>	<i>Comments or discussion</i>
████	██████████ ██████████ ██████████	Stakeholder did not have a preference in relation to the colour or any feedback about the barrier.
████	██████████ ██████████ ██████████	Stakeholder did not have a preference in relation to the colour or any feedback about the barrier.

Stage 2 Beverly Hills-St Peters Snapshot Report

<i>Full Name</i>	<i>Address</i>	<i>Comments or discussion</i>
[REDACTED]	[REDACTED]	Stakeholder would prefer pale eucalyptus colour.
[REDACTED]	[REDACTED]	Stakeholder would prefer pale eucalyptus colour.
[REDACTED]	[REDACTED]	Stakeholder did not have a preference in relation to the colour or any feedback about the barrier, he acknowledged they would not be able to see it due to the type of windows at their property.
[REDACTED]	[REDACTED]	No one home, sorry we missed you card left.
[REDACTED]	[REDACTED]	No one home, sorry we missed you card left.
[REDACTED]	[REDACTED]	Not available at the time to discuss and advised they are going overseas for several months.
[REDACTED]	[REDACTED]	No one home, sorry we missed you card left.
[REDACTED]	[REDACTED]	No one home, sorry we missed you card left.
[REDACTED]	[REDACTED]	No one home, sorry we missed you card left.
[REDACTED]	[REDACTED]	No one home, sorry we missed you card left.

Stage 2 Beverly Hills-St Peters Snapshot Report

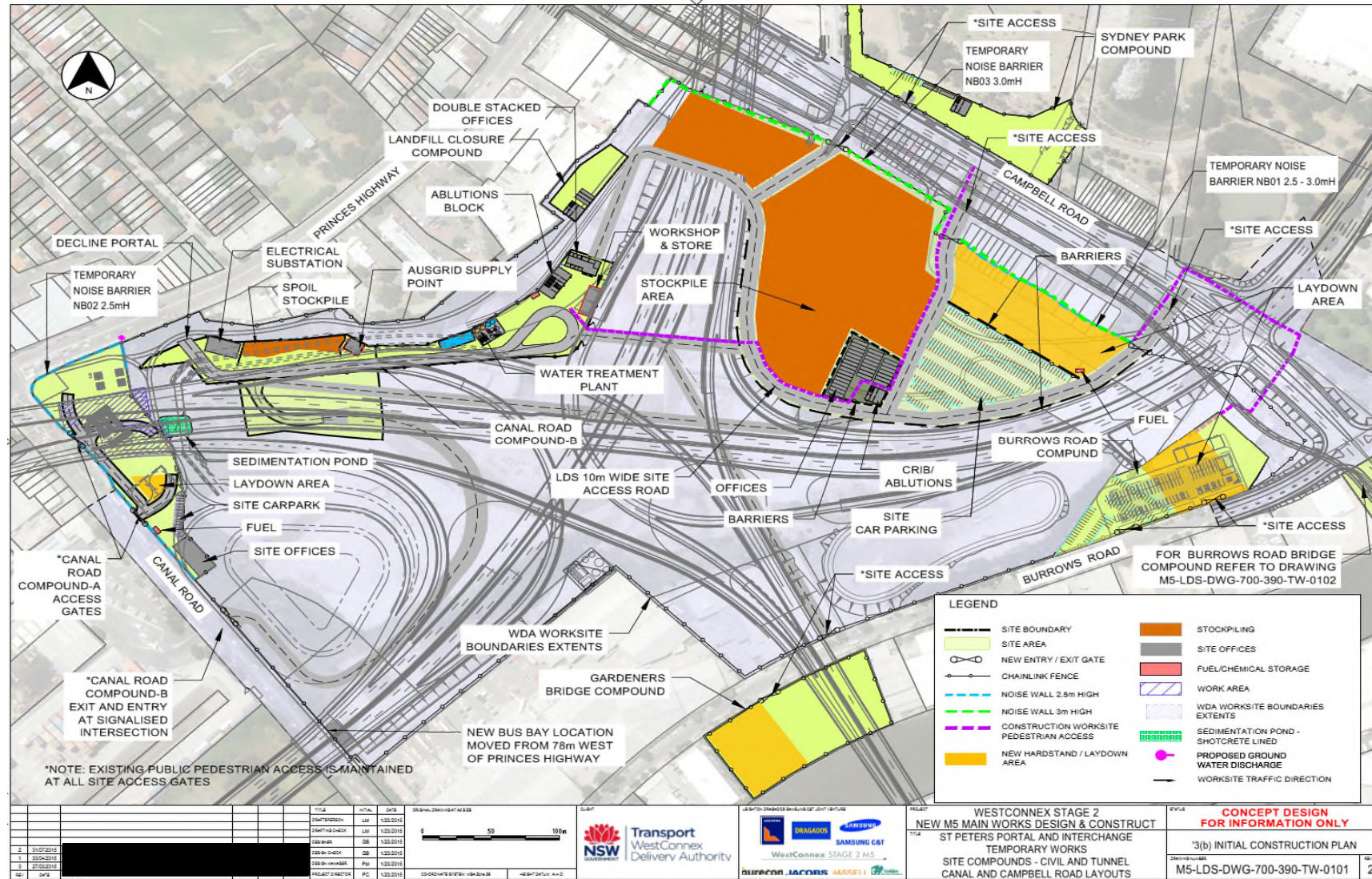
<i>Full Name</i>	<i>Address</i>	<i>Comments or discussion</i>
	[REDACTED]	No one home, sorry we missed you card left.
	[REDACTED]	Stakeholder was busy and did not want to discuss the noise barriers
	[REDACTED]	Preference is pale eucalyptus colour.
	[REDACTED]	No one home, sorry we missed you card left.
	[REDACTED]	Not interested in hearing about the noise barriers.
	[REDACTED]	No one home, sorry we missed you card left.
	[REDACTED]	No one home, sorry we missed you card left.
	[REDACTED]	Stakeholder was busy and did not want to discuss the noise barriers.
	[REDACTED]	No one home, sorry we missed you card left.



Appendix C: Consultation Materials

Table F4.1: Noise Sensitive Receivers and Construction Noise Management Levels

St Peters Interchange Tunnel Support Works





Pale Eucalypt



Dune



Windspray

