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Acciona Ferrovial Joint Venture
Sydney Metro West Central Tunnelling Package
The Bays

Detailed noise and vibration impact statement
February 2025

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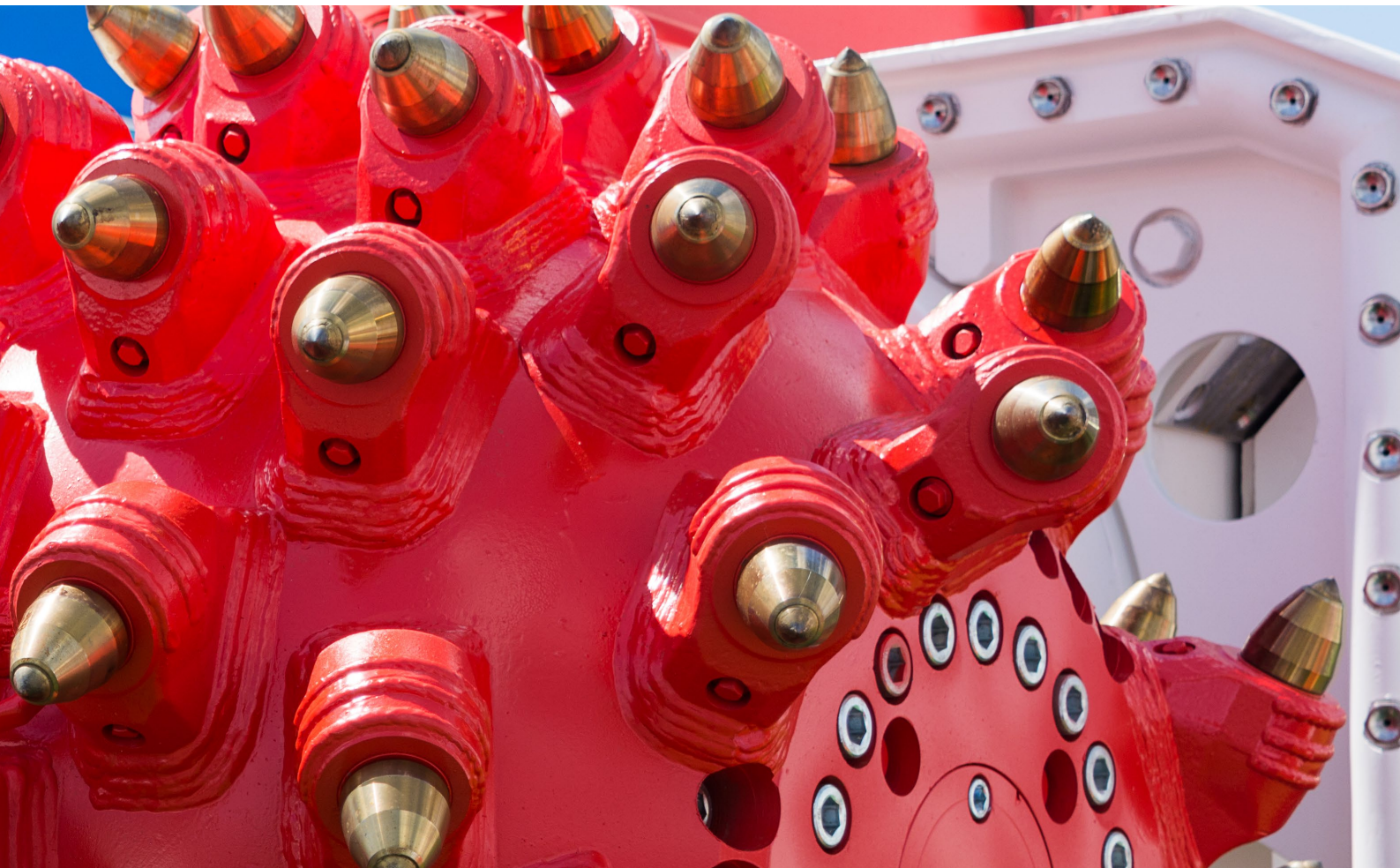

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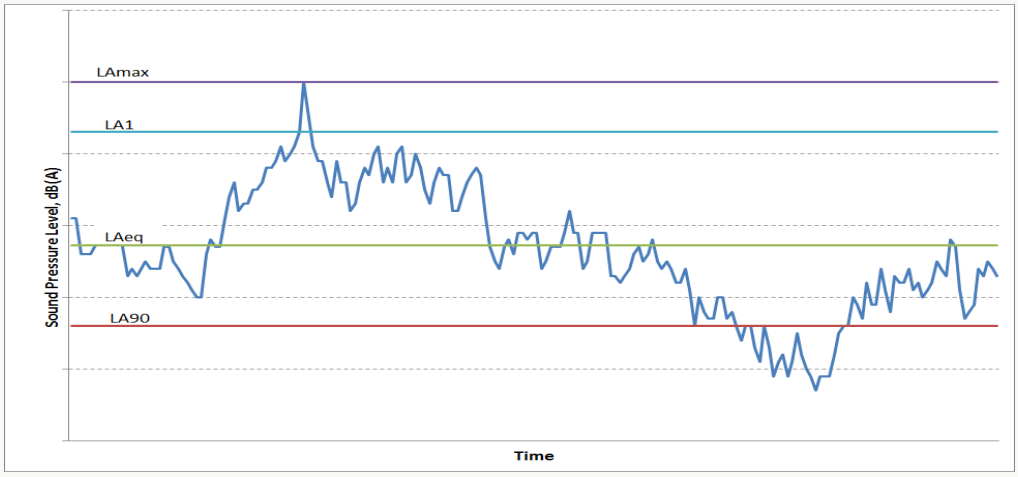
Revision history

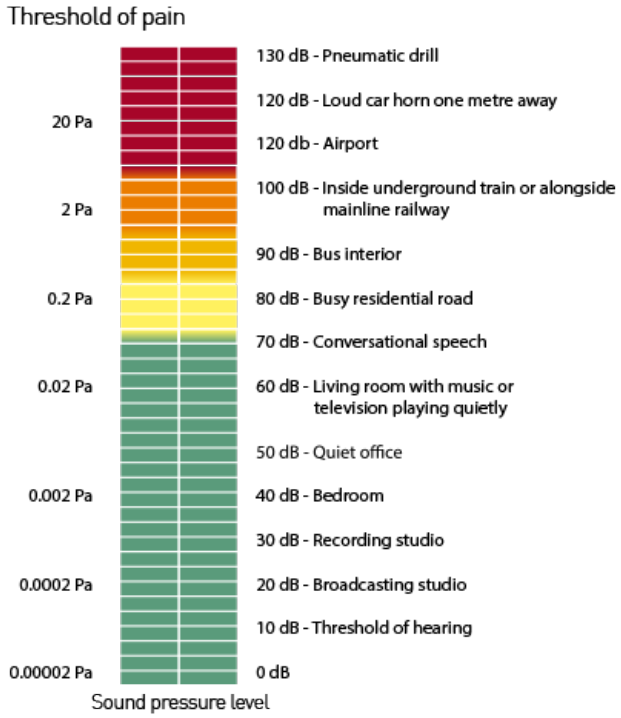
0	22 October 2021	Draft report to client
1	28 October 2021	Amended following client review
2	23 November 2021	Amended following ER and AA comments
3	1 September 2022	Updated to assess Phase 3a/b - TBM assembly
4	19 September 2022	Amended following ER and AA comments
5	4 April 2023	Updated to include TBM activities and operations
6	20 June 2023	Updated to include ER and AA comments
7	9 September 2024	Updated with demobilization details
8	24 September 2024	Amended following ER and AA comments
9	22 January 2025	Amended Plant list for demobilisation activities
10	17 February 2025	Updated with AA and ER comments

Contents

Definition of acoustic terms and acronyms

AA	Acoustic Advisor
AMM	Additional mitigation measures – applicable where standard measures have been implemented and NML is still expected to be exceeded.
Approved hours	Construction hours approved in the Project Conditions of Approval D35. These differ from "standard" hours defined in the ICNG. Work outside the approved hours does not imply the works have not been otherwise approved through the procedures outlined in the NVMP.
Assessment period	The period in a day over which assessments are made.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation.
CoA	Conditions of Approval for the project. These also contain additional definitions.
CSSI	Critical State Significant Infrastructure - State significant infrastructure project essential to the State for economic, environmental or social reasons and determined by the Minister.
Decibel (dB)	A measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm (to base 10) of the ratio of a given sound power to a reference power.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.
dB(C)	Unit used to measure 'C-weighted' sound pressure levels, an adjustment made to sound level to approximate low frequency noise between 10 Hz and 200 Hz.
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
Extraneous noise	Noise resulting from activities that are not typical of the area such as construction, and traffic generated by holiday periods or special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
ICNG	Interim Construction Noise Guideline (Department of Environment and Climate Change 2009)
Noise assessment criteria	A standard rule or test by which the acceptability of the nature and characteristics of noise may be judged or evaluated. Criteria are generally based on guidelines or standards developed by Government agencies (eg EPA) to protect the majority of people for the majority of the time from adverse impacts.
NCA	Noise Catchment Area

Noise level statistics	L_{A90} - The A-weighted sound pressure level exceeded 90% of the monitoring period. This is considered to represent the background noise. L_{Aeq} - The equivalent continuous A-weighted noise level—the level of noise equivalent to the energy average of noise levels occurring over a measurement period. L_{A1} – The A-weighted sound pressure level exceeded 1% of the monitoring period. L_{Amax} – The maximum A-weighted noise level associated with the measurement period. 
NML	Noise Management Level
NVMP	The Project's Construction Noise and Vibration Management Plan
PPV	Peak Particle Velocity – Measurement of ground-borne vibration in units of mm/s
RBL	Rating Background Level - a single figure that represents the background noise level for assessment purposes
ROL	Road Occupancy Licence – granted by Transport for NSW and required for any activity likely to impact on traffic flow.
Sound Power Level (SWL)	The A-weighted sound power level is a logarithmic ratio of the acoustic power output of a source relative to 10-12 watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.

Sound Pressure Level (SPL)	This is the level of noise, usually expressed in dB(A), as measured by a standard sound level meter with a pressure microphone. The sound pressure level in dB(A) gives a close indication of the subjective loudness of noise. A technical definition for the sound pressure level, in decibels, is 20 times the logarithm (base 10) of the ratio of any two quantities related to a given sound pressure to a reference pressure (typically 20 µPa equivalent to 0 dB). Examples of typical sound pressure levels are shown below.  Source: https://www.osha.gov/dts/osta/otm/noise/health_effects/soundpropagation.html
Tonal noise	Noise with perceptible and definite pitch or tone
VDV	Vibration dose value – used when assessing intermittent vibration as it is sensitive to peaks in vibration acceleration and accumulates the vibration energy received over the daytime and night-time periods

1. Introduction

1.1 Project overview

Sydney Metro is Australia's biggest public transport program comprising four main packages of work including Metro North West Line, Sydney Metro City and Southwest, Sydney Metro West and Sydney Metro Greater West. The Sydney Metro West component involves the construction and operation of a metro rail line, around 24km in length, between Westmead and the Sydney CBD.

The planning approvals and environmental impact assessment for Sydney Metro West have been split into several stages recognising the size of the project. These include:

- Sydney Metro West at a Concept level
- Stage 1 – All major civil construction works between Westmead and The Bays including station excavation and tunnelling
- Stage 2 – All stations, depots and rail systems between Westmead and The Bays
- Stage 3 – All major civil construction works including station excavation, tunnels, stations, depots and rail systems between The Bays and the Sydney CBD Station, and operation of the line.

Acciona Ferrovial Joint Venture (AFJV) was commissioned to deliver the Central Tunnel Package of Stage 1, comprising excavation of five station boxes and around 11.5 kilometres of twin-bore tunnel between The Bays and Sydney Olympic Park (the Project). An overview of the Project is presented in Figure 1-1, which includes the tunnel alignment and location of the station boxes at:

- The Bays
- Five Dock
- Strathfield
- Burwood North
- Sydney Olympic Park

Construction of The Bays station box would take place in White Bay and comprises a number of phases including:

- Phase 1 - Site establishment
- Phase 2 - Excavation of the station box
- Phase 3 - Tunnelling
- Phase 4 - Demobilisation

An overview of the initial site layout of The Bays is presented in Figure 1-2. Over the course of the project the site boundary will be updated to accommodate the occupation and operation of other projects including the Eastern Tunnelling Package (ETP) and the Western Harbour Tunnel (WHT). Figure 1-3 presents the location of the site infrastructure to be removed during the final demobilisation phase of the works.

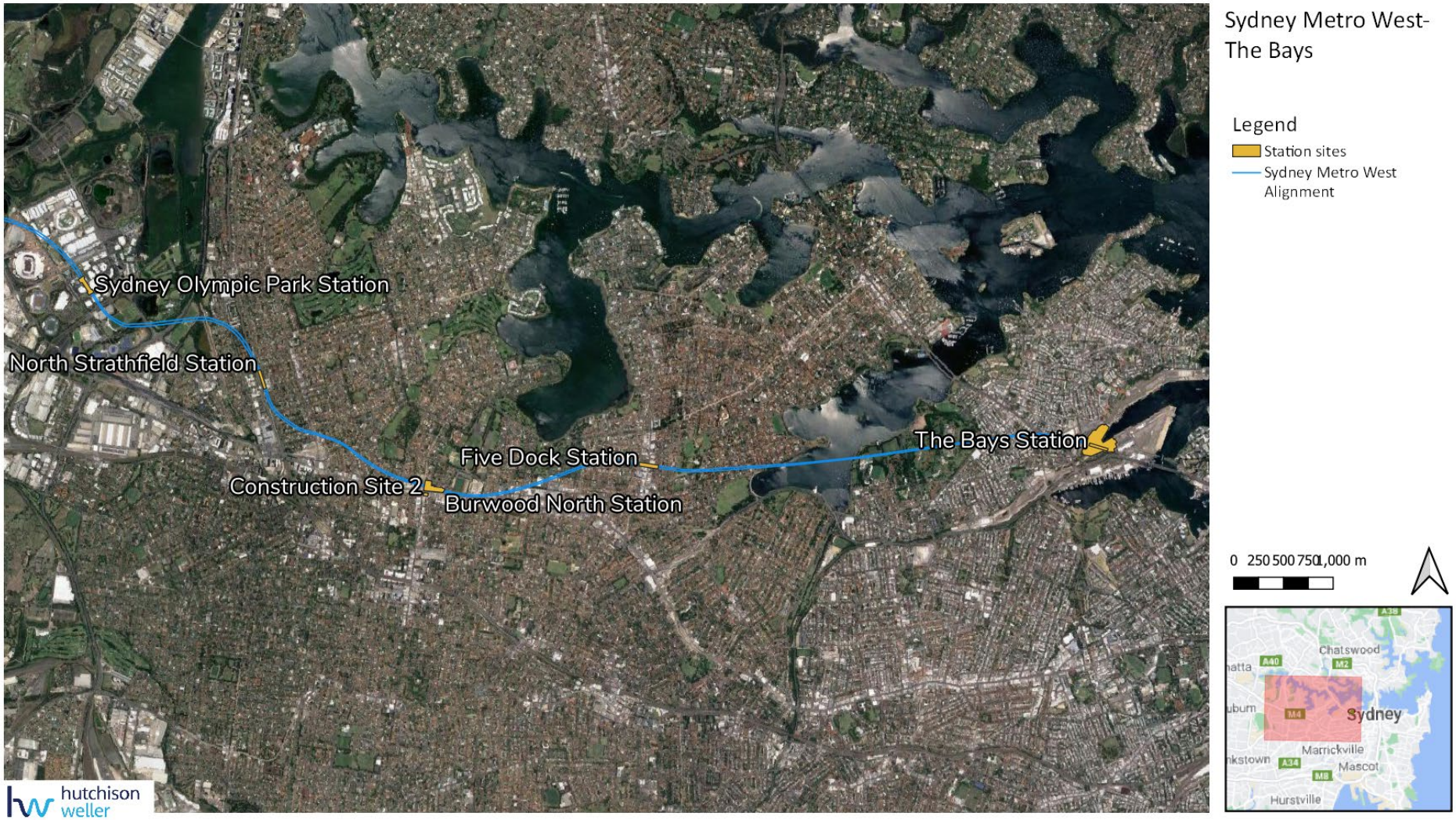


Figure 1-1 Overview of the CTP of Stage 1 of the Sydney Metro West Project.

Figure 1-2 The Bays construction site – Initial site layout

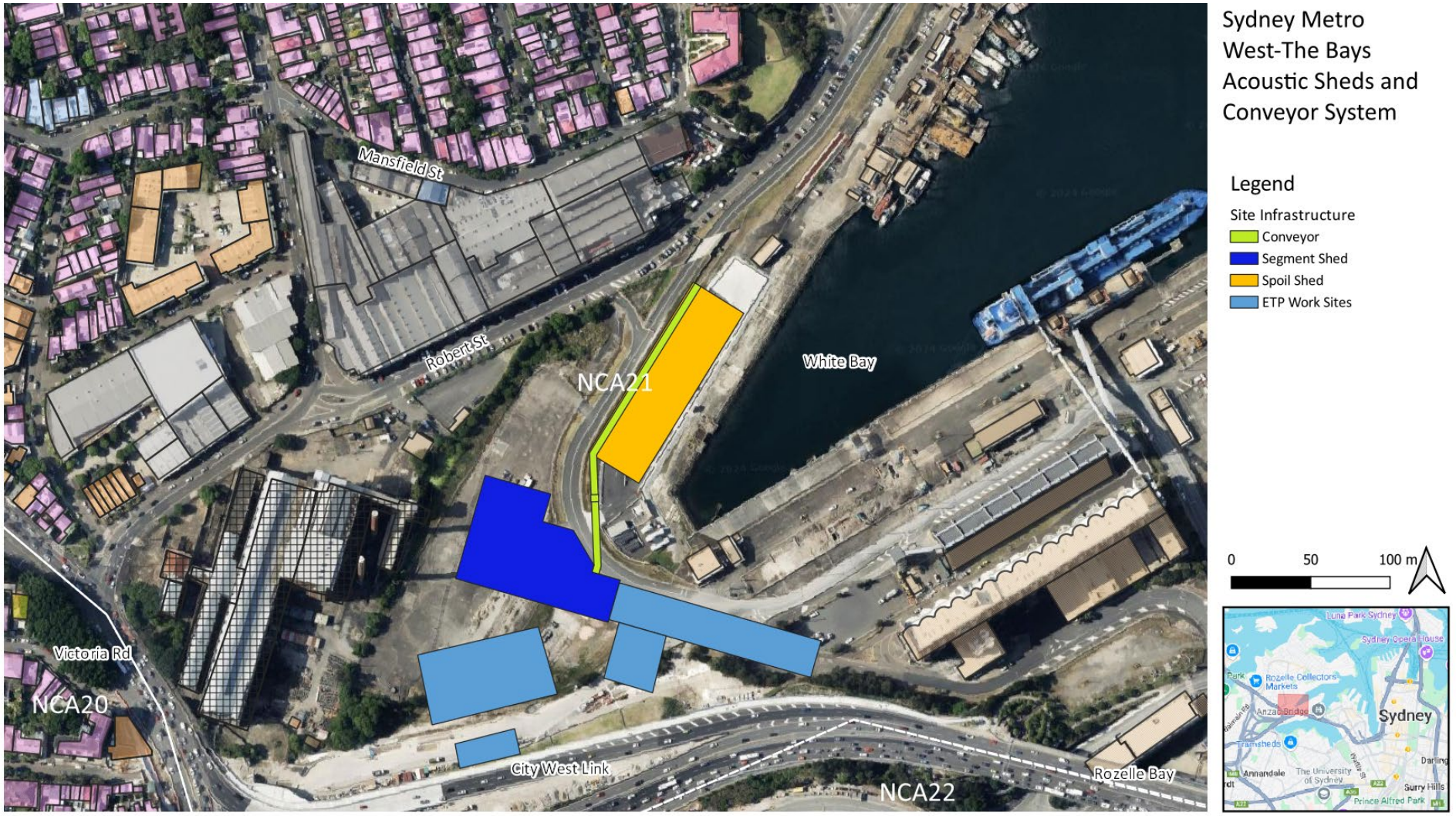


Figure 1-3 The Bays construction site showing existing site infrastructure

1.2 Detailed noise and vibration impact statement

Considering the risk of noise and vibration impact is necessary to ensure appropriate mitigation and management measures can be applied. This Detailed Noise and Vibration Impact Assessment (DNVIS) has been prepared in accordance with the Sydney Metro (2020) Construction Noise and Vibration Standard, v 4.3 (CNVS) and supplements the Project's Construction Noise and Vibration Management Plan (CNVMP) as required in the Project's Condition of Approval (CoA) D43.

The objective of the DNVIS is to establish the location, nature and scale of proposed works, assess the level of impact on the community's amenity and include mitigation measures identified through consultation with affected sensitive land users.

This DNVIS addresses Phase 4 (demobilisation) of the construction program, which is the final phase of works for the site.

The structure of this DNVIS meets the requirements of the Condition of Approval D43 and the CNVS and includes:

- Section 2 – Construction works and hours
- Section 3 – Identification of noise and vibration sensitive receivers and existing noise levels
- Section 4 – Construction noise and vibration objectives
- Section 5 – Description of planned works, equipment and sound power levels
- Section 6 – Construction noise assessment – predicted noise levels and exceedances of objectives, including sleep disturbance
- Section 7 – Construction vibration assessment
- Section 8 – Traffic noise assessment
- Section 9 – Mitigation and management, including consultation

2. Construction works and hours

2.1.1 Planned works

Activities associated with construction of the Central Tunnelling Package CTP at all sites will be completed once the TBMs reach the Sydney Olympic Park (SOP) site, and all associated station box sites have been fully demobilised.

At The Bays, the main phases of site establishment and excavation of the station box have been completed with ongoing TBM support and spoil handling required until the twin TBMs arrival at SOP. Works commenced around October 2021 and are expected to be completed by late 2024 to early 2025. The current program is illustrated in Table 2-2 and shows the duration of each of the remaining phases of work.

TBM arrival at the Sydney Olympic Park site is expected to occur around September 2024. Following the removal of the TBMs, demobilisation works would commence at The Bays, around October 2024 and would take approximately 16 weeks. Works will be largely focused on areas such as the spoil shed, segment shed, conveyors, gantry cranes and surface-based plant and equipment. Full demobilisation of the site will be completed once station box excavation finishing works have been completed, these works are programmed to be completed by end of February 2025.

Due to the lack of access from the adjacent ETP station box, the segment shed would be split into two sections of work, the northern section covering the surface level shed facilities and slab, and the southern section covering the station box.

Demobilisation activities and station box finishing works will be completed with the following indicative timeframes:

Week 1

Site mobilization:

- Mobilization of Plant and Equipment to site. Removal of auxiliary equipment and services prior to demolition. Installation of any protection for site services.

Week 2

Commence removal of spoil shed structure:

- Spoil shed structure would be demolished using high reach excavator with shears and EWPs.

Week 3 to Week 4

Removal of Segment Shed (northern section):

- The northern section of the segment shed would be demolished using high reach excavator with shears.
- Decommissioning and removal of gantry crane

Removal of concrete spoil wall within spoil shed:

- Commence demolition of concrete spoil wall within spoil shed and demolition of the spoil shed slab and foundation.

Week 5 to Week 8

Removal of Segment Shed (southern section):

- Processing and removal of engineered beams
- Demolition of the southern section of the segment shed
- Continued demolition of the spoil wall and slab for the spoil shed.

Station box finishing works:

- Removal of the existing concrete slab and excavation to the designated handover level. Concrete pouring and finishing will be completed once excavation is finished.

Week 9 to week 16

Concrete Demolition within Spoil Shed:

- Continued demolition of the spoil wall and slab for the spoil shed.

Removal of Segment Shed {southern section):

- Processing and removal of engineered beams
- Demolition of the southern sect on of the segment shed
- Continued demolition of the spoil wall and s ab for the spoil shed.

Station box finishing works:

- Removal of the existing concrete slab and excavation to the designated handover level. Concrete pouring and finishing will be completed once excavation is finished.

Spoil shed finishing works:

- Following removal of the spoil shed slab, finishing earthworks will be completed to the designated handover level for that site.

This DNVIS addresses the activities and impacts from the final construction phase for demobilisation of the AFJV site as detailed in Table 2-1.

Table 2-1 Summary of proposed activities at The Bays

Construction phase	Activity		
1. Site Establishment ***Completed***	1a	Typical daily activities	
	1b	Establishment of site sheds and facilities	
	1c	Temporary fencing/ hoardings	
	1d	Haul Roads / Piling Pads	
	1e	Establish Stockpiles	
	1f	Minor utilities relocations	
	1g	Piling	
	1h	Site Concrete Works	
	1i	Site structures including acoustic enclosures	
2. Station Box Excavation ***Completed***	2a	Construction Compound activity	
	2b	Ground improvement – rotary and percussive drilling as needed	
	2c	Piling	Guide walls, piles
	2d		Detailed excavation, break back & capping beam
	2e	Excavation & Retention	Other Than Rock (OTR) - Dozer (No ripping)
	2f		Rippable - Dozer (Ripping)
	2g		Non-rippable - Excavators with hammers or eccentric rippers
	2h		Non-rippable – surface miners
	2i		Retention - Ground Anchors
	2j		Retention - Props
	2k		Shotcrete
	2l	Spoil handling	Ramp and intrasite haulage
	2m		Ramp and on-road haulage
	2n		Telescopic excavator and intrasite haulage
	2o		Telescopic excavator and on-road haulage
3. TBM Works ***Completed***	3a	Assembly	Delivery to Site, unloading & lifting into station box
	3b		Assembly (in station box)
	3c	Operation	Tunnelling & Support
	3d		Spoil Handling
	3e		Tunnel Lining (Segments)
4. Demobilisation	4a	Conveyor vertical riser removal	
	4b	Conveyor gantry/drive removal	
	4c	Spoil shed structure removal	
	4d	Spoil shed spoil wall removal	
	4e	Spoil shed slab removal.	
	4f	Segment shed roof	
	4g	Segment shed gantry cranes	
	4h	Segment shed structure removal (north side)	
	4i	Segment shed structure removal (south side)	
	4j	Segment shed walls removal	
5. Finishing works	5a	Removal of existing concrete slab and excavation of station box	
	5a(i)	Concrete slab cutting	
	5b	Excavation support (surface loadout)	
	5c	Excavation support (surface stockpile)	
	5c(i)	Excavation support (station box stockpile)	
	5d	Station box concrete pours	
	5e	Spoil shed - post demo earthworks	

Table 2-2 Anticipated program for The Bays

Phase	Activity/Work Area	2024												2025								
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
4. Demobilisation	Removal of Structures (Segment Shed, Spoil shed, Conveyor system) and Concrete Demolition																					
	Site demobilisation and cleanup																					
5. Finishing works	Removal of existing concrete slab and excavation of station box																					
	Station box concrete pours																					
	Spoil shed earthworks																					

2.1.2 Approved construction hours

Working hours are set by the Project Conditions of Approval D35 to D36 and L5.1 to L5.2 of the Environment Protection Licence (EPL 21610), as summarised in Table 2-3. Use of power saws for cutting pavement at locations where test pits are necessary is defined as annoying under the Interim Construction Noise Guideline (ICNG) and are 'highly noise intensive works'.

Table 2-3 Approved construction hours

CoA	EPL condition	Construction activity	Monday to Friday	Saturday	Sunday / Public holiday
D35	L5.1	Approved construction	7:00 am to 6:00 pm	8:00 am to 6:00 pm	No work (unless approved under out-of-hours work protocol)
D36	L5.2	Highly noise intensive works that exceed the NML	8:00 am to 6:00 pm[1]	8:00 am to 1:00 pm[1]	No work (unless approved under out-of-hours work protocol)

Notes:

1. if continuously, then not exceeding three hours, with a minimum cessation of work of not less than one hour.

2.1.3 Variations to work hours

In some circumstances, the planned construction activities would be undertaken outside the hours described in Section 2.1.2. As specified in the Conditions of Approval, these activities include those which are:

- Low impact as described in CoA D37b), including:
  - i. construction that causes LAeq(15 minute) noise levels:
    - no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and
    - no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and
  - ii. construction that causes LAFmax(15 minute) noise levels no more than 15 dB(A) above the rating background level at any residence; or
  - iii. construction that causes:
    - continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or
    - intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006).

- By Prescribed Activity, as described in CoA D37d), with circumstances applicable to The Bays including:
  - i. tunnelling (excluding cut and cover tunnelling and surface works) which is permitted 24 hours a day, seven days a week; or
  - iii. delivery of material that is required to be delivered outside of standard construction hours in Condition D35 of this schedule to directly support tunnelling activities
  - v. work within an acoustic shed where there is no exceedance of noise levels under Low impact circumstances identified in (b) above, unless otherwise agreed by the Planning Secretary.

Where out-of-hours work is necessary, appropriate respite would be identified in consultation with the affected community, in line with the NVMP. As per CoA D51, consultation would include providing:

a) a progressive schedule for periods no less than three (3) months, of likely out-of-hours work;
b) a description of the potential work, location and duration of the out-of-hours work;
c) the noise characteristics and likely noise levels of the work; and
d) likely mitigation and management measures which aim to achieve the relevant NMLs (See Section 4) including circumstances of when respite or relocation offers would be available and details about how the affected community can access these offers.

Similarly, the EPL exempts low noise impact works for standard hours as follows.

- L5.3 Exemptions to standard construction hours for low noise impact works

  Works and activities may be carried on outside of the hours specified in condition L5.1 if the works and activities do not cause, when measured at the boundary of the most affected noise sensitive receiver:
  a) L_{Aeq}(15 minute) noise levels greater than 5dB above the day, evening and night rating background level (RBL) at any residence in accordance with the ICNG; and
  b) no more than the "Noise affected" NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and
  c) L_{A1}(1 minute) or LAmax noise levels greater than 15dB above the night RBL for night works;
  d) the preferred continuous or impulsive vibration values greater than those for human exposure to vibration, set out for residences in Table 2.2 in Assessing Vibration: a technical guideline (DEC, 2006); and
  e) the preferred intermittent vibration values greater than those for human exposure to vibration, set out for residences in Table 2.4 in Assessing Vibration: a technical guideline (DEC, 2006).

For the purposes of this condition, the RBLs are those contained in an environmental assessment for the activities subject to this licence prepared under the Environmental Planning and Assessment Act 1979. Alternatively, the licensee may use another RBL determined in accordance with the Noise Policy for Industry (EPA, 2017) and provided to the EPA prior to carrying out any works or activities under this condition.

- L5.4 Exemptions to standard construction hours in exceptional circumstances

  a) The licensee may undertake works and activities outside of standard construction hours specified in condition L5.1 for:
    i. emergency works required to avoid injury to persons, the loss of life or property, or to prevent material harm to the environment; and
    ii. the delivery of oversized plant, structures or materials determined by the police or other authorised authorities to require special arrangements to transport along public roads.
  b) The licensee must, on becoming aware of the need to undertake emergency works under this condition notify the EPA's Environment Line as soon as practicable and submit a report to the EPA by 2:00 pm on the next business day after the emergency works commenced that describes:
    i. the cause, time and duration of the emergency;
    ii. action taken by or on behalf of the licensee in relation to the emergency; and
    iii. details of any measures taken or proposed to be taken by the licensee to prevent or mitigate against a recurrence of the emergency.
  Note: For the purposes of this condition, 'material harm to the environment' has the same meaning as in section 147 of the POEO Act. Emergency works do not require a notification under condition L5.5.

- L5.6 24-Hour works

  The following works are permitted to be undertaken 24 hours a day, 7 days per week:
  (a) Tunnelling activities (excluding cut and cover tunnelling and surface works); and

(b) Haulage of spoil, and delivery of material that is required to be delivered outside of standard construction hours to directly support tunnelling activities, except between the hours of 10:00pm and 7:00am to and from the Five Dock construction site; and
(c) Haulage of spoil, and delivery of material that is required to be delivered outside of standard construction hours to directly support tunnelling activities, except between the hours 10:00pm and 7:00am to and from the Burwood North construction site using any roads or streets other than directly from Parramatta Road; and
(d) work within an acoustic shed where there is no exceedance of noise levels under Low impact circumstances identified in condition L5.3,
Note: Tunnelling does not include station box excavation

- L5.7 Works outside of standard construction hours (out-of-hours works)

  Under this condition, works and activities may be undertaken outside of standard construction hours specified in condition L5.1 and L5.2 until 23 December 2022, and if they are required in relation to one or more of the following:
  a) carrying on those works and activities during standard construction hours would result in a high risk to construction personnel or public safety, based on a risk assessment carried out in accordance with AS/NZS ISO 31000:2009 "Risk Management";
  b) the relevant road network operator has advised the licensee in writing that carrying out the works and activities during standard construction hours would result in a high risk to road network operational performance;
  c) a relevant utility service operator has advised the licensee in writing that carrying out the works and activities during standard construction hours would result in a high risk to the operation and integrity of the utility network;
  d) the TfNSW Transport Management Centre (or other road authority) have refused to issue a road occupancy licence during standard construction hours; or
  e) Sydney Trains (or other rail authority) requires a rail possession for the activities to be performed outside of standard construction hours.

3. Existing environment

3.1 Existing environment

The Bays construction site occupies around 4 ha in the White Bay area south of Balmain and East of Rozelle as illustrated in Figure 1-2. Land uses adjacent to the site are industrial and commercial to the north, east and west. The closest receiver to the site is the defunct White Bay Power Station. To the south across City West Link and James Craig Drive are additional commercial premises and Rozelle Bay.

Residential receivers that may be impacted by works on The Bays site include the nearest in Balmain, around 120 metres north, and in Rozelle, around 250 metres to the south west. Residences in Glebe are around 500 metres across Rozelle Bay to the south.

Receivers in NCA21 generally rise in elevation the further north they are from the construction site. This means that these receivers have little noise shielding from the construction site due to their tiered positioning.

St Joseph's Catholic Church and Sydney Community College are located around 350 metres west of the site. The Bald Rock Hotel is located around 130 metres north of the construction site on Mansfield Street and the Rosebud Cottage Child Care is located around 180 metres west of the construction site on Quirk Street.

The acoustic environment in all areas is described in the EIS as dominated by road traffic noise on the major transport corridors such as Victoria Road and City West Link. Contributions from aircraft and industrial land uses are also noted.

To assess and manage construction noise and vibration impacts, a detailed land use survey was prepared for the Project in line with CoA D34, with results of the survey presented in Appendix A of this DNVIS.

3.2 Heritage items

Parts of The Bays area have been identified in the EIS as possessing items of heritage value, which include the following. These items will be considered for impacts of vibration-intensive activities.

- White Bay Power Station, including buried assets such as culverts or inlet/outlet structures
- Australian Cement Silos

3.3 Noise catchment areas

To facilitate the assessment of noise impacts from the project and to apply representative Noise Management Levels (NMLs) to all receivers, receivers adjacent to The Bays site have been divided into Noise Catchment Areas (NCAs).

NCAs group individual sensitive receivers by representative traits such as existing noise environment and potential exposure to noise and vibration from the Project.

NCAs were established as part of the EIS, are summarised in Table 3-1 and illustrated in Figure 1-1. Background noise monitoring has been completed as part of the EIS to apply appropriate NML to each NCA (see Section 4.2).

Table 3-1 Summary of work areas, Noise Catchment Areas and land uses

NCA	Location	Description	Ambient noise influences
19	North of City West Link in Lilyfield.	Mainly residential. 'Other sensitive' receivers include the University of Tasmania, NSW/Ambulance, Sydney University College of the Arts, Orange Grove Public School, and outdoor recreation areas.	Road traffic on Victoria Road and City West Link including heavy vehicles. Frequent aircraft
20	West of Victoria Road in Rozelle.	Mainly residential with some commercial receivers along Victoria Road and Lilyfield Road. 'Other sensitive' receivers include Sydney Community College, St Joseph's Catholic Church and Rosebud Cottage child care centre.	Road traffic on Victoria Road and City West Link including heavy vehicles. Frequent aircraft
21	East of Victoria Road in Rozelle and Balmain	Includes White Bay, the former White Bay Power Station and Glebe Island. This catchment is mainly residential, with various commercial areas surrounding White Bay and Glebe Island. 'Other sensitive' receivers include Inner Sydney Montessori School.	Road traffic on Victoria Road and City West Link including heavy vehicles. Frequent aircraft
22	South of Victoria Road/Western Distributor in Glebe.	Commercial areas associated with Rozelle Bay area to the south of Victoria Road/Western Distributor and the more distant areas across Rozelle Bay are residential.	Road traffic on City West Link and The Crescent including heavy vehicles. Frequent aircraft

3.4 Background noise survey

Background noise monitoring was undertaken as part of the wider Sydney Metro West Project EIS (Section 2, Technical Paper 2) through unattended background noise monitoring at representative locations. Monitoring was completed in March and July 2019 for each of the NCAs listed in Table 3-1.

Noise levels in The Bays area generally display a typical diurnal trend with lower levels during the night-time than the daytime and evening periods (with some exceptions). This is characteristic of urban and suburban areas, where the ambient noise environment is primarily influenced by road traffic.

The baseline information was used to establish the Rating Background Level (RBL), which represents the average minimum background sound level for each measurement period, averaged over the measurement days. The RBL at each NCA is provided in Table 3-2.

Table 3-2 Background noise levels

	Noise level (dBA)[1]		
NCA	Day[2]	Evening[2]	Night[2]
NCA19	36	36[3]	33
NCA20	51	51	45
NCA21	43	43	35
NCA22	48	47	39

Notes:

1. The RBL values have been extracted from the EIS; refer to Table 4 in the EIS Technical Paper 2.
2. Daytime is 7:00am to 6:00pm, evening is 6:00pm to 10:00pm and night-time is 10:00pm to 7:00am.
3. During the EIS noise assessment, the monitoring level was found to be higher than the daytime. In this situation, the NPfI requires that the evening level be reduced to match the daytime

4. Noise and vibration assessment criteria

4.1 Overview

Project CoA D43 requires planned works to be assessed within this DNVIS where any planned works may exceed the NMLs, vibration criteria and/or ground-borne noise levels specified in CoA D39 and D40 at any residence outside construction hours identified in CoA D35, or where receivers will be highly noise affected.

This DNVIS includes specific mitigation measures identified through consultation with affected sensitive land user(s) and these mitigation measures will be implemented for the duration of the early works investigations.

This DNVIS has been provided to the AA and ER before the commencement of the planned works.

CoA D39 requires noise and vibration from construction activity to be managed with guidance from:

- Noise: the Interim Construction Noise Guideline (ICNG, DECC 2009)
- Vibration for human exposure: Assessing Vibration: A Technical Guideline (DEC, 2006)
- Vibration for building damage: BS 7385 Part 2-1993 – Evaluation and measurement for vibration in buildings Part 2, and
- Vibration for damage of unsound heritage items: DIN 4150-3 Structural Vibration – effects of vibration on structures.

The over-arching document for assessment and management of noise and vibration impacts on this Sydney Metro project is the Sydney Metro *Construction Noise and Vibration Standard* (CNVS, vers. 4.3, Transport for NSW 2020). The following sections outline the framework of these guidelines and the way this DNVIS will assist to assess and manage impacts.

4.2 Noise

4.2.1 ICNG

The CNVS refers to the *Interim Construction Noise Guideline* (ICNG) (DECC 2009), which provides guidance on management of construction noise. The ICNG notes noise that exceeds background noise levels may result in adverse impacts and an increased likelihood of complaints.

During approved hours, where construction noise is within 10 dB(A) of the RBL, impacts are considered acceptable. Where construction noise is more than 10 dB(A) above the RBL, a residential receiver is taken to be noise affected and the proponent should undertake all reasonable and feasible steps to manage the impact and consult with the affected community.

Above a $L_{Aeq,\ 15\ minute}$ noise level of 75 dB(A), a residential receiver is considered to be highly noise affected, requiring respite to be given in consultation with the regulatory authority and the community.

Outside approved construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, noise from activities/equipment such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs and a 3 hours on, 1 hour off respite schedule applies.

A noise level above $L_{Aeq\ 15min}$ 70 dB(A) at a commercial property is considered to warrant noise mitigation. Similarly, an industrial facility would warrant noise mitigation at $L_{Aeq\ 15\ minute}$ noise levels above 75 dB(A).

Table 4-1 presents management levels for noise at other relevant sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Internal noise levels are assessed at the centre of the occupied room. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences.

Table 4-1 NMLs for non-residential sensitive receivers

Sensitive receiver type	NML applicable when in use, LAeq, 15 min
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Childcare centres - sleeping areas - play areas	 Internal noise level 45 dB(A) External noise level 65 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

4.2.2 Sleep disturbance

The CNVS requires maximum noise levels to be analysed in terms of the extent and number of times the maximum noise exceeds specific noise trigger levels, in general accordance with the Noise Policy for Industry (NPfI) (EPA 2017). These triggers are:

- LAeq, 15 minute 40 dBA or the prevailing RBL plus 5 dB, whichever is greater, and the
- LAmax 52 dBA or the prevailing RBL plus 15 dB, whichever is greater.

The NPfI also recommends the DECCW (2011) Road Noise Policy (RNP) be reviewed for further risk assessment. The RNP recommends maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.

4.2.3 Ground-borne noise

CoA D40 requires all reasonable and feasible mitigation measures to be applied when the following residential ground-borne noise levels are exceeded. These levels are only applicable when ground-borne noise levels are higher than airborne noise levels.

a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and
b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A).

4.2.4 Construction traffic

While operating within the construction site, construction vehicles are assessed as part of the construction activity of which they are a part. However, once these vehicles leave the construction site and enter public roads, they are assessed as road traffic.

The Road Noise Policy is generally adopted to assess the impact of construction traffic on public roads. A screening test is first applied to establish whether existing road traffic noise levels will increase by more than 2 dB due to construction traffic. Where any noise increase is less than 2 dB, the objectives of the Road Noise Policy have been met.

The CNVS recommends, where the road traffic noise levels are predicted to increase by more than 2 dB as a result of construction traffic, consideration should be given to feasible and reasonable noise mitigation measures to reduce the potential noise impacts and preserve acoustic amenity.

In considering feasible and reasonable mitigation measures, the actual noise levels associated with construction traffic and whether these levels comply with the road traffic noise criteria in the RNP would be reviewed.

- 60 dB LAeq(15hour) day and 55 dB LAeq(9hour) night for existing freeway/ arterial/ sub-arterial roads.
- 55 dB LAeq(1hour) day and 50 dB LAeq(1hour) night for existing local roads.

4.2.5 Additional mitigation measures

The CNVS builds on the guidance provided by the ICNG and recommends further mitigation measures where all reasonable and feasible mitigation measures to minimise noise at the nearest receivers have been implemented and construction noise is still predicted to exceed the noise or vibration objectives. The Additional Mitigation Measures Matrix (AMMM) from the CNVS is presented in Table 4-2.

Table 4-2 Additional Mitigation Measures Matrix (CNVS)

Construction hours	dB above NML	Additional management measures
Approved hours Monday – Friday: 7am – 6pm Saturday: 8am to 6pm	0 to 10	-
	10 to 20	LB
	20 to 30	LB, M, SN
	>30	LB, M, SN
Evening Monday – Friday: 6pm – 10pm Saturday: 7am – 8am, 6pm – 10pm Sunday / PH: 8am – 6pm	0 to 10	LB
	10 to 20	LB, M
	20 to 30	LB, M, SN, RO
	> 30	LB, M, SN, IB, PC, RO
Night Monday – Saturday: 10am – 7am Saturday: 10pm –8am) Sunday / PH: 6pm –7am	0 to 10	LB
	10 to 20	LB, M, SN, RO
	20 to 30	LB, M, SN, IB, PC, RO, AA
	> 30	LB, M, SN, IB, PC, RO, AA

Notes:
PC = Phone Calls and emails
M = Monitoring
IB = Individual briefings
AA = Alternative accommodation
SN = Specific notification
LB = Letterbox drops
RO = Project specific respite offer

4.3 Project-specific construction noise management levels

Based on the measured RBLs for each NCA and requirements of the ICNG and CNVS, project-specific NMLs are summarised in Table 4-3. NMLs for non-residential receivers are described in Table 4-1.

Table 4-3 Noise management levels

NCA	Noise Management Level, $L_{Aeq\ 15\ minute}$						
	Approved hours		Outside approved hours				
	Noise affected	Highly noise affected	Day	Evening	Night	Sleep disturbance (CNVS)	
						$L_{Aeq,\ 15\ minute}$	L_{Amax}
19	46	75	41	41	38	40	52
20	61	75	56	56	50	50	60
21	53	75	48	48	40	40	50
22	58	75	53	52	44	44	54

4.4 Vibration management

4.4.1 Human comfort

When assessing human exposure to construction-related vibration, the CNVS requires vibration goals to be established using *Environmental Noise Management Assessing Vibration: A Technical Guideline* (DECC 2006), which provides criteria for the assessment of vibration impacts on humans.

Construction activities typically generate vibration of an intermittent nature, which is assessed using a Vibration Dose Value (VDV). Acceptable values of vibration doses are presented in Table 4-4 for sensitive receivers.

Table 4-4 VDV Vibration criteria

Receiver type	Low probability of adverse comment ($m/s^{1.75}$)	Adverse comment possible ($m/s^{1.75}$)	Adverse comment probable ($m/s^{1.75}$)
Residential buildings – 16 hour day (7am to 11pm)[1]	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings – 8 hour night (11pm to 7am)[1]	0.13	0.26	0.51

Note 1: Day time and night time as described in BS6472:1992 (as referenced in the CNVS), i.e. a daytime period of 16 h or a night time period of 8 h, for example 23.00 h to 07.00 h.

4.4.2 Buildings

Potential building damage from construction vibration requires the application of values in BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2. These values are presented in Table 4-5 and relate to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings.

Table 4-5 Guideline values for vibration velocity for the effects of short-term vibration on structures (BS 7385).

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz to 50 mm/s at 40 Hz and above

Where vibration may give rise to magnification due to resonance, especially at lower frequencies where lower guide values apply, the guide values may be reduced by 50%. The CNVS describes rock breaking/hammering and sheet piling activities as having potential to cause dynamic loading in some structures (e.g. residences).

For activity involving rock breakers, piling rigs, vibratory rollers, excavators, vibration predominantly occurs at frequencies in the 10 Hz to 100 Hz range. On this basis, a conservative vibration damage screening level is:

- Reinforced or framed structures: 25.0 mm/s
- Unreinforced or light framed structures: 7.5 mm/s

4.4.3 Heritage

Heritage buildings and structures would be assessed under a conservative cosmetic damage objectives of 2.5 mm/s peak component particle velocity (from DIN 4150). Where vibration levels at heritage items are identified as exceeding this screening level, structural assessment would be completed by the Project team to confirm the structure's sensitivity to vibration. If a heritage building or structure is found to be structurally unsound (following inspection) the conservative criterion would stand. Where the structure is suitably sound, the guideline values from Table 4-5 would be applicable.

4.4.4 Additional mitigation measures

The CNVS recommends additional mitigation measures where all standard mitigation measures to minimise vibration at the nearest receivers have been implemented and vibration is still predicted to exceed the maximum guideline values. The Additional Mitigation Measures Matrix (AMMM) for vibration from the CNVS is presented in Table 4-6. Acronyms are defined at Table 4-2.

Table 4-6 Additional Vibration Mitigation Measures (CNVS)

Construction hours	Mitigation measures where predicted vibration levels exceed maximum levels
Approved hours Monday – Friday: 7am – 6pm, Saturday: 8am to 6pm	LB, M, RO
Evening Monday – Friday: 6pm – 10pm; Saturday: 7am – 8am, 6pm – 10pm; Sunday / PH: 8am – 6pm	LB, M, IB, PC, RO, SN
Night Monday – Saturday: 10am – 7am Saturday: 10pm –8am); Sunday / PH: 6pm –7am	LB, M, IB, PC, RO, SN, AA

Notes:
PC = Phone Calls and emails
M = Monitoring
IB = Individual briefings
AA = Alternative accommodation
SN = Specific notification
LB = Letterbox drops
RO = Project specific respite offer

5. Impact assessment

5.1 Plant and equipment

A summary of proposed activities at The Bays site was provided in Table 2-1. Nominal equipment and estimated sound power levels of each item and activity are presented in Appendix B.

Over the day, evening and night periods, equipment types and numbers will vary, with less equipment proposed outside standard hours. This approach allows some activity to continue into the evening and night while remaining within the NMLs in these periods.

Where demobilisation activities are considered to contain the potential for extraneous noise sources such as hammering or banging of steel sections to facilitate dismantling, an additional correction factor has been added to the estimated activity SWL. This has been omitted from the OOHW noise predictions to estimate potential impacts for minimised operations during the evening and night.

The noise predictions in this DNVIS represent a realistic worst-case scenario when construction occurs at a work location nearest to residences and other sensitive receivers. At each receiver, noise levels will vary during the construction period based on:

- the number of plant items operating at any one time
- plant and equipment location on site and relative to a sensitive receiver
- the actual SWLs of plant and equipment and their operating durations in an assessment period

5.2 Noise modelling

SoundPlan noise modelling software was used to calculate noise impacts in accordance with the ISO9613 prediction method at all identified noise-sensitive receivers. The model included:

- Topography – 1 metre DEM based on LPI Lidar data.
- Ground absorption factors between source and receivers – hard areas such as concrete and water taken as a factor of 0 and absorptive sources such as suburban areas taken as 0.5.
- Individual buildings for façade calculations and to account for shielding and reflections. Building heights are also taken from Lidar data.
- Individual sensitive receivers – One receiver location representing each residential dwelling and located 1.5 metres above most affected floor level (e.g. level 2) and most-affected façade at up to around 600 metres radius.
- Construction noise sources –Activities and equipment included in the noise model as area sources in locations specified by AFJV. SoundPlan takes the worst-case point within each area to perform its calculations, a conservative approach. Sound power levels in Appendix B. Source is modelled at 1.5 metres above ground.
- Meteorology –worst-case conditions: gentle breeze (3-5 m/s) source to receiver and stable conditions (conducive of temperature inversion).

6. Predicted noise levels

6.1.1 Overview

A summary of predicted noise levels for approved hours and outside approved hours works is provided in the following sections for each construction phase. Detailed results for all sensitive receivers are provided in Appendix D and noise contours for selected activities are presented in Appendix C. The contours demonstrate the extent of the worst-case impacts and illustrate buildings around the work sites generally providing good noise screening.

6.1.2 Earlier phases and TBM support

Phases 1 to 3 have been completed for The Bays. TBM and tunnel support operations will be maintained at The Bays until breakthrough at SOP. See earlier revisions of this document for detail of completed activities.

6.1.3 Phase 4 – Site demobilisation

Site demobilisation will consist of removal of all infrastructure related to the project and final clean-up of the site. The main elements will be removal of the spoil conveyor, the spoil shed, concrete slab and the segment shed.

The conveyor removal will progress from top to bottom, with the above ground transfer elements of the conveyor removed, before continuing downward into the box until the final elements inside the station box are removed. Simultaneously, the removal of the conveyor bridge across Port Access Road will be removed prior to dismantling of the spoil shed. Big sections and units of the conveyor will be mobilized with the use of a diesel tower crane.

Conveyor riser and bridge removal is expected to be NML compliant for the day and evening periods. To mitigate impacts above nighttime NML, restrictions on extraneous sources such as hammering metal on metal, use of rattle guns or other noisy works will be applied, reducing the nighttime impact to NML compliant levels.

The spoil shed will be demolished using a high reach excavator with shears and EWP to cut sections of the shed into small sections that will be loaded on trucks for removal. The spoil bund wall and the shed floor slab will be removed using rock hammers and concrete pulverisers. Any associated plant and equipment will be removed prior to dismantling the shed. Where all equipment is employed simultaneously the predicted daytime impacts during this time are up to 556 exceedances in the 0-10dB range and about 61 exceedances in the 10-20 dB range. Impacts during this time will be limited to approved hours only.

The segment shed and associated plant and equipment (including tasman tanks throughout site) will be demolished using a combination of mechanical and manual demolition/dismantling methods using high reach excavators and cranes/EWP to firstly remove roof sheets and then dismantle and remove the gantry crane. While this process is less equipment intensive than mechanical demolition, noisy events such as hammering on metal sections will increase the overall noise levels from this activity. Around 20 receiver locations will be impacted in the 0-10 dB range however, these works are scheduled for approved hours only.

6.1.4 Phase 5 – Remaining finishing works

Station box works to excavate to the finished depth will commence once the segment shed is removed. Demolition of the existing station box floor will require hammering and concrete crushing prior to loading on trucks for removal from site. After the removal of the spoil shed slab, final earthworks will be completed at that site in preparation for handover. All work at the soil shed site would be during approved hours only.

There are no predicted NML exceedances during approved or evening OOH periods when rock hammering is required. During the night, excavation activities would continue without the use of rock hammers to maintain compliance with noise goals. Loading out and stockpiling materials from the station box excavation are predicted to be compliant during the day and evening periods but may generate exceedances during the night. Monitoring of noise levels at affected receiver locations will be used to confirm activity specific noise levels and identify opportunities to extend works where NML compliance for these works is indicated. If works are identified to be above NML compliance additional mitigation will be implemented and monitored again or non NML complaint works will be ceased during nighttime periods.

Table 6-1 Summary of predicted NML exceedances for Phase 4 and 5 – Site demobilisation

Activity		Maximum level, dBA			Predicted no. receivers with exceedance of NML															
					Approved hours			Outside approved hours - Day				Outside approved hours - Evening				Outside approved hours - night			
		Res	Non-res	Rec. >75	0-10	10-20	20+	0-10	10-20	20-30	30+	0-10	10-20	20-30	30+	0-10	10-20	20-30	30+
4a	Conveyor riser removal	54	56	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Conveyor removal (Spoil shed)	38	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4bi	Conveyor removal (Bridge)	47	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4c	Spoil shed structure removal	64	77	1	182	3	0	-	-	-	-	-	-	-	-	-	-	-	-
4d	Spoil shed bund wall removal	64	77	1	168	3	0	-	-	-	-	-	-	-	-	-	-	-	-
4e	Spoil Shed slab removal.	71	83	1	556	61	0	-	-	-	-	-	-	-	-	-	-	-	-
4f	Segment Shed roof	42	47	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
4g	Segment shed gantry cranes	43	47	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
4h	Segment shed structure removal (north side)	56	61	0	20	0	0	-	-	-	-	-	-	-	-	-	-	-	-
4i	Segment shed structure removal (south side)	54	57	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
5a	Excavation Stn Box	51	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5a	Concrete cutting	43	43	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
5b	Excavation (Loadout)	47	49	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
5c	Stockpile (Surface)	50	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5ci	Stockpile (Station Box)	36	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5d	Stn Box Concrete pours	53	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5d	Spoil shed earthworks	55	68	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
-	*No works to be undertaken during these periods																		

6.1.5 Sleep disturbance

Most proposed works at The Bays would be undertaken during standard hours. Some activities may continue into the evening period. For works in the night period, these would only proceed under specific circumstances as detailed in the EPL Condition L5.3 or L5.6, with activities generally only proceeding if within the NML following an activity-specific noise and vibration impact assessment. Based on this approach, sleep disturbance would not be of concern at The Bays.

6.1.6 Cumulative noise impacts

The risk of cumulative impacts of construction noise on the community relate to multiple activities occurring at a single time close to a sensitive receiver and where respite periods are not maintained with breaks in noise from one project being spoiled by noise from other projects or construction sites.

There is a likelihood of multiple construction activities occurring concurrently in the project area including activities from nearby projects such as WestConnex Rozelle Interchange (RIS), Western Harbour Tunnel (WHT) and the Eastern Tunnel Package (ETP), which shares the site with this project.

During the demobilisation phase at The Bays site, the majority of noisy activities are completed during approved hours. Works during OOH periods would be completed where they are predicted to be NML compliant.

Where activities from other sites are concurrent, the noisiest activity or activity closest to the sensitive receiver will be the dominant noise source and essentially 'mask' noise from more distant or quieter activities. When concurrent activities generate noise of similar levels, the total noise experienced at the sensitive receiver may be increased by around 3 dB relative to a single source.

Of the closest projects, only works associated with the ETP are expected to be concurrent with the demobilisation works for the CTP. Indicative timing from the ETP DNVIS shows the potential for 'Stage 2' tunnelling support commencing around mid 2024 and partial demobilisation during their 'Stage 3' works commencing late 2024 to overlap with the CTP demobilisation timetable.

Where residences are located to the north of the two sites, receivers may experience higher than predicted OOH noise levels when the influence of both sites is considered cumulatively. All efforts will be made to regularly coordinate with the Eastern Tunnelling Project to understand the potential for cumulative impacts and manage them accordingly. It may not be practical to always schedule works to avoid cumulative impacts but communication between the teams will provide a good foundation for effecting programming.

6.2 Ground-borne noise

Consideration of ground-borne noise is typically applicable to tunnelling or other underground works which do not create airborne noise impacts at the same receiver.

Excavation at The Bays will involve subterranean vibration generation; however it will also generate airborne noise. Considering the distance from the vibration source to the nearest residential receivers is around 230 metres to the north and southwest, any minor ground-borne noise resulting from vibration will be at a substantially lower level than airborne noise and will not be considered further in this assessment.

6.3 Vibration impact assessment

6.3.1 Assessment method and reference data

Vibration-intensive works are planned during the Project, as follows.

A. Site establishment:

- Vibratory roller (haul roads and piling pads)

B. Excavation:

- Percussive drill rig (ground improvement)
- Hydromill (diaphragm wall)
- Dozer ripping
- Excavator with hammer (range of medium and large excavators with hammer attachments)
- Soil nailing rig (within station box)

To assess the likelihood of impacts on human comfort and structures, reference vibration levels are summarised in Table 6-2 and curves of vibration with distance are presented in Figure 6-1. Reference vibration levels are based on previously measured levels and current literature.

Table 6-2 Summary of vibration-intensive activities and reference vibration levels

Activity	Typical equipment	Typical PPV vibration emission levels, mm/s	Source
Compaction	Vibratory Roller (11 tonne)	5.5 at 10 m	Site measurement
Excavation	Percussive drill (e.g. air track)	1.5 at 10 m	SA Government (2015)
	Hydro mill in rock	0.4 at 7.6	FTA (2018)
	Dozer ripping	0.15 at 10 m	WCX Enabling works CNVIS (WM 2014)
	47 t excavator with hammer	7.6 at 7.6 m	Sydney Metro (Waterloo CNVIS) (2017)
	32 t excavator with hammer	6.9 at 7.6 m	Melbourne Metro Rail Project (2016)
	20 t excavator with hammer	4.7 at 7.6 m	Melbourne Metro Rail Project (2016)
	12 t excavator with hammer	3.3 at 7.6 m	Melbourne Metro Rail Project (2016)
	Dozer ripping	2.2 at 7.6	FTA (2018)
	Rock bolting	0.4 at 2.5 m	Site measurement

Based on the estimated vibration emission levels of each activity and the following equation for geometric damping (conservatively ignoring material damping), predicted levels of vibration with distance can be established.

$$PPV_2 = PPV_1 \left(\frac{R_1}{R_2}\right)^n$$

Where:
PPV – Peak Particle Velocity at the source (PPV_1) and Receiver (PPV_2)
R – distance from source of reference level (R_1) and distance from source of receiver (R_2)
n – ground factor assumed as 1.7 for body waves near the ground surface

Predicted levels of vibration over distance are illustrated in Figure 6-1.

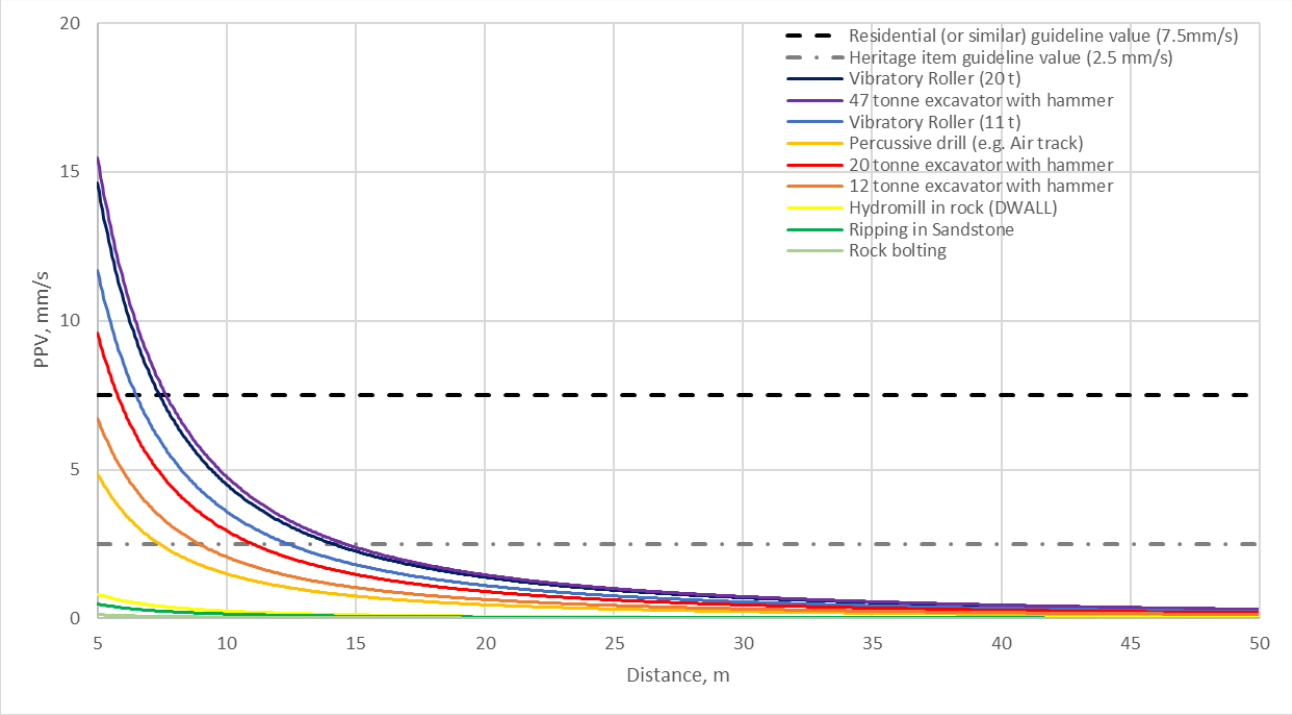


Figure 6-1 Curves of vibration with distance from the source

6.3.2 Cosmetic damage

Considering the vibration guideline values prescribed in the CNVS, with residential dwellings at 7.5 mm/s, the risk of cosmetic damage is low for all equipment outside around 5 - 8 metres from the source. Where unsound heritage items are present (including the WBPS and cement silos), with a guideline value of 2.5 mm, the risk of damage increases below 10 - 15 metres.

Contours representing the distance at which the vibration guideline values are predicted to be achieved are presented in Appendix C. During station box demolition/excavation, no sensitive structures are likely to fall within the cosmetic damage contours for heritage or residential buildings.

6.3.3 Human exposure

When assessing intermittent vibration against human comfort criteria, a vibration dose value is typically established. This requires a range of assumptions on duration and level of vibration over the day and night periods.

Assessing Vibration: A technical guideline (DEC 2006) provides alternative equivalent units for assessment of continuous vibration, which can be used as a simplified screening level of impact on residential receivers. At night, a preferred vibration level of 0.2 mm/s is recommended.

Based on this value, receivers outside 60 metres of the assessed activities in Table 6-2 are not expected to experience vibration in excess of the vibration guidelines.

Contours in Appendix C demonstrate there are no residential receivers within this distance, with the nearest being 120 metres to the north. Therefore, the risk of vibration on human comfort from establishment and excavation at The Bays is expected to be negligible

6.4 Construction traffic

Construction-related traffic servicing The Bays during demobilisation and station box excavation would be significantly reduced compared to tunnelling support traffic movements. Movements would be limited to daytime only and would include deliveries of concrete, materials, and equipment as well as haulage of salvage and spoil during demobilisation and excavation activities.

Construction traffic would access and leave the site via main roads along the Western Distributor / City West Link. This traffic corridor accommodates large traffic volumes at all times of the day and night and passes through commercial and industrial areas without approaching residential receivers.

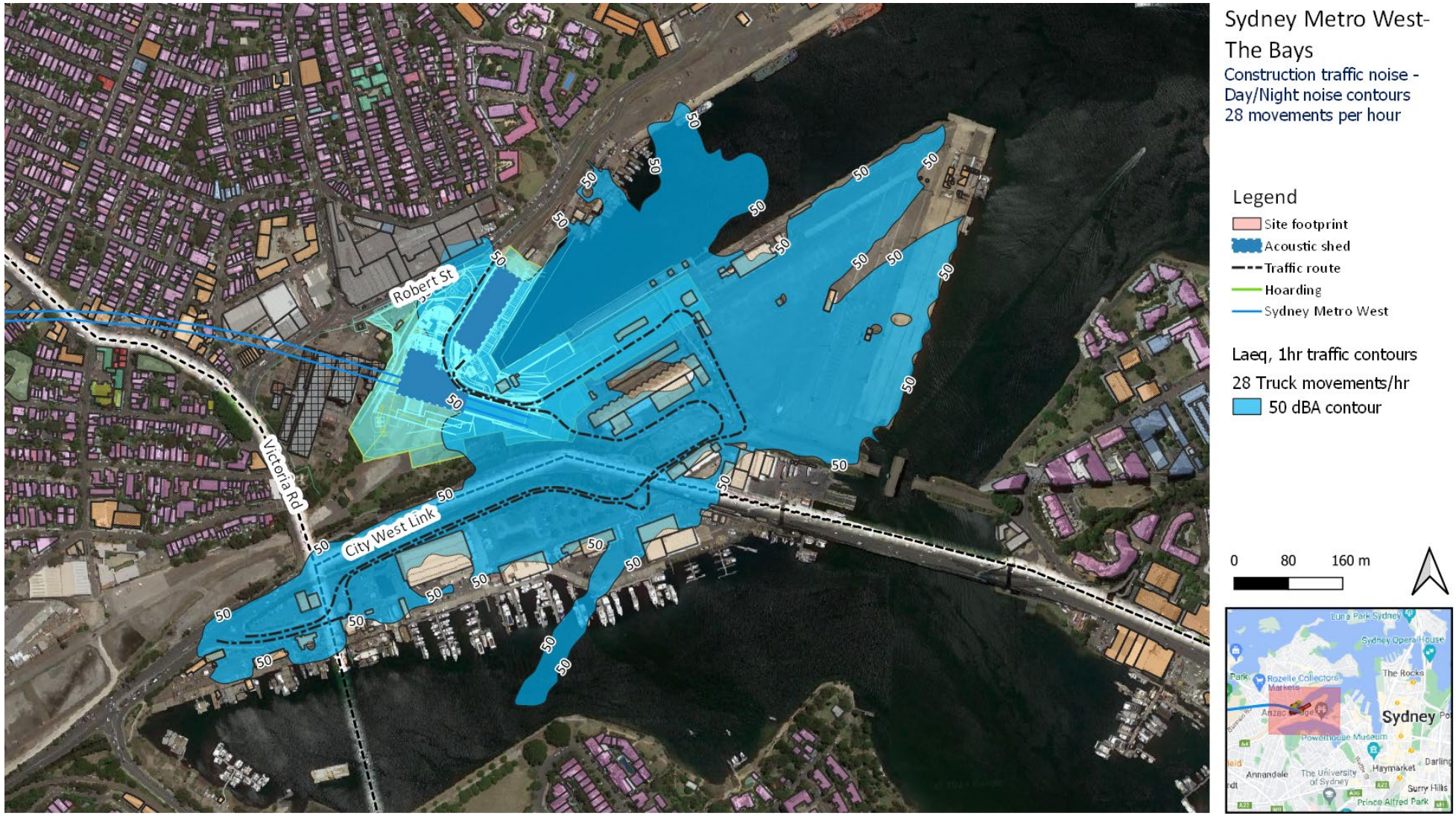


Figure 6-2 Traffic noise contours for 28 movements per hour

7. Summary and recommendations

7.1.1 Impact summary

Predicted levels of noise and vibration from the demobilisation (Phase 4) and final station box excavation (Phase 5) of The Bays site indicates most activities will have at least a noticeable impact at nearby receiver locations during approved standard hours. Where demolition or excavation work using rock hammers is undertaken out of hours, the number of impacted receivers and category of impacts is increased, as such, rock hammering works will be conducted during evening and standard construction hours only (evening time hammering has been modelled NML compliant).

In assessing the level of risk of adverse community impacts from works at The Bays, this DNVIS has considered the following factors:

- The type and proximity of sensitive receivers to the work site. Commercial and industrial receivers closest to the site with medium density residential further away. The area in general is highly urbanised with existing influence of traffic and industrial noise.
- To the southwest, many of the nearest buildings in Rozelle have been treated with construction noise attenuating features such as secondary glazing, mechanical ventilation and acoustic curtains. These treatments will ameliorate residual impacts in this location.
- The existing noise level, noise objectives and exceedances of the objectives during standard and non-standard hours, including the likelihood of sleep disturbance. Where works proceed outside standard hours and night time activities are likely, sleep disturbance would be reviewed on a case-by-case basis through the Out of Hours Works Protocol.
- Exceedances of noise objectives during standard hours would be minor (less than 10 dB above the NML) based on nominated equipment and activities.
- The types of noise generated by demolition activities would largely be non-tonal, however, a major portion of the program will involve removal of steel sections and rock breaking which may generate impulsive noise emissions.

Based on the above factors, the risk of noise resulting in adverse impacts on the local community is low during approved and evening out of hours works. The number of receivers impacted in the noticeable category increases significantly where demolition and rock hammering is extended into the night period.

Vibration is highly unlikely to result in adverse impacts at residential properties given the nature of the activities and distance to receiver locations. There is a minimal to no risk of heritage sites adjacent to the works being damaged, with no construction vibration levels indicated during prior monitoring surveys.

Recommended mitigation measures are summarised in the following sections.

7.1.2 Standard mitigation

Standard noise mitigation measures described in Table 7-1 should be implemented at all stages of the project in addition to those described in the project Construction Noise and Vibration Management Plan (CNVMP).

In line with CoA D42 best practice construction methods will be implemented where reasonable and feasible to ensure noise is maintained at a practical minimum. Practices will include:

- use of regularly serviced low sound power equipment;
- temporary and permanent noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities; and
- use of alternative construction techniques.

Construction programming will ensure only activities established as low impact would be undertaken outside standard hours. Where noisier works are unavoidable, community consultation and AA and ER input and EPA approval will be sought to minimise impacts on the community.

Table 7-1 Standard mitigation measures

Measure	Description
Administrative	
Construction hours	• As much work as possible will be programmed during approved hours. Where work outside approved hours is proposed, this will be completed in line with the CNVMP and Out of hours works protocol
	• Particularly noisy activities will be undertaken outside scheduled church service times where reasonable and feasible
	• Noisy activities as defined in the ICNG, such as hammering and percussive drilling, will be undertaken on a 3 hours on, 1 hour off basis to provide respite to the community, unless otherwise approved
Community consultation	• In line with the CNVMP, nearby receivers should be notified of the upcoming works, including the duration and predicted level of impact
	• In line with the CNVS, community consultation will be undertaken regarding the DNVIS and proposed mitigation such as respite offers
	• Owners of the WBPS and cement silos should be informed of potential for cosmetic damage during drilling and utility works if occurring within 15 metres of the structure.
Site induction	• Site Environmental Induction should be delivered to the team and should include consideration and awareness of noise impacts
Cumulative impacts	• Programming for works undertaken outside approved hours will also consider works being undertaken by third parties
Behaviour	• Avoid yelling and swearing near sensitive receivers • Avoid dropping heavy objects from a height (e.g. loading spoil into trucks). Instead place objects on the ground or in trucks • Plant used intermittently to be throttled down or shut down. Switch engines off when not in use for a short time (e.g. 15 minutes)
Noise control	
Equipment selection	• Priority will be given to the use of quieter and less vibration emitting construction methods and plant alternatives where feasible and reasonable
	• All equipment shall be well maintained, including mufflers and any noise suppression
	• All equipment will meet the maximum sound power requirements of Table 13 of the CNVS.
	• Trucks approaching construction sites will avoid the use of compression braking, especially in the night period
	• Traffic management signage vehicles shall be padded to reduce rattling as much as possible.

Measure	Description
Noise barriers	• Use temporary and permanent noise screens and enclosures as much as possible to reduce noise emissions from noisier equipment when stationary or operating in one location for a reasonable duration such as percussive drills and rock breakers. • Screens (such as Echobarrier) should be placed between source and receivers, be continuous (without gaps) and installed according to manufacturer directions. • Hoarding and acoustic sheds should be erected as soon as possible in the establishment program. • Site offices, storage containers, bunding, and other structures should be placed between noise sources and sensitive receivers where possible.
Use and siting of plant	• Noise-emitting plant to be directed away from sensitive receivers where possible. • Stationary plant should be located behind a structure or enclosed if practicable. • Avoid compression breaking on approach to the site.
Reversing alarms.	• Non-tonal reversing beepers (or equivalent) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Monitoring	
Noise monitoring	• Noise monitoring shall be completed to: - verify assumptions of this DNVIS regarding estimated equipment noise emissions, - demonstrate works outside approved hours are operating within the NMLs, - as required by the AMM for each assessed activity and - as required by the NVMP and associated monitoring program. • To assist in verifying predicted noise levels and assumptions, one or more monitoring locations will also be included closer to specific work sites, with predictions at these locations provided for comparison against monitoring outcomes.
Vibration monitoring	• Vibration monitoring is not required based on modelling for the demolition phase of the works, but a monitor is available for attended monitoring in the event it is required.

7.1.3 Additional mitigation measures

Additional noise mitigation measures described in the CNVS AMMM should also be implemented as indicated in Appendix A for each receiver. AMM for each receiver is indicated by colour-coding as per the AMMM in Table 4-2.

Based on the timing of the construction activities in this DNVIS, which are predominantly during approved hours, AMMM would be largely limited to notifications and monitoring. Where works are undertaken outside approved hours, additional notification would likely be required as well as ensuring appropriate respite is provided. Alternative Accommodation is not likely to be needed; however, this will be reviewed on a case-by-case basis.

Though vibration impacts are unlikely, AMM should be applied for sensitive receivers where measurement indicates it is applicable. In this case, measurement means either at a single location, which also indicates the likely level (and relevant AMM) at other similarly exposed locations or as established by site law measurements to indicate which receivers would be within the site-specific safe working distances.

7.1.4 Monitoring

The Bays is a large site with a range of activities and equipment. Several assumptions have been made in this assessment to provide representative predictions, such as work location, equipment types, numbers, intensity of operation and noise screening options and these will be verified once works commence and regularly throughout the program.

Noise and vibration monitoring will be undertaken in line with the Noise and Vibration Monitoring Program and out-of-hours protocol as appropriate., with the following monitoring to be completed as a minimum.

- Sound power level verification to ensure equipment meets the requirements of the CNVS
- Monitoring at nearby sensitive receivers to verify predictions at various stages of construction. Specific locations will vary at the time of monitoring and would be based on the nearest receiver to the works at the time.
- To assist in verifying predicted noise levels and assumptions, one or more monitoring locations will also be included closer to specific work sites, with predictions at these locations provided for comparison against monitoring outcomes.
- Real-time noise and vibration monitoring, with results readily available to the construction team, Sydney Metro, the AA and ER, will be established close to or at the nominal locations described in the Monitoring Program, depending on power, security, and access to the monitoring site.

7.1.5 Consultation

Conditions of Approval D43 and D44 require mitigation measures presented in this DNVIS to be identified through consultation with the affected community. This applies to standard hours and works outside standard hours. All mitigation measures developed as part of this DNVIS have been formed around community needs and concerns established through the community consultation process, as required by CoA D43.

The nearest receivers beyond site are businesses along Roberts Street Rozelle on the northern side of the site and these are more than 110m from the station box excavation site. This strip of businesses receives hand delivery of construction update notifications by the Place Manager, who has had impromptu conversations about the AFJV work with some commercial tenants during that process.

The closest residential receivers to the station excavation site are around 200m to the west across Victoria Road and to the north behind the commercial/industrial area. To date, AFJV has received no correspondence from the community about work at the Bays.

Given the construction site is restricted access and quite removed from the nearest public receivers, visual, noise and vibration impact from site work is minimal. Key proximity stakeholders include port tenants, Cement Australia and Sugar Australia on Glebe Island.

Due to the reduction in site activities at The Bays site in 2024, the AFJV Interface Manager has changed the fortnightly interface meetings with Port Authority of NSW (PANSW) to every three (3) months. This meeting is high level and regarding all work on the site and liaison with port tenants. The PANSW interface directly with the AFJV site team, to give them White Bay cruise terminal arrival and departure dates. In addition, similar meetings take place with Place Management NSW regarding work in and around the White Bay Power Station precinct. There is also a fortnightly Bays/Rozelle area interface meeting between the communications and engagement reps from infrastructure projects being undertaken in the area including Sydney Metro West, Central and Eastern Tunnelling Packages and Western Harbour Tunnel.

AFJV will continue to consult with the community about planned out of hours works by providing regular updates about upcoming out of hours activities, associated impacts and mitigation measures being implemented as well as invite ongoing feedback to be provided via email, 24-hour phone line or in person meetings. Work notifications for The Bays are published monthly outlining ongoing and new work as well as detailing any planned out of hours work. These are delivered to closest public stakeholders on Roberts Street, uploaded to the Sydney Metro West website, emailed to the Bays distribution list and notified via the Metro Connect App.

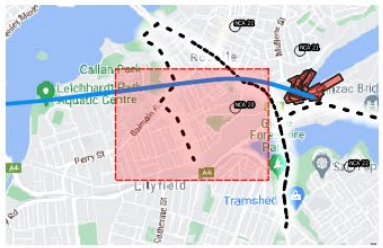
Regarding cosmetic damage from vibration, at some points near the project boundary, some vibration-intensive activities may occur within a safe working distance from the WBPS and cement silos. Where this is the case, owners/managers of the relevant structure would be notified in line with CoA D45 prior to these works taking place.

Appendix A. Land use survey and NCA maps

The Bays
Land use survey

Site footprint
Sydney Metro West
Bays NCAs

Land uses
Childcare
Commercial/Business
Commercial/Residential
Community Use
Community/Residential
Education
Garage
Hotel
Industrial/Utilities
Recreational/Open Space
Residential
Medical
Place of Worship
Recreational Passive
Vacant / dilapidated

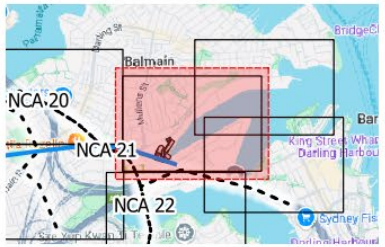


0 50 100 150 200 m

The Bays
Land use survey

Site footprint
Sydney Metro West
Bays NCAs

Land uses
Childcare
Commercial/Business
Commercial/Residential
Community Use
Community/Residential
Education
Garage
Hotel
Industrial/Utilities
Recreational/Open Space
Residential
Medical
Place of Worship
Recreational Passive
Vacant / dilapidated



0 50 100 150 200 m

The Bays
Land use survey

Site footprint
Sydney Metro West
Bays NCAs

Land uses
Childcare
Commercial/Business
Commercial/Residential
Community Use
Community/Residential
Education
Garage
Hotel
Industrial/Utilities
Recreational/Open Space
Residential
Medical
Place of Worship
Recreational Passive
Vacant / dilapidated

0 50 100 150 200 m

Appendix B. Proposed equipment and sound power levels

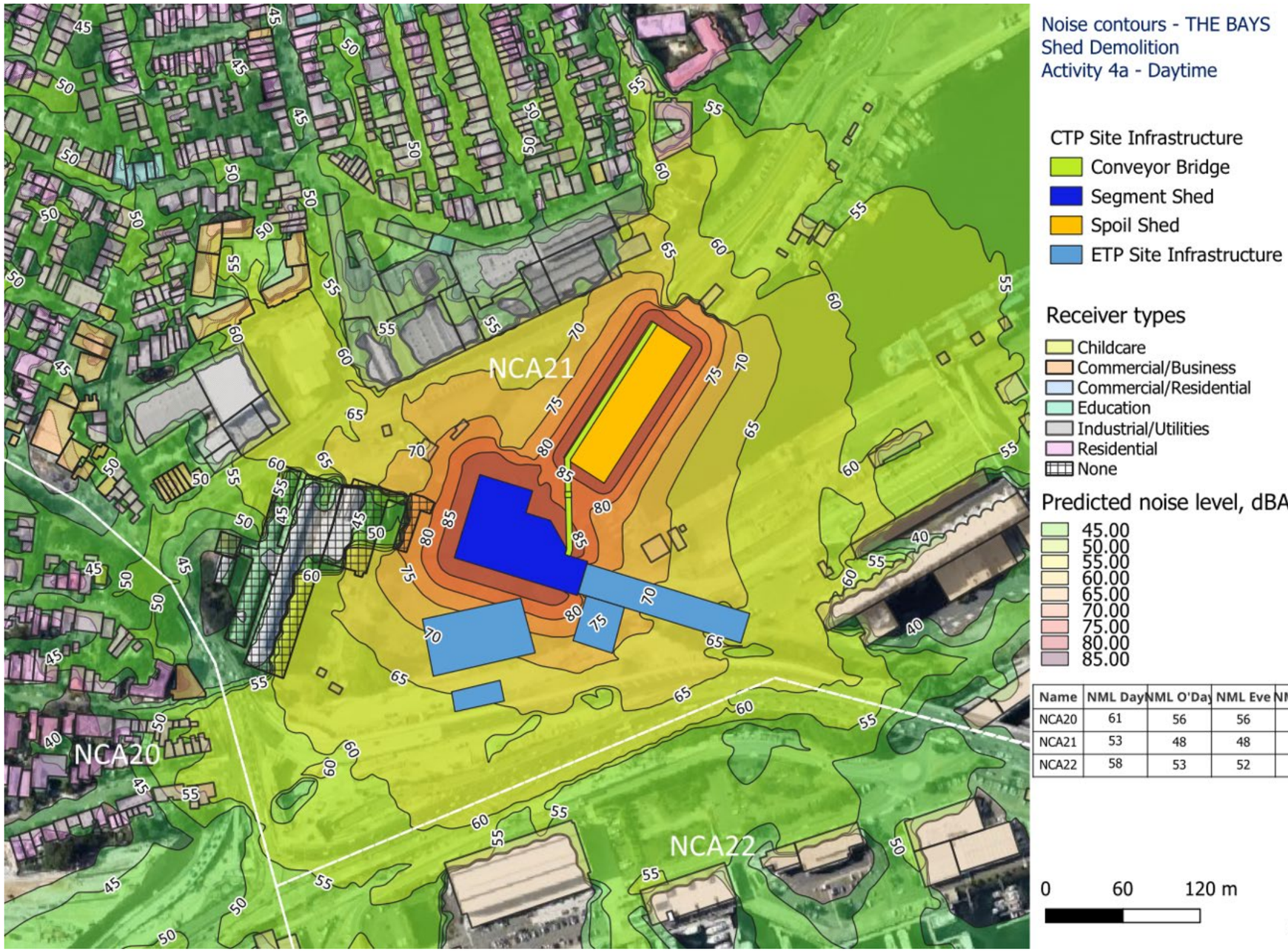
B.1 Site demobilisation

Phase		Activity/Work Area	Aspect		Plant/Equipment	Day	Evening	Night	SWL, dBA	Usage	Assumed barrier reduction, dB	Penalty, dB	Lmax	Adj equipment SWL, LAeq,15 minute			Activity LAeq, 15 min SWL		
						7am - 6pm	6pm - 10pm	10pm - 7am						Day	Evening	Night	Day	Evening	Night
4	**Demobilise**	CONVEYOR REMOVAL	4a	Demobilisation of Vertical Conveyors in Station Box	M2480D Tower Crane	1	1	1	95	0.4		0	100	91	91	91	113	104	99
					180ft EWP	1	1	1	91	0.3		0	96	86	86	86			
					80ft EWP	1	1	1	89	0.3		0	94	84	84	84			
					45ft EWP	1	1	0	89	0.3		0	94	84	84	0			
					16t Forklift (Inside acoustic shed/station box)	1	1	1	108	0.5		0	0	0	0	0			
					2t Forklift	1	1	1	100	0.5		0	105	97	97	97			
					Hammering (Steel)	1	0	0	115	0.2		5	123	113	0	0			
					Angle grinder	1	1	1	93	0.2		5	101	91	91	91			
					Rattle guns	1	1	0	105	0.2		0	110	98	98	98			
					Oxy/acetylene	1	1	1	89	0.5		0	94	86	86	86			
					Pressure washer	1	1	0	94	1		0	95	94	94	94			
					semi trucks	1	1	1	102	0.2		0	107	95	95	95			
		SPOIL SHED AND REINFORCED CONCRETE WALL DEMOLITION	4b	Demobilisation of Surface Conveyors (Spoil Shed)	130t Mobile crane	1	1	1	98	0.4		0	103	94	94	94	107	107	107
					80ft EWP	1	1	0	89	0.3		0	94	84	84	84			
					45ft EWP	1	1	1	89	0.3		0	94	84	84	84			
					16t Forklift	1	1	1	108	0.5		0	113	105	105	105			
					2t Forklift	1	1	0	100	0.5		0	105	97	97	97			
					Angle grinder	0	0	0	93	0.2		5	101	91	91	91			
					Rattle guns	1	1	1	105	0.2		0	110	98	98	98			
					Oxy/acetylene	1	1	1	89	0.5		0	94	86	86	86			
			4bi	Demobilisation of Surface Conveyors (Conveyor Bridge)	130t Mobile crane	1	1	0	98	0.4		0	103	94	94	0	110	107	98
					49t Excavator + attachments	1	0	0	108	0.4		0	113	107	0	0			
					80ft EWP	1	1	1	89	0.3		0	94	84	84	0			
					45ft EWP	1	1	0	89	0.3		0	94	84	84	0			
					16t Forklift	1	1	0	108	0.5		0	113	105	105	0			
					2t Forklift	1	1	1	100	0.5		0	105	97	97	0			
					Angle grinder	1	1	0	93	0.2		5	101	91	91	0			
					Rattle guns	1	1	0	105	0.2		0	110	98	98	98			
					Oxy/acetylene	1	1	1	89	0.5		0	94	86	86	86			
			4c	Demolition of spoil shed walls/roof	70t Excavator High Reach with Shear Attachment	1	0	0	112	0.6		0	117	110	0	0	122	0	0
					49t Excavators with Shear attachments	1	0	0	109	0.8		0	114	108	0	0			
					37t Excavators with Hammer Attachments	1	0	0	122	0.3		5	130	122	0	0			
					25t Excavator	1	0	0	105	0.4		0	110	101	0	0			
					Elevated Working Platform	2	0	0	89	0.3		0	94	87	0	0			
					Oxy/acetylene	1	0	0	89	0.5		0	94	86	0	0			
					Hand Tools/ Power Tools	1	0	0	94	0.2		0	99	87	0	0			
					Tipper Trucks	1	0	0	98	0.4		0	103	94	0	0			
			4d	Demolition of spoil shed bund wall	49t Excavators with Pulveriser & Shear attachments	1	0	0	109	0.8		0	114	108	0	0	122	0	0
					37t Excavators with Hammer Attachments	1	0	0	122	0.3		5	130	122	0	0			
					25t Excavator	1	0	0	105	0.4		0	110	101	0	0			
					Elevated Working Platform	1	0	0	89	0.3		0	94	84	0	0			
					Oxy Set	1	0	0	89	0.5		0	94	86	0	0			
					Hand Tools/ Power Tools	1	0	0	94	0.2		0	99	87	0	0			
					Tipper Trucks	1	0	0	98	0.4		0	103	94	0	0			
			4e	Demolition of spoil shed slab	49t Excavators with Pulveriser & Shear attachments	1	0	0	109	0.8		0	114	108	0	0	129	0	0
					70t Excavator + Hammer	1	0	0	125	0.3		5	133	125	0	0			
					50t Excavator + Hammer	2	0	0	122	0.3		5	130	125	0	0			
					48t Excavator + Hammer	1	0	0	122	0.3		5	130	122	0	0			
					37t Excavator with bucket and Hammer Attachments	1	0	0	120	0.3		5	128	120	0	0			
					Road saw	1	0	0	114	0.2		5	122	112	0	0			
					Hand Tools/ Power Tools	1	0	0	94	0.2		0	99	87	0	0			
					Tipper Trucks	1	0	0	98	0.4		0	103	94	0	0			
		SEGMENT SHED REMOVAL - Demolition direction north to south	4f	Remove segment shed roof sheet	Elevated Working Platform	1	0	0	89	0.3		0	94	84	0	0	100	0	0
					130t Mobile crane	1	0	0	98	0.4		0	103	94	0	0			
					Angle grinder	1	0	0	93	0.2		5	101	91	0	0			
					Rattle guns	1	0	0	105	0.2		0	110	98	0	0			
			4g	Remove gantry cranes	M2480D Tower Crane	1	0	0	95	0.4		0	100	91	0	0	101	0	0
					130t Mobile crane	1	0	0	98	0.4		0	103	94	0	0			

Phase		Activity/Work Area	Aspect		Plant/Equipment	Day	Evening	Night	SWL, dBA	Usage	Assumed barrier reduction, dB	Penalty, dB	Lmax	Adj equipment SWL, LAeq,15 minute			Activity LAeq, 15 min SWL		
						7am - 6pm	6pm - 10pm	10pm - 7am						Day	Evening	Night	Day	Evening	Night
					180ft EWP	1	0	0	91	0.3		0	96	86	0	0			
					Angle grinder	1	0	0	93	0.2		5	101	91	0	0			
					Rattle guns	1	0	0	105	0.2		0	110	98	0	0			
					Hand Tools/ Power Tools	1	0	0	94	0.2		0	99	87	0	0			
			4h	Demolish segment shed north	70t Excavator High Reach with Shear Attachment	1	0	0	112	0.6			117	110	0	0	114	0	0
					49t Excavators with Pulveriser & Shear attachments	1	0	0	109	0.8			114	108	0	0			
					Hammering (metal	1	0	0	115	0.1		5	123	110	0	0			
					Elevated Working Platform	1	0	0	89	0.3			94	84	0	0			
					Oxy Set	1	0	0	89	0.5			94	86	0	0			
					Hand Tools/ Power Tools	1	0	0	94	0.2			99	87	0	0			
					Tipper Trucks	1	0	0	98	0.4			103	94	0	0			
			4i	Demolish segment shed south	M2480D Tower Crane	1	0	0	95	0.4			100	91	0	0	111	0	0
					120t Mobile crane	1	0	0	98	0.4			103	94	0	0			
					550t Crane	1	0	0	108	0.4			113	104	0	0			
					180ft EWP	1	0	0	91	0.3			96	86	0	0			
					Hammering (metal)	1	0	0	115	0.1		5	123	110	0	0			
					Angle grinder	1	0	0	93	0.2		5	101	91	0	0			
					Rattle guns	1	0	0	105	0.2			110	98	0	0			
					Hand Tools/ Power Tools	1	0	0	94	0.2			99	87	0	0			
					Oxy Set	1	0	0	89	0.5			94	86	0	0			
5	Demobilisation	Station Box Finishing Works	5a	Removal of existing concrete slab and excavation of station box	70t excavator + Hammer	2	1	0	122	0.3		5	130	125	122	0	125	122	112
					50t excavators+ bucket	2	1	1	109	0.8		0	114	111	108	108			
					30t excavator + erkat	1	1	1	108	0.4		0	113	104	104	104			
					30t excavator + Pulveriser	1	1	1	108	0.4		0	113	104	104	104			
					13 tn excavator + saw cutting attachment (corners)	1	1	1	110	0.4		0	118	104	104	104			
					30 tn Excavator + saw cutting attachment (trenches)	1	1	1	110	0.4		0	118	106	106	106			
			5a(i)	Removal of concrete	Road saws (Not concurrent with other plant)	3	3	0	114	0.2		5	122	117	117	0	117	117	0
			5b	Excavation Station Box (Loadout)	36t excavator	1	1	0	107	0.5		0	112	104	104	0	106	106	0
					Truck and dog (Loading Rubble)	1	1	0	108	0.1		0	113	98	98	0			
					Truck and dog (idling)	1	1	0	102	0.8		0	107	101	101	0			
			5c	Excavation (Stockpile – Surface))	49t telescopic	1	1	0	109	0.8		0	114	108	108	0	109	109	100
					150t Mobile crane	1	1	1	101	0.8		0	106	100	100	100			
			5c(i)	Excavation (Stockpile - Stn Box)	30t excavator + Bucket	1	1	1	107	0.4		0	112	103	103	103	110	110	110
					Mobile concrete crusher	1	1	1	111	0.6		0	119	109	109	109			
			5d	Station Box Concrete Pours	Concrete pump (Station box or barrier)	1	1	1	107	0.4	5	0	112	103	103	103	108	108	104
					120t Crane (Station Box)	1	1	1	98	0.4		0	103	94	94	94			
					Concrete Agi's (discharging)	2	2	1	103	0.3		0	108	101	101	101			
					Concrete Agi's (idling)	2	2	1	101	0.7		0	106	102	102	102			
		Spoil Shed Finishing Works	5e	Spoil shed post demo earthworks	Mobile concrete crusher	1	0	0	111	0.6		0	119	109	0	0	113	0	0
					36t Excavators	2	0	0	108	0.4		0	113	107	0	0			
					12t vibrating roller	2	0	0	105	0.4		5	113	109	0	0			
					Grader	1	0	0	101	0.7		0	106	99	0	0			

Appendix C. Construction noise and vibration contours

C.1 Shed Removal noise contours – Phase 4



Noise contours - THE BAYS
Shed Demolition
Activity 4a - Daytime

CTP Site Infrastructure
- Conveyor Bridge
- Segment Shed
- Spoil Shed
- ETP Site Infrastructure

Receiver types
- Childcare
- Commercial/Business
- Commercial/Residential
- Education
- Industrial/Utilities
- Residential
- None

Predicted noise level, dBA
- 45.00
- 50.00
- 55.00
- 60.00
- 65.00
- 70.00
- 75.00
- 80.00
- 85.00

Name	NML Day	NML O'Day	NML Eve	NML Night
NCA20	61	56	56	50
NCA21	53	48	48	40
NCA22	58	53	52	44

0 60 120 m

C.2 Station Box finishing works noise contours – Phase 5

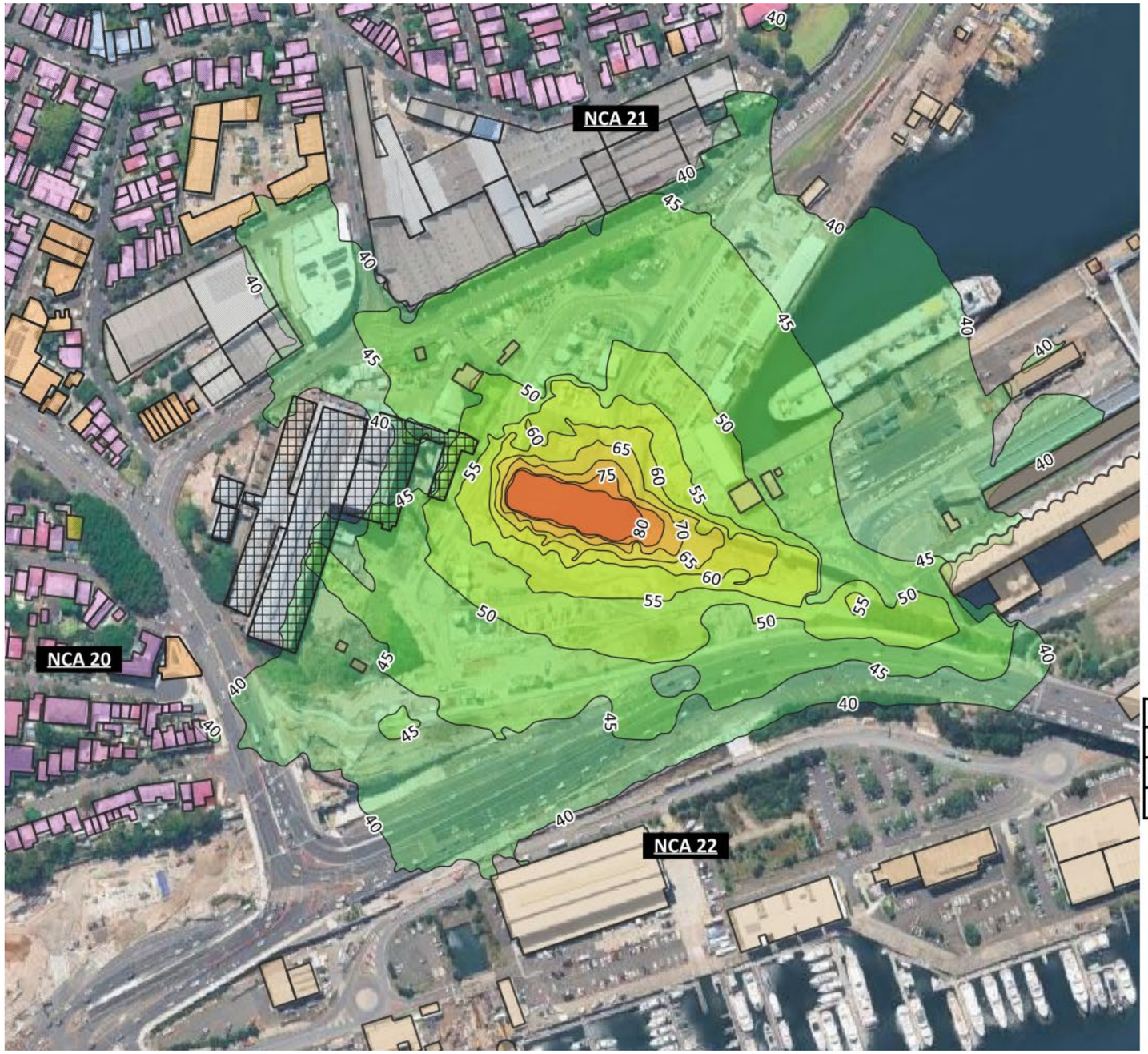
Noise contours - THE BAYS
Station Box Excavation
Activity 5a - Daytime

Receiver types
- Childcare
- Commercial/Business
- Commercial/Residential
- Industrial/Utilities
- Residential
- None

Predicted noise level, dBA
- 35.00
- 40.00
- 45.00
- 50.00
- 55.00
- 60.00
- 65.00
- 70.00
- 75.00
- 80.00
- 85.00

Name	NML Day	NML OD	NML Eve	NML Night
NCA20	61	56	56	50
NCA21	53	48	48	40
NCA22	58	53	52	44

0 60 120 m



Noise contours - THE BAYS
Station Box Excavation
Activity 5a - Night

Receiver types
- Childcare
- Commercial/Business
- Commercial/Residential
- Industrial/Utilities
- Residential
- None

Predicted noise level, dBA
- 40.00
- 45.00
- 50.00
- 55.00
- 60.00
- 65.00
- 70.00
- 75.00
- 80.00

Name	NML Day	NML OD	NML Eve	NML Night
NCA20	61	56	56	50
NCA21	53	48	48	40
NCA22	58	53	52	44

0 60 120 m

Appendix D. Detailed noise predictions for individual receivers

D.1 Phase 4 & 5 – Site Demobilisation

Provided as attached excel worksheet.